6-7-2021

Chapter 8- Creating Adaptable Courses: A Course Design Approach that Accommodates Flexible Delivery

Kosta Popovic
Rose-Hulman Institute of Technology, popovic@rose-hulman.edu

Eric M. Reyes
Rose-Hulman Institute of Technology, reyesem@rose-hulman.edu

Jennifer B. O'Connor
Rose-Hulman Institute of Technology, oconnor@rose-hulman.edu

Kay C. Dee
Rose-Hulman Institute of Technology, dee@rose-hulman.edu

Ella Ingram
Rose-Hulman Institute of Technology, ingram@rose-hulman.edu

Recommended Citation

Popovic, K., Reyes, E., M., O'Connor, J. B., Dee, K. C, & Ingram, E. L. (2021). Creating adaptable courses: A course design approach that accommodates flexible delivery. In Thurston, T. N., Lundstrom, K., & González, C. (Eds.), *Resilient pedagogy: Practical teaching strategies to overcome distance, disruption, and distraction* (pp. 148-165). Utah State University. https://doi.org/10.26079/a516-fb24.

8.

CREATING ADAPTABLE COURSES: A COURSE DESIGN APPROACH THAT ACCOMMODATES FLEXIBLE DELIVERY

Kosta Popovic, Eric M. Reyes, Jennifer B. O'Connor, Kay C Dee, and Ella L. Ingram

In early 2020, educators and students around the world endured lapses in quality of educational experiences due to the disruption caused by COVID-19. In return for these lapses, students continued their programs of study within previously established timelines, and educators balanced helping students achieve learning objectives while keeping a manageable workload. Moving forward, students will expect educators and their institutions to deliver high-quality education when disruptions occur, like natural disasters, facilities emergencies, or supply chain disturbances. This expectation will extend to all modes of delivery. We assert that training educators to build adaptable courses that provide them and their students with flexibility allows future disturbances to be managed with reduced stress for all stakeholders, while maintaining the quality of the educational experience.

Preparing for disruption is a risk-management trade-off. Educators balance the risk of expending time and energy creating materials, processes, and structures that may ultimately not be used, with the risk of operating on a just-in-time basis, reworking those materials, processes, and structures with little advance warning. It is possible to create courses that can be delivered anywhere along the spectrum between fully online and fully face-to-face without designing multiple course versions. However, this approach is unfamiliar to many educators, at least partly due to skepticism regarding the quality of online learning and limited use of instructional design support staff (Jaschik & Lederman, 2019), combined with the lack of experience and professional development to keep up with the ever-changing landscape of pedagogical tools and standards (e.g., universal design for learning, accessibility standards, or third-party software platforms).

We present a training experience centered on designing courses that can adapt to multiple delivery modes. For faculty developers interested in hosting a similar program at their institution, we discuss the philosophy that led to our core principles, the implementation of our training, and lessons learned. For educators interested in making their courses more resilient, we present the core principles of our approach and examples illustrating each principle.

Philosophical Stance

Although adjusting to disturbances is often approached as slow shifts that accommodate institutional culture and common practices in the field (Kezar, 2018), we had an urgent need for course development that did not permit gradual and conservative modifications. In addition, we recognized the existence of microcultures within academic departments at our institution; for example, one department has a culture of autonomy in course development, whereas another department implements collaborative course development. Therefore, we adopted elements of political change theory (Kezar, 2018): creating a leadership team representing key academic departments, providing incentives for participants, realigning support office responsibilities and budgets, and facilitating communication and networking among allies. This approach allowed us to accomplish rapid change while acting in accordance with our institution's mission to "provide the world's best undergraduate science, engineering, and mathematics education in an environment of individual attention and support" (Rose-Hulman Institute of Technology, 2021). This mission is deeply significant to our community and is the reason most of our courses are normally delivered in small face-to-face sections; in this new context, providing individual attention and support means achieving student learning objectives regardless of the course delivery method.

Our work was informed by the concept of strategy:

> Strategy is a system of expedients; it is more than a mere scholarly discipline. It is the translation of knowledge to practical life, the improvement of the original leading thought in accordance with continually changing situations. It is the art of acting under the pressure of the most difficult conditions. (Helmuth von Moltke quoted in Hughes, 1995, p. 123)

Our strategy is represented in the core principles, or expedients, shared later in this chapter. In accordance with Moltke's translation of knowledge to practical life, we provided participants with research-informed, practical approaches to course design and delivery rather than information about pedagogical theory or intellectual discussions of scholarly work. We modeled expedience in continually changing situations by adjusting the resources provided and the program timeline as questions and requests emerged from participants.

We introduced and advocated for the concept of lean (originating in manufacturing, Krafcik, 1988; applied to higher education, Balzer et al., 2016), consistent with our identity as a STEM-centered institution. Lean calls for maximizing value while minimizing waste in any process or activity. In education settings, lean eliminates materials, activities, and assessments that are not aligned with course objectives. In the spirit of lean, we asked faculty to implement only the most critical standardizations across courses—those that would most help students.

