

Using Learning Design Technologies for Teachers' Practice-Driven Research

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Abstract: This paper presents two case studies related to developing educational technologies paired with teacher professional development (PD) courses to support practice-driven research among teachers. The case studies emerged from multidisciplinary projects involving schoolteachers and researchers. The first project supports teacher use of evidence-based teaching strategies that align with the science of learning such as retrieval practice and distributed practice. The second project supports teachers in helping students learn to manage stress using evidence-based self-regulation techniques such as mindfulness and cognitive reappraisal. The projects fuse together concepts of teacher inquiry, learning design, online communities of teachers, and open educational resources to support teacher practice-driven research. An overview of teacher-generated research and impressions of the PD courses gathered during piloting are presented along with descriptions of the two supporting technologies. Implications for practice are also shared.

Keywords: Teacher inquiry, Teacher professional development, Practice-driven research, Learning design, Online communities of teachers

1. Introduction

Practice-driven research is “undertaken in order to gain new knowledge partly by means of practice and the outcomes of that practice” (Candy, 2006). Involving teachers in such research is a way in which “a strong and coherent body of professional knowledge owned by the teaching profession” (Schleicher, 2020, p. 29) can be built. A teacher professional development (PD) approach that aligns with practice-driven research is teacher inquiry (TI) into student learning which involves teachers exploring the use of data to answer questions that emerge from teaching practices (Michos et al., 2018).

Innovative education technologies are well positioned to increase teacher opportunities and abilities to participate in practice-driven research. Learning design (LD) tools, for instance, support teachers in the process of conceptualizing, authoring, and documenting learning tasks (Wasson & Kirschner, 2020). LD tools can be embedded into online communities of teachers (OC) platforms that support interactions among teachers when co-creating, sharing, exploring, and commenting on learning designs in processes of mutual inspiration (Hernández-Leo et al., 2018). The shared learning designs represent open educational resources (OER) that can be freely reused and refined by the educational community. These technologies facilitate collective knowledge building and TI, thereby allowing teachers to expand their practices (Michos & Hernández-Leo, 2020). While there are a number of existing LD technologies focusing on different pedagogical approaches and features, most do not incorporate the required features to support practice-driven research advancing evidence-based teaching opportunities. A system that does integrate options for the required features is the Integrated Learning Design Environment (ILDE). ILDE has been used with online courses supporting PD to improve teachers' skills when designing for technology-enhanced learning (Garreta-Domingo et al., 2017). With a heightened focus on facilitating TI processes to advance practice-driven research into evidence-based practices among teachers, two projects were undertaken. These projects explore the integration of

innovative educational approaches and technologies such as TI, LD, OC, and OER. The following sections present case studies of the two projects.

2. Case 1: Evidence-Based Teaching

2.1 Problem Definition

“Teachers often use instructional practices known to be wrong (i.e., massing rather than interleaving examples to explain a topic)” (Roediger & Pyc, 2012, p. 242). With increased availability of new technologies (OC, OER) to document and share practices, there is a risk of disseminating ineffective practices. Hence, a multidisciplinary project (Illumine) was initiated to support teacher use of evidence-based teaching strategies and digital technologies.

2.2 Professional Development Course Design

A survey study conducted at the onset of the project, found that teacher motivation is higher for learning to use evidence-based teaching strategies and digital technologies for teaching and learning than for TI for PD (Beardsley & Albó, 2022). To align with these findings, the PD course was designed to focus on introducing teachers to evidence-based teaching strategies and digital technologies to support their use of these strategies. LD and TI were presented as the processes through which teachers would make use of and reflect upon their use of the strategies. A 30-hour course (eleven 2-hour workshops and 8 hours of asynchronous work) was prepared. The first 2 workshops introduced science of learning and learning design theory. Workshops 3-9 alternated between introducing theory and research studies related to teaching strategies and providing time for teachers to co-design implementations. The final workshops involved sharing results and reflecting on the overall course.

2.3 Learning Design Technology to Scaffold Practice-Driven Research

With a focus on introducing strategies and scaffolding TI, the technology (<https://illumine.upf.edu/>) is conceptualized as an OC for teachers to learn about and practice their use of evidence-based teaching strategies via the creation of teacher-generated research lessons. A research lesson in this context can be viewed as a simplified interpretation of a Japanese lesson study research lesson (Takahashi & McDougal, 2016) in that teachers conduct the lesson with the purpose of learning about their practices. Research lesson creation is scaffolded via a 5-step teacher-led inquiry design template. TI dictates the selection and sequence of steps with LD providing the functionality for adding learning activities, sharing activity resources, and being able to copy, adapt, and reuse not only the learning materials but the overall research lesson. The reusable research lessons and learning activity material within them are OER contributed to the educational community as shown in Figure 1.

