What Does Course Design Mean to College Science and Mathematics Teachers?

By Gary A. Smith, Audriana Stark, and Julie Sanchez

A phenomenographic study at a research university identified five categories of description for how STEM (science, technology, engineering, and mathematics) instructors conceptualize the design and redesign of undergraduate courses. These categories form a hierarchical outcomes space with increasing complexity of awareness of the phenomenon. The basic conceptualization (Category 1) is individual focus on the content to teach. Another focus turns to how to teach the content (Category 2). In Category 3, course design involves critical reflection that informs adjusting what is taught and how it is taught. Category 4 extends course design from individuals to collaborative activity within a department. In Category 5, instructors' course-design lens expands beyond a department to embrace collective engagement with people across disciplines and universities to develop a culture to innovate teaching and learning. The study shows that instructors, administrators, and faculty developers should view course design not only as a variety of individual approaches, but also as opportunities to stimulate networks to enhance the design process and its impact.

The national call for increasing the graduation of STEM (science, technology, engineering, and mathematics) majors (National Academies of Sciences, Engineering, and Medicine, 2010; President's Council of Advisors on Science and Technology, 2012) stimulated research and reform focused on undergraduate STEM instruction (National Academies of Sciences, Engineering, and Medicine, 2015, 2017; National Research Council, 2012). In turn, higher education institutions use the emerging research and calls to action to drive redesign of STEM courses and curricula (Association of American Universities, 2017; Dolan et al., 2016; Wieman, 2017).

Multiple sources (Fink, 2013; Felder & Brent, 2016; Handelsman, Miller, & Pfund, 2007; Jones, Noyd, & Sagendorf, 2015; Wiggins & McTighe, 2005) provide a uniform view of the general attributes of the course-design, or redesign, process. Although varying in advocacy for linear or relational approaches, these sources converge on describing course design as the integration of learning objectives, informational content, instructional strategies, and both formative and summative assessment of learning. In addition, designing courses has grown in the last decade to be an important signature program of faculty-development centers (Beach, Sorcinelli, Austin, & Rivard, 2016). Nonetheless, the matter of how STEM instructors responsible for design and delivery of courses conceptualize the design process remains vague.

Guiding framework

Understanding course design relates to existing research characterizing teachers' definitions of teaching and curricula and their descriptions of learning and development as a teacher. Most of this prior work draws on the phenomenographic approach, which originated within higher education research (Tight, 2016). The method has been used to determine how students and teachers conceptualize learning and teaching (e.g., Bowden & Green, 2005; Marton & Säljö, 1976; Trigwell & Prosser, 1999), how faculty conceptualize the meaning of "curriculum" (Fraser & Bosanquet, 2006), and how faculty view their learning and development as teachers (Åkerlind, 2007; McKenzie, 2007, Töytäri et al., 2016).

Primarily phenomenographic studies show consistent variations in how college teachers describe and conceptualize teaching. These conceptualizations range from teacher-focused strategies with the intention of transmitting knowledge, through variously defined intermediate stages to learner-focused strategies intended to foster students' construction of

knowledge and conceptual change (e.g., Kember, 1997; Trigwell & Prosser, 1999; Trigwell, Prosser, & Taylor, 1994; Prosser & Trigwell, 2006; Samuelowicz & Bain, 2001).

A parallel hierarchical view of what it means to develop as a teacher is elucidated in the phenomenographic research of Åkerlind (2007) and McKenzie (2007) in different studies of Australian university faculty. Faculty members' views of their development span from becoming more familiar with what to teach (to be a more comfortable and confident teacher) to becoming a more effective facilitator of students' learning via research-based practices regarding student development.

In another qualitative study of Australian faculty, Fraser and Bosanquet (2006) found a range in conceptualizations of "curriculum." These views ranged from the content of individual courses or a program of study to a dynamic entity developed interactively by faculty and students.

Other work points to the interdependence between individuals and the sociocultural environment of the institution as key elements of faculty work. Boelryk and Amundsen's (2016) research documents the social influences of faculty members' interactions with peers, students, and institutional priorities. Similarly, when considering how instructors report what they learn, Töytäri et al. (2016) found four related categories of individual learning, collegial learning, team learning, and innovative partnership learning.