Implementation

For faculty developers, we discuss how we designed the Creating Adaptable Courses (CAC) training to fit our institutional culture; educators may skip to the core principles section without loss of continuity. The program was launched as a self-paced course in our learning management system (LMS); we asked participants to complete it in one month during the summer of 2020. Responsibilities of the Learning & Technology staff (instructional designers, LMS coordinator, and video specialist) were adjusted to allow the development of the training experience. Porter and Graham (2015) identified three key positive influences for educator use of online learning tools: LMS infrastructure (including fast upload and download of materials), availability of technical support, and shared purpose of instructors and their institution for moving to online, blended, or hybrid learning. Using the LMS for this training helped demonstrate its capabilities to CAC participants. The personal attention given to participants by our Learning & Technology staff displayed our technical support capabilities. Finally, our shared purpose as educators emerged from our strong desire to plan for possible changes in delivery mode in the subsequent academic terms, thereby avoiding the urgency and confusion we experienced in the spring. By accounting for both our institutional culture and the positive influences recommended by Porter and Graham (2015), we created a program that resulted in broad adoption of our recommendations, described below.

Each module of the training followed the same general format: a statement of the objectives of that module, a sequential list of resources to review and activities to complete, a checklist of related tasks to be completed for the specific course(s) participants were developing, and a reflection opportunity. Discussions and networking took place in Microsoft Teams channels, in LMS discussion forums, and via email for individual feedback and support.

In keeping with our institutional mission to provide an environment of individual attention and support, we formed a group of peer mentors. These mentors were experienced in online teaching, had complementary areas of expertise and excellence, and belonged to academic departments serving many first-year students. The mentors reviewed and provided feedback on course plans, assisted with technical support, and offered emotional support. Because mentors had credibility in the microcultures of their academic departments, these mentors communicated between and within those microcultures. The political knowledge and skills of mentors proved critical in leveraging support for implementing this academic change project.

To ensure timely feedback to questions posted on the LMS discussion boards and the Microsoft Teams module channel, designated mentors acted as moderators for each module. The Teams channels led to abundant discussions. For example, the Teams channel set up to discuss asynchronous interactions with students included 37 separate posts with only 3 from the moderators, 83 moderator replies to posts, 105 replies from participants, and 165 reactions. Overall, more than 20% of participants engaged in this specific

discussion. Among the various forums, posts included questions, teaching ideas, affirmations, problems solved, and collaborations.

The reflection component at the end of each module was based on Gibbs's reflective cycle (Gibbs, 1988). Participants described what they did in their course because of the module and addressed if: (a) the module helped align their learning objectives with assessments and activities, (b) they agreed with or rejected principles of lean education in this module, (c) the module invoked feelings about being an educator or the course development process, or (d) the module shaped future course development plans. Moderators provided individual feedback to questions raised in the reflections.

Just over 70% of our full-time faculty accessed the CAC training, and the resources remain online and available for all Rose-Hulman instructors. The primary incentive for participation was the negative experience of switching to remote learning during the preceding spring and the possibility of a similar switch in the near-term future. Intrinsically motivated faculty with strong self-identification as excellent teachers but who were inexperienced with online learning opted into the program. Additional extrinsic motivation was provided in the form of supplemental pay; participants who completed all modules in the CAC training received a small stipend. A subset of participants continued as a cohort to develop courses for first-year students. These individuals received an additional stipend scaled by the credit hours of the course being developed and funded by an institutional grant supporting revision of the first-year experience. Participants received half of this additional stipend prior to the start of the academic year if the in-progress course demonstrated compliance with quality standards for accessibility, LMS navigation and use, universal design for learning, and regular instructor–student and student–student interactions. The other half of the stipend was disbursed upon completion of the course development and maintenance of the quality standards. Finally, mentors received a stipend for their roles in the CAC training.

The CAC training could be modified for other institutional contexts and cultures. For example, larger institutions could create disciplinary or cross-disciplinary discussion cohorts rather than opening discussions to the entire faculty. The cohorts could be formed based on individual instructors' schedules to facilitate cohort progression through the activities at a similar pace, creating shared accountability, and providing timely opportunity for discussions. Although our program was asynchronous, synchronous presentations could be incorporated (e.g., on instructor presence, a topic that generated much online discussion) for institutions with a culture of in-person faculty development. We included an optional module on laboratory experiences because our institution focuses on STEM—studio art, performance disciplines, culinary studies, and other disciplines that may appear low in resilience would be excellent candidates for supplemental modules as appropriate to an institution's programs. Selecting mentors, establishing incentives for participation, and handling the logistical aspects of such a project can be aligned with institutional culture.

Regardless of the institutional context, CAC training can strengthen the "teaching, yet still learning community" of educators (as stated by a tenured professor in engineering), with connections that bring to light critical questions and innovative solutions.

Core Principles

Four principles guided the Creating Adaptable Courses (CAC) training. These principles flowed from our philosophy: focusing on expedients, maximizing value while minimizing waste, providing individual attention and support, and creating or curating materials, processes, and structures (what Riggs & Linder, 2016, call "the architecture of engagement") that could be used in a variety of delivery methods. By applying the following principles, faculty can create courses resilient to disruption.