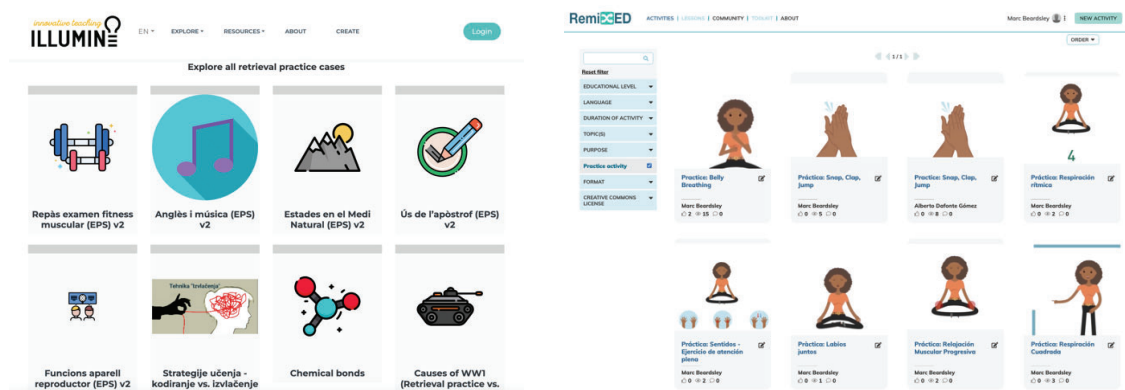


Figure 1. (L) Illumine research lessons, (R) Remixed open educational resources

All in all, the technology scaffolds practice-driven research by teachers on the use of evidence-based teaching strategies through its teacher-led inquiry design template that guides teachers through creating, implementing, reflecting upon, and sharing their research lessons as OER.

3. Case 2: Teaching Students About Stress Management

3.1 Problem Definition

A lack of stress management skills combined with ongoing stressors related to academic demands can negatively impact student academic performance, mental health, and wellbeing (Pascoe et al., 2020). Hence, a multidisciplinary project (RemixED) was initiated to support teacher use of lesson material (OER) introducing evidence-based stress management techniques such as mindfulness and cognitive reappraisal.

3.2 Professional Development Course Design

Results of a survey study conducted at the onset of the project indicate that teachers have a strong interest in learning about the topic of stress (Albó & Beardsley, 2023) but their stress mindsets, defined as their perceptions of the effects and role of stress (Crum et al., 2013), are overly negative and present an obstacle to overcome. Adapting to these insights, the PD course was designed so that participants completed demonstration lessons on stress mindsets and self-regulation techniques as a way to ensure participants learned about positive stress mindsets. These lessons provided an initial experience participants could build upon when adapting additional OER for their students. LD and TI were introduced as processes through which teachers were to plan and reflect upon their use of OER. A 20-hour course (six 2-hour workshops and 8 hours of asynchronous work), shown in Table 1, was prepared.

Table 1. *Teacher PD Course on Evidence-Based Self-regulation Techniques (Case 2)*

Session	Week	Topic
S1	1	Getting started: Expectations & demonstration lessons
S2	2	Preparation: Introduction to learning design concepts
S3	4	Planning: Research lesson sharing & feedback
-	6-8	Autonomous work: Conducting research lessons with students
S4	9	Sense making: Research lesson reflections
S5	11	Publishing: Presenting work & OER publication
S6	12	Lessons learned: Reflecting on the overall course

3.3 Learning Design Technology to Scaffold Practice-Driven Research

With a focus on guiding teachers to help their students learn to manage stress using evidence-based self-regulation techniques, the technology (<https://remixed.upf.edu/>) is conceptualized as an OC for teachers to discover, adapt, and share OER related to stress management (see Figure 1). OC is emphasized through the community interface that facilitates interactions among community members. LD is at the center of the technology in both the creation, sharing, and reuse of learning activities and lessons. Through the LD interfaces, teachers are able to upload files to share, document their adaptations, and provide example use cases. TI reflection prompts work within the activity and lesson creation interfaces to scaffold teacher testing and reporting on the usage of the resources shared with the community. All in all, the technology supports practice-driven research by teachers on the reuse of OER related to stress management for students through the integration of TI reflection prompts into the activity and lesson creation interfaces. These prompts benefit both the creators of resources through aiding their planning and reflecting on their teaching practices, and the community by documenting and sharing examples from the authentic use of the resources.

4. Practice-Driven Research Pilots and Implications

4.1 Research Design

A design-based research approach (Cole et al., 2005) was followed in which the projects' technologies and PD courses were iteratively developed. In both projects, survey research studies were conducted to inform the initial design of the PD course and technologies (Beardsley & Albó, 2022; Albó & Beardsley, 2023). PD courses were then piloted in multiple European countries (Case 1: Spain, Portugal, Serbia, Estonia; Case 2: Spain, Denmark, Cyprus). In these courses, participants worked in small groups (2 to 4 teachers) to design and implement research lessons as a form of collaborative TI. From the pilots, additional data was collected from course participants through pre- and post-course surveys, reflection activities, focus groups, and artifacts produced in the course (i.e., research lessons). A university research ethics committee approved the research in both projects.

