Personalized learning is an emerging school reform strategy that seeks to place the interests and abilities of learners at the center of their education experience. As a school-wide reform strategy, personalized learning invites educators to develop environments in which students and teachers together build plans for learners to achieve interest- and standards-based goals. Personalized learning typically includes four key components:

- **competency-based progression** that defines trajectories of content for learners and provide ongoing, formative assessment toward learning;

- **flexible learning environments** organized around the needs of students;

- **personal learning paths** that customize activities to learner motivations and goals; and

- **learner profiles** to capture the progress students make toward learning goals. *(Education Week, 2014)*

Thousands of educators around the world have embraced personalized learning as a model to re-create schools that focus on learner needs and interests. Like many emerging education reform movements though, personalized learning suffers from a lack of empirical research to define its key components and to measure its outcomes. This lack of scholarly attention to the questions of definition and outcomes may lead researchers to dismiss personalized learning as a fad, or worse, as a ploy to undermine public education. *(Enyedy, 2014)*

The Learning Sciences community has developed around a series of ideas emphasizing how to create powerful socio-technical learning environments that elicit and build on learner interest *(Bransford, et. al. 2000; Sawyer et. al. 2014)*. Yet personalized learning has received little attention in recent Learning Sciences research.¹ This paper develops a framework around core ideas in the Learning Sciences to review the results of a four-year research project to define what personalized learning looks like in practice. In an effort to bridge the research practices of the Learning Sciences with the efforts of cutting-edge education reform, we built a conceptual framework around learner-driven pedagogies, real-world pedagogy and socio-technical systems to reflect upon the efforts of educators engaged in personalized learning. This paper presents the results of this analysis, shows where practice deviates from LS research, and considers avenues for how ambitious reform practices can indicate new avenues for LS research.
Ideas. The core ideas of the Learning Sciences have sparked a wide variety of research on how to create ideal environments grounded in cutting-edge learning theory. To explore the range of practices used in personalized learning schools, we identified three key concepts reflected across much of the Learning Sciences research.

- **Learner-driven pedagogies** focus on identifying the needs and interests of learners in the development of education environments (Quintana, et. al., 2014). Grounded in constructivism (Kafai, 2014), this principle builds on what learners know and can do to build contextual scaffolds activities toward desired learning goals (Bouillion & Gomez, 2001). The role of the educator is to work with the learner to identify needs and interests and to design environments and facilitate learner control toward progress through inquiry (Cobb & McClain, 2014) and project-based activities (Krajcik & Blumenfeld, 2014).

- **Real-world learning activities** focus on the nature of the tasks that engage learners (Edelson & Reiser, 2014). Real-world learning grounds activities in problems actually encountered by learners, and motivates the learning through inquiry-based activities that reflect authentic situations (Collins, 1991). Real-world activities could spark occasions to learn already-existing disciplinary knowledge (Lehrer & Schauble, 2014) and/or to engage learners in on-going contemporary social concerns (Nasir, et. al. 2014).

- **Socio-technical learning environments**. Learning Sciences researchers have long-been fascinated by the power of digital technologies to transform learning (Papert 1980; Stahl, et. al. 2014). Researchers have focused on the learning technology design (Koedinger and Corbett, 2014), the development of data technologies to facilitate learning (Baker & Yacef, 2010) and assessing the consequences of technology-aided learning. Taken together, these the organization of technology + people systems are studied as learning ecologies (Barron, 2006).

These Learning Sciences core ideas provide a powerful framework to explore how an emerging education reform initiative reflects (or fails to reflect) leading thinking on how learning occurs and how to design environments to best facilitate learning.

Methods. The data analyzed in this paper result from a four-year study to document how personalized learning unfolds in real-world schools. The study was supported by grants from the US Department of Education and the Joyce Foundation, and involved a research-practice partnership between a research university and a professional organization designed to support personalized learning in schools. The research team studied 20 elementary, middle and high schools nominated by educators, leaders and researchers as innovative personalized learning schools. Some of the schools used a “school-within-a-school” model to deliver personalized learning instruction; others used personalized learning as a whole-school intervention.

Data collected included between 5 and 15 days in each school of classroom observation; interviews with most faculty and staff involved in personalized learning; and focus group discussions with students and parents. The data were collected in MaxQDA and the research team iteratively developed a coding scheme grounded in the literature on personalized learning and informed by a systematic review of the on-going data collection. The data analysis resulted
in school-level reports that were triangulated with educators in each school community as well as tests of inter-coder reliability among the research team.

Findings. The initial findings of the study from the project are published in a variety of journals and conference proceedings. For the purpose of this paper, we drew on these already analyzed findings as well as a new round of data analysis to examine the practices through the lens of core ideas from the Learning Sciences.