Make a Detailed Plan for What Matters Most

A resilient course has a plan for what students learn to do, how they practice doing those things, how their mastery will be assessed, and how the course operations will support learning. Educators determine what role they want to play in their students' learning and create a plan to use their time and expertise in that role as much as possible, thereby driving student engagement (Sawers et al., 2016). The work of creating a course plan helps faculty identify which elements of a course are resilient to changes in delivery mode and which elements require additional attention.

The concept of a well-defined course plan was established in the first module of the CAC training experience. Educators examined resources on backward design (creating objectives first, then assessments, then activities; Wiggins & McTighe, 2005), including several models of learning objectives, such as Bloom's taxonomy of the cognitive domain of learning (Krathwohl, 2002) and Fink's model of significant learning experiences (Fink, 2003). Educators selected a preferred model, thereby exercising their experience, expertise, and autonomy (Shadle et al., 2017), and developed a list of learning objectives that became the organizing structure for building their course plan. Over the remaining modules in the CAC training experience, educators enhanced their course plan by linking planned activities and assessments to these objectives, ensuring they could justify each activity and assessment. We encouraged educators to eliminate course elements that did not connect directly to the course objectives or did not work in various modes of delivery. These changes allowed educators to reclaim time and energy that was unlikely to translate to improved learning.

The lean course plans resulting from this work illustrated many approaches to increase course resilience. For example, an untenured professor in science included a variation of the problem-solving studio (Le Doux & Waller, 2016) in his course plan, in which students worked collaboratively in small groups to answer a series of questions and create a system model. This professor planned to spend his time moving among discussion groups to guide thinking, adjust difficulty per group, and answer questions. The students iteratively enhanced

their models and responses as they observed demonstrations at specific time points or learned new information from the instructor. This activity contributed to the resilience of the course because it could be accomplished in a face-to-face setting with a live demonstration or video, in a synchronous online environment with breakout rooms and on-demand delivery of resources (minding the individual groups' progress), or in an asynchronous online environment with discussion forums and a recorded demonstration. The resilient course plan allowed this educator to commit to the problem-solving studio experience and how it relates to learning, not to the delivery mode of the activity.

A resilient course plan highlights how the LMS and other institutionally supported resources help educators flex between modes of delivery while maintaining their most important role in learning. Seeking to promote self-regulated learning, a tenured professor in engineering added checkboxes next to activities and assignments within the LMS. When students completed an activity, they could check the corresponding box, creating a visual signal of their progress toward achieving the learning objectives. Self-monitoring of progress is an important part of self-regulated learning. An additional benefit to this practice was that instead of answering emails that asked what activities needed to be completed in the week, the professor engaged in more meaningful exchanges with students regarding the course content. In a different case, an untenured professor in science used study modules from third-party software (e.g., the Mastering resources from Pearson integrated with the LMS). This software provided students with immediate, consistent, and meaningful feedback on lower-level concepts, which allowed the professor to reduce his time spent grading information-recall questions, and increase his time providing students with rich feedback on other, higher-level assignments. Because the study modules were deployed to the students within the LMS and could be accessed regardless of the mode of delivery of the course, this enhanced the resilience of the course and allowed the professor to maintain his most important role in students' learning. In both examples, the course plan used the capabilities of the LMS to support achievement of learning objectives.

A detailed course plan allows educators to prioritize their role in learning. The plan aligns objectives, activities, and assessments, revealing where the course is lean and resilient and provides a map of the course that educators can share with colleagues and students. Resilient courses have a detailed course plan that allows educators to be agile.

Communicate Strategically

Communication is information exchange. In the context of teaching, communication involves teacher-initiated exchanges like sending a reminder email or sharing a resource, and student-initiated exchanges like asking a question, submitting an assignment, or consulting a peer for help. Using this broad understanding of communication, all course materials constitute information exchange. When educators review every course element through the lens of information exchange combined with their self-determined most important role

in learning, they can review communication needs and options and align them to a specific communication approach. When educators have options for communication, courses become more resilient.

The CAC training differentiated synchronous from asynchronous communication and prompted educators to determine if colocated face-to-face communication was necessary for achieving learning objectives. The training emphasized that synchronous communication is a significant investment, requiring students and educators to gather in the same physical or virtual space simultaneously, and therefore should be reserved for activities that pay the highest returns. We suggested alternatives for effective communication, including open educational resources, discussion forums, virtual poster sessions, and more. Educators recognized that materials appropriate for an online course can also be used in a face-to-face or hybrid course, whether as central learning tools, supplemental materials, or even to bridge a short-term absence. In addition, they learned strategies for efficient and effective one-way or push communications, like regular video updates or text-based course announcements. Part of this module centered on best practices for self-created videos, but participants also shared sources of existing content, including simulations and demonstrations, publisher-provided videos like process animations, and educational material archived on YouTube (e.g., clips of BBC's Blue Planet series or debates in the House of Commons of the United Kingdom). By deliberately selecting communication strategies in the context of the course learning objectives, educators added resilience to their courses.