Acknowledging the documentation of multiple conceptualizations of teaching, curriculum, and professional development in the body of literature referenced previously, we use a phenomenographic, qualitative framework to investigate higher education instructors' understandings of STEM course design. Phenomenography asserts that individuals have different concepts of the world because any person at any time only partially experiences a phenomenon (Bowden & Walsh, 2000; Marton, 1981, 1986). Therefore, people discern contrasting aspects of a concept or a phenomenon to different degrees, including differences that arise in varying context or at different times. This leads to the fundamental nondualistic ontological position in phenomenography; object (in this case, course design) and subject (i.e., teacher) are inseparable because the subject's experience and understanding of the object is a relationship between the two. Therefore, phenomenography is a second-order research approach because it does not simply seek to describe the phenomenon but rather the relation between the phenomenon and how people experience it from different perspectives.

Purpose

This study is prompted by the question: What does course design mean to college science and math teachers? The inquiry contributes to the research on teaching that allows instructors to ground their work within the conceptualizations of other teachers while informing faculty developers of effective practices in course-design programs.

Methods

This research used a qualitative phenomenographic methodology. The researchers aim to conceptualize the experiences of a phenomenon—the meaning of mathematics and science course design to STEM teachers to describe the participants' various understandings in a shared, relational, and categorical manner.

The study utilized semistructured interviews, each lasting 60–90 minutes, with nine STEM instructors. The nine participants consisted of tenured professors, full-time nontenure-track teaching faculty, and graduate teaching assistants in STEM disciplines. Although the participants had different levels of teaching experience, all participants completed a STEM course redesign professional development program as part of a team and taught the newly designed course prior to this study. Because of the small sample size, we do not disclose demographic data of the participants to preserve anonymity.

TABLE 1

Standard interview questions.

1. What does it mean to design a course?
2. How do you go about designing or redesigning a course? Why do you do it this way?
3. Have you always done it this way? If not, how and why has your experience changed during your career?
4. Tell me about how other people have influenced your conceptualization of course design in a negative, positive, or neutral way.
5. In your experience, what processes enhance or impede the successful design or redesign of a course?

Each interview was a predesigned protocol of open-ended questions, shown in Table 1, with further probing by the interviewer to gain a description of course design. The project was approved by the institutional review board at the authors' university. The interactions between the interviewer and interviewees aided the instructors to create meaning about the phenomenon of course design (Larsson, & Holmström, 2007). Concrete examples were elicited to understand how and why courses are designed as they are.

Using criterion sampling (Lincoln & Guba, 1985), participants were selected from among members of a STEM professional-development program for course redesign at a research-intensive university. The professional-development program was 1 year long and included an intensive 2.5-day institute followed by monthly meetings and consultations with two faculty developers. Instructors formed teams of 2–5 members who redesigned an existing gateway science or mathematics course or developed a new course based on literature and best practices in teaching and learning. Each of four annual cohorts included three to four such teams who met together as a faculty learning community. Guided by the approach of Handelsman et al. (2007), each team generated active learning–focused courses based on revised or new learning objectives and accompanied by new formative and summative assessments. Interaction between teams within each cohort and across cohorts allowed for peer input beyond facilitation by the two faculty developers. The program components are described further by Smith and Stark (2016).

Interviews were conducted by an investigator who was not connected to the professional-development program. Audio recordings of the interviews were transcribed and analyzed using qualitative methods in line with a phenomenographic approach.

The three-person research team read the interview transcripts to reveal categories of description (Bowden & Green, 2005), which were identified as qualitatively different meanings or ways of experiencing the phenomenon. The categories emerged in totality from collective participant conceptualizations. Therefore, statements by an individual may fall into various categories, and the categories describe ways of conceptualizing course design and not ways of describing the individual participants. The categories resulted from an iterative analysis process with the researchers challenging, revising, and aligning the transcribed interview utterances to the apparent categories (Bowden & Walsh, 2000). The category descriptions were refined into the outcomes space that represents the course-design phenomenon as experienced by the participants (Marton & Booth, 1997). The research team analyzed all categories to ensure they were distinct, logical, and relational, as is crucial for phenomenographic analysis (Bowden & Green, 2005).