Learner-Directed Pedagogies. We found abundant examples of how educators (and school communities) built environments that scaffolded learners toward goals. We found a notable distinction, however, between educators who focused on learner interests vs. learner needs. Focusing on learner needs typically involved adopting a standards-based approach. In these kinds of learning environments, educators positioned standards as the goals for the learner. Students were assessed on previous learning and skill-levels, then assigned to activities, often involving computer-adaptive learning tools, that could help learners work toward standards-based learning goals. Personalization, in these schools, involved the creation of individualized learning pathways for students by educators.

Educators who focused on learner interests, on the other hand, typically invited students to take control of the means and/or the goals of their learning. Taking control of the means meant that students had input into the pace of their learning, the sequencing of lessons, the place where the learning happened, or the medium of instruction. In many of these cases, educators continued to use content standards to shape the goals of instruction. In other examples, though, educators invited students to develop the goals for learning as well. These instances show how students and educators developed projects around student defined learning goals, typically involving collaborative work organized by learning technologies. Although projects typically occurred within school-defined courses, in one high school students were invited to propose and teach courses of interest. Personalization here involved the creation of learning pathways by students with educators.

In both cases, educators relied on conferring as a primary instructional method to assess student needs and/or interests. Conferring involved regular one-to-one (or, in some cases, small group) interactions where teachers and students discuss plans for students to frame and attain learning goals. Educators spoke of conferring as the building block for developing the kinds of academic relationships that would support and sustain student participation across learning activities. The relevance of conferring as a core practice in personalized learning schools indicates the importance of relationship building as a cornerstone for engaging in constructivist learning. Learning Sciences discussions of learner-directed environments not only allow personalized learning educators to tease out the degrees to which students have agency over the means and goals of their schooling experience, but can also provide opportunities for Learning Scientists to study how such environments occur in the wild.

Real world learning activities. The distinction between standards- and interest-based learning was also seen in the degree to which learning was situated in real-world contexts. Educators who leaned toward interest-based instruction typically situated activities in real-world opportunities to use disciplinary knowledge to understand real phenomena or to engage with authentic social
problems. In one school, for example, students sought out authentic environmental problems in their communities, and worked with educators to use relevant disciplinary concepts and methods. In most cases, though, educators relied on the traditional pedagogical context of schooling to convey content, and the majority of learning was demonstrated in decontextualized academic situations. This was particularly apparent in math courses that relied on computer adaptive learning programs, such as ALEKS and DreamBox math, to sequence activities for students toward learning goals. The Learning Sciences emphasis on authentic learning environments can serve as a model for personalized learning educators to rely more on authentic contexts to motivate learning.

**Socio-technical systems.** Like most 21st century schools, personalized learning schools exist among an incredible variety of digital learning tools. We found that educators assembled a variety of digital tools to fit their instructional and assessment needs. Typically, this process involved testing out a number of tools in the context of teaching and sharing insights across educators to settle on tools that could be used across contexts. In a number of schools, this process of technology-testing resulted in a resilient professional community organized around what we called “technology literacy.”

Each school used three different kinds of technologies. First, each school used Google classroom and other basic application tools for daily instruction and administrative functions. Google Docs, Forms and Sheets, for example, served as a primary medium for interaction between teachers as lesson designers and students who used the tools to complete, critique, and assess their everyday work. Second, each school used a form of computer-adaptive learning environment to assess student needs and to guide students toward standards-based outcomes. Based on cognitive tutoring research, these systems were typically used to support student learning in math (and sometimes in developing reading skills). Third, on occasion, each school used new media environments, such as YouTube, iMovie and SoundCloud, to support interest-driven project-based learning activities. The research team did not find as many examples of these types of activities across schools, but found that educators and students were enthusiastic about the possibilities of learning with these media.

We found the concept of a learning ecology (Barron 2006) evocative to describe how educators and learners assembled tools into a socio-technical system that supported personalized learning. In some cases, the learning ecologies of personalized learning reflected the shared purpose, the peer cultures and openly networked aspects of the connected learning research model (Ito, et. al., 2013). However, the use of new technologies to teach standards-based content and goals demonstrates the persistence of the traditional school model in the midst of technological transformation. Again, we feel that while Learning Sciences research can highlight the key aspects of personalized learning, educators on the ground engaged in building socio-technical learning systems illustrate how to satisfy traditional outcomes while creating room for exciting new learning opportunities.

**Discussion and Conclusion.** Our paper seeks to build a bridge between the Learning Sciences, a research community interested in studying and developing cutting-edge environments grounded in learning theory, and personalized learning, an exciting education reform effort that engages thousands of educators in real-life experimentation on the frontiers of
school design. We hope that our effort to analyze the work of these ambitious educators in the light of ideas that guide Learning Sciences research will spark further collaboration between these dynamic communities inform the future of education reform with the insights of leading researchers, and to point researchers toward places where real innovation is unfolding.

References


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1 For example, there is one paper on personalized learning in the 2095 pages of the 2018 International Conference of the Learning Sciences Proceedings; one 2014 paper considers personalized learning in the Journal of the Learning Sciences.