Using the lens of communication allows educators to revisit how they spend their preparation time and class time. For example, a tenured professor in mathematics typically used lectures to communicate process knowledge (as many educators do; Stains et al., 2018). However, he recognized this same content was covered in an online textbook, existing online videos from the software developers, and short programming vignettes written by experts in the field. He redesigned his course to utilize this content instead of creating his own new video lectures. He then developed interactive programming tutorials, which supplemented and augmented the curated content. By replacing his lectures with a combination of high-quality existing content and new programming tutorials, this professor reduced the amount of lecture development time and required synchronous communication, and thus enhanced the resilience of his course.

A course plan including strategic communication minimizes stress induced by switching between face-to-face and remote settings. For example, a tenured professor in mathematics included a computer-aided problem-solving activity in her course and planned two methods of implementing that activity. In a face-to-face setting, students would turn to one another informally to debug their solutions together, thereby exchanging information and building community. In a remote setting, the professor planned to use the formal pair programming approach (Wells, 1999) using a video conferencing platform. Students would work in pairs sharing their screen with one another to correct syntax errors; each pair would work in separate channels within the platform. The professor would move between channels to check on student progress and answer questions. By identifying the strategic communication need—students debugging code in pairs and in real

time, with the professor checking in—and preparing implementation plans for both face-to-face and remote settings, the professor minimized stress induced by the possibility of needing to shift the delivery method of her course.

Communication can itself be a learning objective. For example, in creating his course plan, an untenured professor in science recognized that some lab sessions involved trivial data collection but also required negotiation on study design. As a result, he distributed the research question, background, and sample data as a push communication, removing the focus of the activity from data collection. Students familiarized themselves with the tools and the objective of the lab independently. They synchronously reflected on study designs and their alignment with the theoretical model being studied, and following this discussion, analyzed the provided data. Because this approach focuses on communication as the key learning objective, it removes the need for students' physical presence in the laboratory. The communication itself can be made platform-neutral and can be accomplished regardless of the mode of delivery for the course, without sacrificing the critical learning objective.

Communication involves significant cognitive effort on the part of all participants. Having the end goal in mind for every communication helps educators determine the appropriate methods of communication. Integrating strategic communication methods within the course plan allows for courses to adjust to significant disruptions.

Schedule Regular Interactions With and Between Students

Rich engagement between educators and students and among students is critical to student achievement of course objectives, regardless of the mode of delivery. By planning when and for what reasons different types of interactions occur (e.g., information delivery vs. performance feedback), educators capitalize on the course environment and effectively use their interaction time. Students benefit from interactions in terms of elevated focus and clarity on activities, assessments, and the learning objectives behind them (Jaggers & Xu, 2016; Bernard et al., 2009). In addition, educators who plan "regular and substantive interaction between the students and the instructor" and include instructor-initiated communication meet the United States Department of Education requirements for distance education and maintenance of federal financial aid for students enrolled in the course (Online Learning Consortium, 2019).

In the CAC training, the concept of interaction centered on the community of inquiry model (Garrison et al., 1999), with social and cognitive presence of the instructor and students as the key considerations. Participants learned that cognitive presence is the unique meaning-making of individual community members, accomplished through critical discourse. The participants compared that definition with social presence; that is, representing oneself as an authentic person, including behaviors like expressing emotion, using names and inclusive pronouns, and referring to others' contributions to the class. During the training,

we provided educators with resources on strategies to demonstrate presence regardless of course delivery mode. They participated in discussion forums on presence, and as a result they learned about the concepts of presence and practiced presence as part of the training. For example, one forum addressed ways to accomplish everyday interactions in different delivery modes and included 15 unique forms of interaction, from peer code debugging to group map reading to using small whiteboards to facilitate sharing.

These examples addressed both educator–student interactions and student–student interactions. One point of emphasis was low-bandwidth teaching, both in the literal sense of internet bandwidth availability and mental bandwidth for both students and educators (Stanford, 2020). We encouraged educators to reserve high-bandwidth activities or synchronous experiences for objectives that could not be met any other way. Educators updated their course plans with how and when they would create instructor presence. Educators' courses became more resilient by incorporating multiple options for interactions with and among students.

Educators can plan interactions to support learning in multiple ways. Seeking to include peer-to-peer learning, foster personal choice in learning, and application of course topics to current events, a tenured professor in science used an activity she called 'science minute': students submitted news stories that connected to course learning objectives, and randomly selected students explained their items to peers. In a face-to-face setting, the professor used handwritten papers and a verbal summary; in an online setting, she used the questionnaire function of the LMS and required students to submit a typed or recorded summary. These short interactions allowed students to feature their personalities and interests. With an interaction that was easy to accomplish in any setting, this professor supported learning in multiple ways and increased the resilience of her course.