The primary limitation of this study arises from the relatively small sample of STEM participants from a large-enrollment, research-intensive institution, all of whom participated in a team-based, faculty-development program for course redesign. STEM instructors from other institutions, particularly those with more focused teaching missions and smaller class sizes, may conceptualize course design differently from the participants in this study. Likewise, references to experiences in the STEM course redesign initiative indicate conceptualizations of what it means to design a course to include participation in faculty development programs, and learning from peers within faculty learning communities, which will not be true for all STEM instructors. Finally, outcomes may differ for faculty members outside of the STEM field.

Categories of description

Phenomenographic studies refine themes that emerge from interviews into distinct, hierarchically related categories of description. For this study, five qualitatively distinct notions of course design emerged from the interviews (Figure 1). The categories together form an outcomes space depicting the varying conceptualizations of course design. Furthermore, the categories are hierarchically related and ordered in terms of comprehensiveness and complexity that indicates increasing breadth of awareness of the experienced phenomenon.

Following are the five categories of description capturing the ranging ideas of what it means to design a course. Each category is accompanied by an archetypal question.

- *Category 1*. Course design as content: "What do I teach?"
- *Category 2*. Course design as methods: "How do I best teach this material?"
- *Category 3*. Course design as a reflective practice: "What is working, what is not working, and how can I make it better?"
- *Category 4*. Course design as departmental collaboration: "How can we align our teaching across sections and courses to make learning experiences better for students?"
- *Category 5*. Course design as collective change: "How can

we enlarge our impact and learn from one another to continuously improve teaching and learning in higher education?"

These categories and their accompanying questions serve as our results from the study. We will now explore each category from the utterances in the transcripts in the following sections.

Category 1: Course design as content

Category 1 descriptions illustrate course design as a process of selecting content. Participants ask themselves, "What do I teach?" This first category describes course design as an individual action to determine course content based on topical priorities and/or stated learning outcomes along with the time allocated to each topic or outcome (see Table 2). As one participant put it: "I come up with my list of topics, [and] then, [determine] what can be accomplished in said time period."

The course topics might be a perception of what is traditionally accepted in the discipline, how the course has been previously taught, or the content featured in a textbook. On the basis of this topical list, instructors determine the time to spend on each topic. Student learning outcomes were included as an essential part of designing the course. Some instructors shifted their focus from topics to outcomes throughout time (Table 2, quote c).

Category 2: Course design as methods

Category 2 descriptions illusrate course design as a process of choosing the best methods for instruction (see Table 3). This category is characterized by the question, "How do I best teach this material?" Instructors conceptualize course design as an individual action where they determine the strategies and tools for instruction and assessment. In this category, instructors think about activities for the student to accomplish learning outcomes; for example, "I start to think what was the best format and activities that can allow the students to accomplish those outcomes."

Participants would question how to best teach after considering the course content or learning outcomes (Table 3, quote a). Some instructors described incorporating in-class and

FIGURE 1

The outcomes space for instructors' conceptualization of course design consists of five categories of description that are hierarchically ordered in terms of comprehensiveness and complexity that indicates increasing breadth of awareness of the experienced phenomenon. Each category can be associated with a guiding question that describes course design at that level. Categories 1 through 3 focus on individual action, with "I" in the guiding questions. Categories 4 and 5 view course design within larger communities, with "we" in the guiding questions.