4.2 Data Collection and Analysis

This paper presents data related to the artifacts (research lessons), reflection activities, and focus groups from pilots run in Spain. Secondary and vocational education teachers participated in the courses (Case 1: 10 teachers, Case 2: 13 teachers). In both cases, teachers documented their research lessons using a TI template. The data from these templates is summarized in the findings. Additionally, both cases had teachers reflect on the implementation of the course. In Case 1, an asynchronous reflection activity was run at the midpoint of the course and a synchronous reflection activity was run in the final workshop. For Case 2, an online focus group using a conversational method (Devillard et al., 2012) was held with six teachers at the midpoint of the course and a synchronous reflection activity was conducted in the final workshop. Themes were identified from the reflection activity artifacts, transcripts from the focus groups, and observational notes from the final workshops using a cutting and sorting approach (Ryan & Bernard, 2003).

4.3 Findings: Teacher-Generated Research Lessons

Table 3 provides a summary of research lessons run. Case 1 had four research lessons. Three were between group comparisons in which a traditional lesson (i.e., how the teachers would regularly teach such a class) was compared with a lesson using an evidence-based strategy. The fourth research lesson adopted a within group study approach using pre-post measures.

Table 3. *Summary of Research Lessons Produced by Teachers*

	Case 1	Case 2
Number of research lessons	4	6
Strategies explored	Spaced learning, brain breaks, reframing, retrieval practice, and distributed practice	Reframing, square breathing, progressive muscular relaxation, mindfulness
Data collection	Online tools (Google Classroom, Google Forms, Kahoot!), paper-based assignments, and teacher observations	Online tools (Padlet, EdPuzzle, ClassMood App, Google Forms, Google Jamboards, Google Classroom, Kahoot!), paper-based assignments, and teacher observations
Students participating	~165	~200

From Case 2, six research lessons were run. All followed a within group study approach. All these lessons introduced theory on the science of stress as well as self-regulation techniques. Videos and presentation slides were the most frequently used OER. Most lessons used pre-

post surveys related to stress mindsets (Crum et al., 2013) as an evaluation measure and also collected data on student impressions of the lessons.

4.4 Findings: Teacher Reflections

Challenges mentioned by participants that future iterations of the PD courses need to address are summarized in Table 4. In reflecting on the courses centered on research lessons, Case 1 participants shared how they found the strategies suitable and effective to use with their students based on measures of student performance and/or changes in classroom climate. In writing about what they would change in their future research lessons, participants would adopt a more systematic and rigorous application of the activities over time, include student feedback on their impressions of the activities, and change how they implemented specific strategies such as giving immediate feedback on retrieval practice activities. Overall, the use of strategies in research lessons generated insightful reflections among participants seemingly allowing them to contrast their experience with the training and the provided materials.

Case 2 participants noted benefits to the research lessons such as higher motivation, better performance, and an improved classroom climate. They highlighted changes in the perceptions and attitudes towards stress among students. When reflecting about improvements and future implementations, participants highlighted the importance of expounding the scientific evidence behind the practices; and having colleagues share their positive experiences gained from using the resources. In sum, having teachers perform research activities to not only plan their lessons but also reflect on lesson outcomes in a collaborative manner was positively received.

Table 4. *Challenges Identified by Participating Teachers*

Themes	Case 1	Case 2
Workload and time pressure	Having to learn theory, create and implement research lessons was too much work. Also, time to collaborate was not made available within their current teaching schedules	A lot of time needed to be invested to design and then implement sessions. Also, the course was cognitively demanding as a lot of information
School culture	Peer work was not part of the school culture.	A culture of sharing in which time is available to analyze and discuss materials and experiences was not yet established in the school.
Bridging theory and practice	It was a challenge to translate research studies on teaching strategies into practice	NA

4.5 Implications for Practice

In the context of practice-driven research, PD course participants were able to learn about evidence-based teaching, come up with inquiry questions related to the introduced strategies and materials, design learning activities to explore their questions, collect data through implementing the activities with students, reflect on their experiences, and produce lessons learned. In a sense, they were able to conduct practice-driven research and generate outputs that can be useful to the educational community – as case studies of their experiences. Nonetheless, there are still gaps to close before such work can make greater contributions to professional knowledge owned by the teaching profession. Similar to obstacles identified that have slowed the adoption of Japanese Lesson Study outside of Japan (Chokshi & Fernandez, 2004), we observed that many participants struggled to free up enough time to adequately engage in inquiry processes and collaborate with peers, lacked procedural research knowledge and data literacy that affected the quality of data collected and their interpretations of the data, and needed to use the resources (i.e., strategies and materials) with students more than one time to become proficient in using them comfortably for research lessons.

In terms of implications for practice and policy, interpretations of these two cases suggest that collaborative TI, evidence-based teaching, and digital technologies are themes that can be used to engage teachers in continuing PD. Yet, to have teachers contribute to a professional knowledge base grounded in evidence through practice-driven research, efforts are needed to overcome gaps in pedagogical and inquiry practices (e.g., procedural research knowledge and data literacy) and to lessen perceived burdens (workload, time pressure, school culture). Ongoing PD that supports teacher development of both pedagogical and inquiry practices in parallel is likely to play a critical role in establishing and maintaining teacher-owned professional knowledge. Further, innovative technologies that foster online communities of teachers, scaffold LD and TI processes, provide reusable research lessons (OER) – such as the examples presented in this paper – have the potential to support and sustain teacher PD that targets both practices.

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