Assessment is a critical teaching interaction, and its timeliness is a required component of lean because assessments for which feedback is delayed or not provided may not contribute to fulfilling learning objectives. Seeking to highlight and resolve conceptual fallacies by his students via timely feedback, an untenured professor in science implemented weekly quizzes, with grading automated by the LMS for immediate performance assessment. The professor then identified commonly missed concepts from the analytics provided by the LMS and addressed those misconceptions during the following class. His course plan included intentional choices about regular and frequent interactions with students and minimizing the time between their performance of learning objectives and receiving feedback, therefore aligning with lean principles. Furthermore, given that the assessment was tied to the LMS, the post-quiz feedback interaction could take place in class, synchronously via Teams, or via recorded video that could be reviewed asynchronously, adding to the resilience of this course.

Student–student interaction is often where subtleties in interpretation are debated and resolved. In other words, the informal and less-stressful nature of student–student interactions allows augmented understanding of fundamental concepts, the precision of disciplinary language, applicability of theories to practice, the boundaries of a concept or theoretical system, and where supposed objectivity ends and

subjectivity begins. Educators can make these interactions part of a resilient course, increasing equity, learning, and community identity. An example of capitalizing on student–student interactions is provided by a tenured professor in humanities who found value in having students evaluate disciplinary writing. His course plan included guiding students through a few examples as a class, then having students practice similar work in small groups to learn, for example, how changing the voice from passive to active reveals more information and how to include a quotation without disrupting the flow of a document. The groups captured their observations in a collaborative document, thereby building an answer key as a class, and individual students reported group findings to the class. The rich student–student interactions designed by this professor therefore helped address higher-order learning objectives.

Educator and learner presence, accomplished through interaction with each other and with content, improves student performance (Bernard et al., 2009). Scheduling interactions with students and among students as part of the course plan ensures that these interactions contribute to learning while being independent of the mode of delivery.

Embrace Alternative Assessments

Assessment is integral to learning, providing feedback to students regarding their progress toward achieving learning objectives. Assessment occupies significant cognitive space and requires significant time. Students often focus on assessments in terms of course grades rather than feedback, and educators often dread the burdens of grading and policing misconduct. Although traditional face-to-face or synchronous timed exams are high in expedience, they are low in resilience (e.g., a student might be located in a time zone that renders a synchronous exam inequitable—3pm in New York City is 3am in Beijing). Alternative assessments support learning without the challenges associated with traditional exams (Gozuyesil & Tanriseven, 2017).

The CAC training encouraged educators to think creatively about assessment; we asked them to escape the tyranny of the traditional timed, synchronous assessment. With well-crafted learning objectives, educators determined what they wanted to test (or have students demonstrate they can do). Then, they selected assessments that reflected that intent (e.g., Parmer, 2020; Suskie, 2009). Educators explored the differences between low-stakes and high-stakes assessment schemes and learned that low-stakes approaches are more consistent with academic integrity (Lang, 2013; Darby, 2020). The subsequent discussion addressed topics like rubrics, lockdown browsers, code comparison tools, assessing language translations, and pacing of assessments. As assessments were planned, educators backfilled their course plan with activities (including interactions) and communication strategies. Having all these elements in the course plan allowed educators to see a broader context for how students would achieve the learning objectives. By reserving timed, synchronous assessments for when no other assessment would serve, and incorporating alternative assessments elsewhere, educators increased the resilience of their courses.

The specifications grading assessment model (Nilson, 2014) caught the attention of several educators via a short reading and example syllabi. This model relies on specifications that establish expectations for passing work, and grades are assigned based on the accumulation of passes, meaning meeting all specifications. Embracing specification-based assessment, two tenured professors in science adopted a weekly essay structure they called the "ongoing midterm exam" for their upper-level elective courses. In each case, an essay prompt was posted weekly, focusing on the explication of a concept via taking a stand on a debated issue in the specific field. Specifications included: The essay (a) takes a position; (b) supports arguments with data or logic; (c) identifies constraints, limitations, or alternate perspectives; (d) demonstrates Bloom's taxonomy levels of analysis, synthesis, or evaluation; and (e) incorporates the primary or secondary literature. Students consulted all available resources in constructing their submissions. The open-ended nature of this assessment and its focus on constructing an argument increased time on task and reduced the likelihood of academic misconduct. Because this specification-based assessment can be accomplished via multiple platforms and is asynchronous, it enhanced the resiliency of the course.

Many educators' course plans included assessments derived from high-impact practices (Kuh, 2008), such as in the case of a term-long project being assigned in place of a traditional final exam by an untenured professor of mathematics. Students used a complex data set to address a research question, such as predicting future sales for Walmart using nationwide historical sales data. The project was comprised of five stages; students received feedback at each stage and compiled the various stages into a complete report. This assessment was implemented through the LMS, increasing the resilience of the course because the LMS could be used for either face-to-face or remote course delivery.

Backward design calls for establishing assessments and the performances of learning prior to designing learning experiences and activities. Many educators discovered that assessments can themselves be part of the learning experience (e.g., two-stage exams; Knierim et al., 2015), and further, allow students' ingenuity, creativity, and resourcefulness to emerge. Overall, adopting alternative assessments results in a more resilient course.