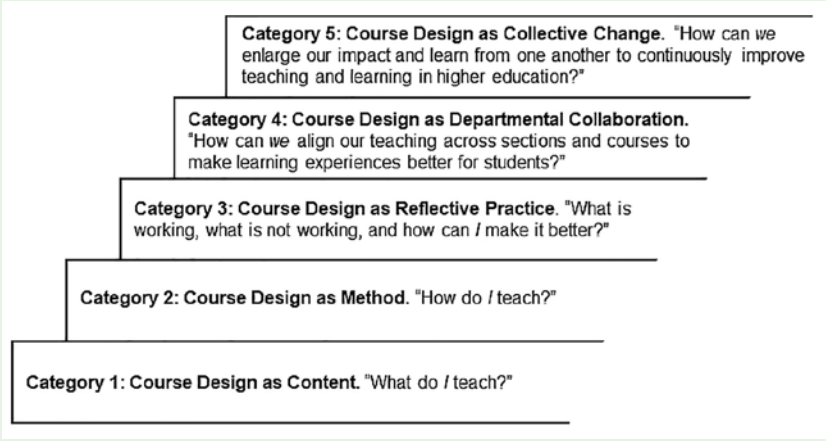

TABLE 2

Instructor statements relevant to Category 1: Course design as content.

a) "Okay where's the textbook? How many [chapters] do I have to cover? . . . What's the content that they're supposed to know?"
b) "I think about what the end goals are. What are the outcomes that my students are supposed to take away? And then work backwards from there."
c) "My previous approach started from what I want to teach them. And now I start with what's the goal . . . , objectives, and what kind of outcomes I'd like my students to have after they complete a course."

out-of-class learning elements (Table 3, quote b).

A variety of teaching methods used in courses were described. The teaching strategies and tools discussed during the interviews by participants included: preparing lecture videos for online access, interactive lectures, students working in groups, instructor writing on a chalkboard or whiteboard, use of audience-response systems, writing to learn, completing homework assignments, conducting laboratory experiments, collecting data, incorporating real-world examples, and formative and summative assessment that served as learning opportunities. No participant specifically referred to creating lectures as a part of their design. Instead, instructors gravitated toward discussion about active learning techniques and how their methods for engaging learners may change over time (Table 3, quotes c and d).

TABLE 3

Instructor statements relevant to Category 2: Course design as methods.

a) "To design a course is just putting down the information you want to get across . . . and then you think about how are they going to do it, and what are they going to do?"
b) "I think about three spaces in terms of learning. I think about what students can learn before class time to prepare for the class . . . what students are going to do in the class, and . . . what students have to do after the class to practice and cement that piece."
c) ". . . because I wanted to interact with the students more. I wanted to do more than just stand there and lecture . . ."
d) "When you first start teaching, you think 'okay so what did my teachers do?' And so, you're like 'okay, so I'm going to model my teacher and so then they [the students] will model me'; the cycle of life shall continue. But, then after a while you realize this is no replacement for them [students] doing it, you know. They have to do something, not just watch me."

TABLE 4

Instructor statements relevant to Category 3: Course design as reflective practice.

a) "It's all about what did I do last year and then just revising to make improvements."
b) "You either fix the lower hanging fruit or you say, 'I have to work on the harder ones and let the lower hanging ones go because they were tolerable and sure there were some little mistakes but we'll fix those along the way.' So every semester it becomes easier; there's less to fix, there's less trial and error. And, then when you get to the point where you're pretty happy then you start to reevaluate again."
c) "I'm teaching a class and maybe forty percent of the students get a failing grade. That can't all be the students. There's gotta be something else going on or I don't know what is going on."
d) "You get the same student responses: 'I really studied this'; 'I really understood this'; 'I've just got an F on this test.' So when you get a few of those, as a teacher you begin to reflect on yourself, you start to think, 'WOW! What am I doing wrong?' [laughing]. 'Why isn't this working?' 'How come everybody isn't getting it?'"
e) "When you've been tasked to teach a class you think, 'So when I took that class what did it look like?'"

Category 3: Course design as a reflective practice

Category 3 descriptions illustrate course design as a reflective practice that individuals use to improve their own course. The category is characterized by asking, "What is working, what is not working, and how can I make it better?" Course design conceptualized in this category involves an ongoing process of individual reflection on data, experiences, and/or beliefs that inform adjustments to both what is taught and how it is taught (see Table 4). A participant summarized their thinking: "What happened here? Why? Then, as a result of that thinking or reflection, I started to think about how to modify it."

In this category, design is viewed as an iterative process that is informed by data about student learning (Table 4, quotes a and b). After teaching the course, some instructors focused on reworking the content and pedagogy rather than creating an entirely new approach. However, some instructors felt it necessary to completely discard what was not working in favor of new ideas and material to test in the classroom. Even after developing

a track record with a course, some instructors would continue to collect pertinent data and refine the course using analyses from their classroom-action research.