These core principles and the work associated with implementing them produce a resilient course that maintains its learning trajectory and teaching strategies even when a disruption occurs. Keeping these four core principles in the forefront during course design and implementation allows educators to fulfill their most important role in learning, however, they define that role.

Benefits and Challenges

We gauged the benefits and challenges of the CAC training via user comments, garnered from over 100 participants (all quotes used with permission). When asked to reflect on their experiences from the course, users highlighted significant benefits and challenges. One benefit was the value of developing the course plan,

consistent with the core principle of making a detailed plan using backward design. Multiple participants commented on the value of this design method for future teaching efforts. In contrast, some participants noted the novelty (to them) of this design approach and the time investment it requires. Nevertheless, most participants expressed that deliberate course planning was worth the undertaking.

> It is very refreshing to have time to think intentionally about course development. Very few terms offer the time and space required to rethink a course in its entirety. I enjoy using the backward design approach to think carefully about course and module learning objectives, and then to align activities and assessments with these objectives.(tenured in science)

> I am overwhelmed by the amount of work and time I had to spend to finish Session 1 [on course design], but at the same time I understand that it is the foundation of the course development process and it is totally worth it to use all the time it takes. (untenured in science)

Our teaching and learning center and our learning and technology office have advocated for intentional course design and planning for years, and the pandemic experience highlighted to many educators how their jobs were made easier through such work. We anticipate that educators that were learning about and implementing both backward design and intentional course design for the first time will have long-term individual and institutional benefits.

Participants noted the value added to their courses from the process of ruthlessly rethinking which activities and assessments are appropriate for the stated learning objectives. This outcome aligned with backward design, the lean philosophy approach, and our emphasis on educators identifying their most important role in learning. Some professors considered alternatives to activities and assessments but decided not to change them. In situations where multiple colleagues worked on the same course, they discussed and shared resources, ideas, problems, and solutions, thereby improving efficiency and standardization. In general, participants expressed that putting every course aspect under the microscope—from the development of new activities (e.g., interactive programming tutorials), to adoption of alternative assessments (e.g., course portfolios), and integration of novel assessment models (e.g., specifications grading)—was a valuable experience.

> I think mapping the assessments to objectives and then reflecting on how many assessments I really needed really helped a lot because it helped me take pressure off of the higher stakes exams which seem to be where most of my issues with students being less than academically pure reside. (tenured in science)

> The objective driven approach and the alternative assessment has got me reconsidering everything about the way I approach the class. (tenured in engineering)

We were especially heartened by benefits identified by experienced colleagues; as one tenured professor in engineering noted, "we will all be better teachers after this." The exercise of determining how every course element fits together and advances the course objectives brought lean to the forefront and showed educators where they had opportunities for flexibility.

Participants also noted the positive experience of interacting with our LMS in the role of students and being offered an (online) environment of individual attention and support. Most participants appreciated examining the possibilities of the LMS and incorporating those possibilities into their courses.

> I am glad that we are taking this class the way that students will take courses. (tenured in engineering)

> I am excited to have a course where the basic content is delivered via video and asynchronously. My role will change to being less of a content deliverer to more of a manager, keeping track of the progress of students, following up with students falling behind, making sure expectations are clearly presented, keeping the course fresh and engaging, and fostering student-student contact. (tenured in mathematics)

Engagement with the training and LMS tools led to a better understanding of the students' experience and how the LMS tools support teaching goals. Educators expanded their LMS capabilities, and therefore increased ways in which they could create high-quality learning experiences.

Participants identified the high volume and rapid pace of online discussions as a challenge. At least one asynchronous discussion occurred during each of the six CAC training modules. One exchange, a sequence of more than 30 messages about learning objectives, involved nine tenured professors and more than 5,000 words in less than 24 hours. The enthusiasm of participants produced voluminous and often close-to-real-time discussion threads ranging from technical process topics ("How do I do X?"), to best practices ("I do X this way, is there a better way?"), to philosophical challenges about the expedients presented and theories referenced.

> I find the forum simply overwhelming. What we have is vastly superior to students writing terse comments that are repetitive. I don't feel like I will ever have time to read all of the comments. (tenured in engineering)

Fortunately, these discussions were respectful, substantive, and sometimes eye-opening. Using names triggered an alert for the individuals mentioned and personalized the conversation, so we were reminded that we were interacting with a colleague, not a chatbot or an anonymous troll. Key phrases like "I appreciate your replies" and "I guess I see this a little differently, though there's plenty of overlap…" modeled acknowledging different perspectives, inquiring to learn more, and affirming positive intent behind comments and challenges. The discussions were a significant source of engagement among participants and with the mentors but overwhelmed some participants.

Some participants resisted revisiting every component of their existing courses and confirming alignment due to workload and a desire to produce the best possible learning experiences. They expressed anxiety and frustration about this aspect of the CAC training. Other participants invested a large amount of time seeking perfect equivalents to nonresilient course components when a good-but-not-perfect resilient replacement would have allowed progress on their course development.

> Seriously working through objectives for the course [then] modules [then] individual assignments, activities & lectures is not a quick task for me at all. I've barely scratched the surface after working for a long time today. (untenured in mathematics)

> This is daunting! I'm just old enough that I can identify with the frustrations of some other senior-ish faculty who might be sensitive to their usual practices seeming a little bit outmoded. (tenured in humanities)

We reminded participants that they might not rebuild in two months a course crafted over ten years; instead, we encouraged them to think of both the short- and long-term benefits of creating a more resilient course and refining it in the future. Our message was that any shift toward resilience and away from fragility, occurring at any pace, was beneficial.

Mentors and Learning & Technology staff identified the rapid pace and volume of discussions as an implementation challenge. Two mentors or support staff were intended to be primary moderators for each module, checking on the discussions once every 48 hours to respond to open questions or comments and affirm or provoke more discussion as needed. However, because mentors and support staff wanted to provide personal, direct, and timely feedback, they responded to posts multiple times per day. This outcome occurred despite each of them being experienced with online education and pacing instructor support.

> After working 10 hours straight yesterday and then doing my best to not feel the pressure to answer emails/posts through the evening and early morning, I am wondering if we should have posted a communication plan on our behalf. Is it too late to do so? (support staff member)

> You need to spend time with your family and the Teams ding is distracting. Please give yourself a break (and feel no guilt). You are always super-responsive to everyone but we should not expect you to be there whenever we have a question. (mentor)

Even though peer support within this group helped with setting professional boundaries, self-applied pressure to respond quickly to posts and questions remained until the CAC training ended.

A second challenge for mentors and support staff was the uneven adoption of core principles across department microcultures, especially relating to the courses for first-year students. These principles were readily integrated into microcultures that had established work processes that included making agreements by

consensus. In departments for which collaborative teamwork and compromise were not the norm, the mentors increased acceptance of the core principles by that department's faculty using negotiation or mediation. This work relied on support from department heads in three ways. First, department heads affirmed the program's goals and methods repeatedly and often, starting from the beginning of the endeavor. Second, they adjusted teaching schedules to allow interested educators to opt into participating, and vice versa. Finally, they held difficult and direct conversations with educators whose courses did not meet the CAC quality standards. These combined efforts were successful: Of the 57 faculty members who committed to developing courses for first-year students that met the CAC standards, 52 have done so.

A continuing challenge of the CAC training is the high informational value of the discussions. Copious useful information was shared and debated; however, reading through the threads from beginning to end is inefficient. This inefficiency limits the long-term utility of these discussions.

> When I have completed online courses in the past and see forums or chats with lots of users and threads, I won't even bother to look at them, because it seems like it will take too much time to search for the information I want. (untenured in engineering)

Maintaining these discussions within Teams allows educators to search for key terms and read specific posts but is an unwieldy process at best. We do not currently have a strategy for archiving these discussions and repurposing the information they contain.

Conclusion

The core principles comprise a system of expedients that can be adopted by educators to fit their personal philosophies of education and their institutional cultures. Educators who implement an adaptable, resilient course add value to their departments, programs, and students. Institutions that adopt a similar training program provide their faculty with direction, agency, and productive coping strategies in times of crisis. Despite our fervent hopes, we cannot control the outside world—the pandemics, the natural disasters, the incidents and accidents—that affect how we deliver our courses. But we can control how we act under Moltke's "pressure of the most difficult conditions." An adaptable course increases our options for that response and helps us be prepared for whatever comes.

Acknowledgments

We thank the following Rose-Hulman friends and colleagues: Sarah Summers and Jay McCormack, for serving as mentors; Janie Szabo, for assisting with program development, faculty mentoring, and instructional design; Alan Ward, for providing video production, editing, and design; Danny Tetteh-Richter, for assisting with culturally inclusive teaching and instructional design. Faculty participants developing first-year courses

were supported by funding from the Lilly Endowment Inc.'s Charting the Future for Indiana's Colleges and Universities initiative, awarded to Richard Stamper, provost and vice president for academic affairs, Rose-Hulman Institute of Technology.

References

Balzer, W. K., Francis, D. E., Krehbiel, T. C., & Shea, N. (2016). A review and perspective on lean in higher education. *Quality Assurance in Education*, *24*(4), 442–462. https://doi.org/10.1108/QAE-03-2015-0011

Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., & Bethel, E. C. (2009). A meta-analysis of three types of interaction treatments in distance education. *Review of Educational Research*, *79*(3), 1243–1289. https://doi.org/10.3102/0034654309333844

Darby, F. (2020, September 24). 7 ways to assess students online and minimize cheating. *Chronicle of Higher Education*. https://www.chronicle.com/article/7-ways-to-assess-students-online-and-minimize-cheating

Fink, L. D. (2003). *Creating significant learning experiences*. Jossey-Bass.