Instructors pointed to various catalysts for their reflection including viewing students as sources of data to inform change. Reflection was triggered by conversations with students, patterns in assessment questions missed by multiple students, watching students and seeing what topics cause unproductive struggle, or reading student ratings (e.g., Table 4, quotes c and d). Participants also reflected on their past student experience to inform their course design decisions (Table 4, quote e).

Category 4: Course design as departmental collaboration

Category 4 describes course design as a collaboration to improve sections and courses within a department. This category focuses on answering, "How can we align our teaching across sections and courses to make learning experiences better for students?" It is distinct from the previous categories because the discussion moves from "I" to "we" (see Table 5). This conception of course design includes people within a single department collaboratively coordinating instruction across course sections or cooperatively integrating courses within the departmental curriculum. One participant described the collaboration as such: "So, if you're teaching 'X' course and there's five faculty that are teaching, then the five faculty should get together and decide what the outcomes are."

Participants noted that course design is fueled by the collaborative energy of engaging with department colleagues. Faculty, graduate students, and administrators within the department are part of an ecosystem for teaching and learning (Table 5, quotes a through e). Instructors share resources and insights from their teaching and the problems they experience. The "collective wisdom" spreads through the department among both advanced and novice instructors and becomes part of what it means to design a course (Table 5, quote c).

Although instructors share resources and knowledge, participants insisted that no one is compelled to teach in a specific manner, so instructors can retain their autonomy. Rather, they are provided with the resources should they choose to use them and encouraged along (Table 5, quote f). Despite varying degrees of experience, participants state that they are regarded

TABLE 5

Instructor statements relevant to Category 4: Course design as departmental collaboration.

a) "The thing that attracted me the most [to redesigning a course] was probably the willingness of the people involved to do something about it. . . . There's always the thought in the back of your head that this is not going to change, I can't do anything by myself, and you have to get enough people that care about it to actually do something. . . . It's like there's a problem that you always know about, and then finally somebody says, we're going to do something about it and then you get excited to be a part of that."
b) "We had weekly meetings amongst all the teachers who were teaching general chemistry and so that was a place where we would talk about problems we were having, especially because the year I started teaching there were also a couple of other (instructors) . . . who were either new to teaching that class or new to using the active learning techniques that we were using."
c) "I was a part of a cohort of instructors, where we discussed things through and I was the most junior in that cohort. It was very much a learning experience for me and in a lot of ways I drew from their collective wisdom that they had worked on."
d) "We meet as a group of instructors to set certain common core questions. So we don't always set the same exam, although quite a lot [of instructors] in Gen-Chem II we end up sitting the same exam. But, Gen-Chem I, they tend to be two camps in terms of somebody likes it really conceptual, somebody couldn't care about the conceptual but wants the really hard math problems. But, we can all agree on four or five questions that we think are really important for the students to know that link to our outcomes."
e) "It's being part of the team that you trust to not let you go too far off track, but still gives you the freedom to explore, that is interested in hearing your ideas, and not just 'this is what we're going to do, this is how we're going to do it, this is when it's going to get done.' I think that the team took my opinions seriously, which was, very helpful in getting me to actually say something. I felt comfortable approaching everybody on the team about something that I thought was an issue, and that was a very important thing for me."
f) "I told one of the new faculty coming in, I warned him, that we're doing a lot of strange things here, and . . . we don't expect you to do anything this semester. . . . In the middle of the semester he came back to me and he said, 'I think I want to do the small group discussions . . . I really want to give our students a chance to try it out.' And, I say, 'okay go for it.'"

as valuable members of their department with expertise in areas that can be added to the shared wisdom of the group.

Category 5: Course design as collective change

Category 5 descriptions portray course design as a collective change process across higher education to improve teaching and learning. The category is oriented toward answering, "How can we enlarge our impact and learn from one another to continuously improve teaching and learning in higher education?" This category views course design as an activity that expands beyond a department to embrace people across disciplines and universities to develop a culture to innovate teaching and learning (see Table 6). A participant explained: "I really think that redesigning needs to be a culture. We need to work on redesigning toward a change of culture."