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in text-based environment: Computer conferencing in higher education. *The Internet and Higher Education*, *2*(2), 87–105. https://doi.org/10.1016/S1096-7516(00)00016-6

Gibbs, G. (1988). *Learning by doing: A guide to teaching and learning methods*. Further Education Unit, Oxford Polytechnic.

Gozuyesil, E., & Tanriseven, I. (2017). A meta-analysis of the effectiveness of alternative assessment techniques. *Eurasian Journal of Educational Research*, *70*, 37–56. https://doi.org/10.14689/ejer.2017.70.3

Hughes, D. (Ed.). (1995). *Moltke on the art of war: Selected writings*. Presidio Press.

Jaggers, S. S., & Xu, D. (2016). How do online course design features influence student performance? *Computers & Education*, *95*, 270–284. https://doi.org/10.1016/j.compedu.2016.01.014

Jaschik, S., & Lederman, D. (Eds.) (2019). *2019 survey of faculty attitudes on technology*. Inside Higher Ed. https://www.insidehighered.com/news/survey/professors-slow-steady-acceptance-online-learning-survey

Kezar, A. (2018). *How colleges change: Understanding, leading, and enacting change* (2nd ed.). Routledge.

Knierim, K., Turner, H., & Davis, R. K. (2015). Two-stage exams improve student learning in an introductory geology course: Logistics, attendance, and grades. *Journal of Geoscience Education*, *63*(2), 157–164. https://doi.org/10.5408/14-051.1

Krafcik, J. F. (1988). Triumph of the lean production system. *MIT Sloan Management Review*, *30*(1), 41–52.

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. *Theory Into Practice*, *41*(4), 212–218. https://doi.org/10.1207/s15430421tip4104_2

Kuh, G. D. (2008). *High-impact educational practices: What they are, who has access to them, and why they matter*. American Association of Colleges & Universities.

Lang, J. M. (2013). *Cheating lessons: Learning from academic dishonesty*. Harvard University Press.

Le Doux, J. M., & Waller, A. A. (2016). The problem-solving studio: An apprenticeship environment for aspiring engineers. *Advances in Engineering Education*, *5*(3), 1–27. https://advances.asee.org/wp-content/uploads/vol05/issue03/Papers/AEE-19-Flipping-LeDoux.pdf

Nilson, L. (2014). *Specifications grading: Restoring rigor, motivating students, and saving faculty time*. Stylus.

Online Learning Consortium. (2019). *Regular and substantive interaction: Background, concerns, and guiding principles*. https://files.eric.ed.gov/fulltext/ED593878.pdf

Parmer, L. L. (2020). *Alternatives to the traditional exam as measures of student learning outcomes*. The Scholarly Teacher. https://www.scholarlyteacher.com/post/alternatives-to-the-traditional-exam-as-measures-of-student-learning-outcomes

Porter, W. W., & Graham, C. R. (2015). Institutional drivers and barriers to faculty adoption of blended learning in higher education. *British Journal of Educational Technology*, *47*(4), 748–762. https://doi.org/10.1111/bjet.12269

Riggs S. A., & Linder K. E. (2016). *Actively engaging students in asynchronous online classes*. IDEA Center Paper Series #64. https://www.ideaedu.org/research-resources/idea-papers-series/

Rose-Hulman Institute of Technology. (2021). *About us*. https://www.rose-hulman.edu/about-us/index.html

Sawers, K. M., Wicks, D., Mvududu, N., Seeley, L., & Copeland, R. (2016). What drives student engagement: Is it learning space, instructor behavior or teaching philosophy? *Journal of Learning Spaces*, *5*(2), 26–38. http://libjournal.uncg.edu/jls/article/view/1247

Shadle, S. E., Marker, A., & Earl, B. (2017). Faculty drivers and barriers: Laying the groundwork for undergraduate STEM education reform in academic departments. *International Journal of STEM Education*, *4*, Article 8. https://doi.org/10.1186/s40594-017-0062-7

Stains, M., Harshman, J., Barker, M. K., Chasteen, S. V., Cole, R., DeChenne-Peters, S. E., Eagan Jr., M. K., Esson, J. M., Knight, J. K., Laski, F. A., Levis-Fitzgerald, M., Lee, C. J., Lo, S. M., McDonnell, L. M., McKay, T. A., Michelotti, N., Musgrove, A., Palmer, M. S., Plank, K. M., . . . Young, A. M. (2018). Anatomy of STEM teaching in North American universities. *Science*, *359*(6383), 1468–1470. https://doi.org/10.1126/science.aap8892

Stanford, D. (2020, March 16). Videoconferencing alternatives: How low-bandwidth teaching will save us all. *IDDLBlog*. https://www.iddblog.org/videoconferencing-alternatives-how-low-bandwidth-teaching-will-save-us-all/

Suskie, L. (2009). *Assessing student learning: A common sense guide* (2nd ed.). Jossey-Bass.

Wells, D. (1999). *Pair programming*. Extreme Programming. http://www.extremeprogramming.org/rules/pair.html

Wiggins, G., & McTighe, J. (2005). *Understanding by design* (2nd ed). ASCD.