The collective sharing of teaching practices that are supported by administrators, faculty members, and students define a culture of continuous improvement in teaching and learning across all of higher education.

Expanding design beyond a department includes communication across disciplines. Instructors consider other courses that students encounter along their pursuit of a degree and connect with faculty from those departments to share teaching and learning practices (Table 6, quotes a and b).

Participants discussed being part of an ecosystem of on-campus support centers. Libraries, tutoring centers, and faculty-development centers are local sources for catalyzing and reinforcing a culture for course design that spreads beyond disciplinary boundaries (Table 6, quotes d and e).

Category 5 also includes reaching to neighboring institutions and off-campus resources to improve courses. For example, participants discussed the advantages of working with counterparts at neighboring institutions. In this category, instructors look for models of best practices in teaching and learning across institutions (Table 6, quotes f and g). Professional development conferences and workshops along with research literature are seen as essential diffusion of teaching innovations that inform course design (Table 6, quote h).

TABLE 6

Instructor statements relevant to Category 5: Course design as collective change.

a) "It was a sense of it not just being a community in chemistry, but the entire campus; and not just between the faculty but also between the students and the faculty, the students and the students."
b) "I [Mathematics faculty] meet with a couple of Chemistry faculty and we are coming up with a Math 121 section [with] some kind of curriculum that is really going to help incoming chemistry students. We've had so many good conversations when we all get together, I just learn so much from each other, from sharing."
c) "Connections are so important. I have established great rapport with the library, and when I told them I wanted to start having my classes come over to the library, they were champing at the bit."
d) "Because we have such good resources here, we've got [student support service], . . . we've got [faculty development center], we've got [STEM professional development program] . . . I can't do everything myself (laughs) and I would go to them."
e) "At the end of that semester I found [the faculty development center] and I went to a designing multiple-choice tests workshop. I realized that there were people who actually knew about how people learn, and there are people who had studied as much as I studied chemistry and the sort of best practices and structure. So I went to the course-design institute and basically was really inspired and jumped in and redesigned my course."
f) "We have the faculty from [a neighbor 2-year institution] teach for us, and that is for many multipurposes. For example, they can bring our practice back to [the neighbor institution]."
g) "There was so much precedence, so many schools, state schools like [another institution], schools like (an institution), . . . across the board it was very successful, and so we thought we could look at those things, and just model it based on that, and it's been running. The pass rates have been higher in both classes. "
h) "Can I start reading up? Can I start going to conferences where they would have education venues? Um, what is it that they're doing? What is it that they're trying?"

The outcome space at a glance

To summarize, relevant utterances from interviews were grouped and refined into five distinct interpretations of what it means to design a course. Each category is a mixture of responses that were gleaned from

the interviews and refined by the researchers. Categories 1–3 include an individual emphasis on choosing what to teach, how to teach, and what to change in the course. Categories 4 and 5 include a community approach to designing courses within the department, across disciplines, and beyond one's own institution. This outcome space illustrates course design as both an individual and collective activity of developing a course by considering content, pedagogy, reflection, and a sharing of resources and knowledge.

Integration and significance

The conceptions of course design captured in this study point to refining the culture of teaching and learning as a continuous individual and social process of improvement, with the latter including processes within departments, across disciplines, and expanding to other campuses. Designing courses is central to how instructors view teaching, their personal development as a teacher, and their perceptions of learning (Töytäri et al., 2016). How faculty conceptualize course design is also crucial to facilitating instructional-change processes (Henderson, Beach, & Finkelstein, 2011; Kezar, Gehrke, & Elrod, 2015) and thus is an important factor for faculty developers to consider.

It is important to note that our results extend beyond the idea of individual instructors developing courses (Categories 1–3) to a broader conception of course design that entails collaboration among communities of instructors who work together to develop courses (Category 4) and to collective efforts across and beyond institutions (Category 5). This finding is consistent with the view of individual learning, collegial learning, team learning, and innovative partnership learning among faculty as discussed by Töytäri et al. (2016). Elrod and Kezar (2017) similarly regarded organizational learning beyond departments as essential for reforming STEM instruction. Therefore, faculty should seek collaborators within and beyond their disciplinary departments when seeking to design new courses and redesign existing ones, and STEM department chairs and faculty developers should encourage and arrange such networking opportunities.

The strength of this broader concept of course design by the study participants differs from views of collaboration and collectivism as contrary to the culture of higher education (MacGillivray, 2017). It is consistent, however, with Boelryk and Amundsen's (2016) conclusion that social, as well as individual, factors affect faculty learning about teaching. The broader conceptions of design as collaborative and collective activities also incorporates STEM instructors' preference for personal evidence rather than empirical evidence (Andrews & Lemons, 2015; Dancy, Henderson, & Turpen, 2016), given that instructors become a part of a supportive ecosystem where personal connections are fostered.

Collectively, the aforementioned body of research, including this study, points to the importance of the instructor as an individual (Categories 1–3), as the member of a department (Category 4), and as part of a larger community within and beyond their own institution (Category 5) as factors in course design. This result matches with the urging by MacGillivray (2017) to catalyze innovation and progress within disciplines across geographic and cultural boundaries. Administrators, including deans and chairs, are important players in shaping the institutional culture (Kelly, 2014), but ultimately it requires energy from stakeholders at all levels, including students and instructors (Oliver & Hyun, 2011).

The work of faculty-development centers to spark and support course design and redesign should move beyond programming for individual instructors. Those interested in catalyzing change to broaden the conception of course design as a collaborative (Category 4) or collective (Category 5) endeavor should work toward promoting a shared vision (Oliver & Hyun, 2011); nurturing communities of practice (Anderson & Schönborn, 2008; Stark & Smith, 2016) and departmental faculty networks (Andrews, Conaway, Zhao, & Dolan, 2016); establishing faculty learning communities (Cox, 2004); guiding and participating in action research projects (Kember & McKay, 1996); and valuing scholarship of teaching and learning (Fraser, 2016; Saroyan & Trigwell, 2015).

The current study reveals hierarchical conceptualizations of course design (Figure 1) that interestingly parallel the results in previous, also mostly phenomenographic, studies of how faculty view teaching (Prosser, Trigwell, & Taylor, 1994; Trigwell & Prosser, 1999) and their development as teachers (Åkerlind, 2007; McKenzie, 2007). For example, Åkerlind (2007) found that instructors envision their development as teachers within a hierarchy from becoming more familiar with what to teach, to becoming more familiar with how to teach, and to finding out which teaching strategies do and don't work for both teacher and students. This hierarchy in the development as a teacher is mirrored in the findings from this study where instructors perceived course design

as what to teach (Category 1), how to teach (Category 2), and reflection on teaching experiences that inform improvement (Category 3). These comparable categories for describing different phenomena may reveal a close relationship between how faculty perceive their development as a teacher and how they perceive course design as a core responsibility. Furthermore, McKenzie (2007) viewed reflective practice as central to faculty members developing from teacher-centered to student-centered views of teaching, which matches with research results focused on how faculty define their teaching approaches (Henderson et al., 2011; McKenzie, 2007; Trigwell, Martin, Benjamin, & Prosser, 2000) and is in line with what emerged in our data for Category 3 (course design as reflective practice). Whereas McKenzie's (2007) discussion of reflection in the context of teacher development focused on the difference between teachers reflecting on themselves, their teaching, and students' reactions to teaching, within the conceptualization of course design presented here there is greater faculty reflection on student learning.

To summarize, the results of our research provide a model for understanding what course design means to faculty that can be used by faculty and faculty developers to plan course-design processes. The research results share some characteristics with parallel but different studies about faculty roles in teaching, thus increasing the trustworthiness of the results. Furthermore, what it means to design a course is a process that can be individual or collective, selective or reflective, and a dynamic factor influencing not only teaching, but also the learning that occurs for students. ■

Acknowledgments

The authors express appreciation to the instructors who participated in the study. This work was supported by University of New Mexico STEM Gateway through the U.S. Department of Education Title V Program, P031C110184.

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