Examining How Faculty Reflect on Instructional Data: A Call for Critical Awareness and Institutional Support

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Reflective practice, or the idea that individuals should critically examine their own practices, experiences, and assumptions to improve subsequent decision-making and task performance, is a core idea in adult learning and teacher education. Engaging in self-reflection, as part of an ongoing process of learning and professional development, is central to theories of transformative learning (Mezirow, 1990), self-directed learning (Knowles, 1975), and reflective practice (Schön, 1983). While empirical research has been conducted on the nature of reflective practice among a variety of professionals in fields such as K-12 education (Patterson, Minnick Santa, Short, & Smith, 1993), medicine (Mann, Gordon, & MacLeod, 2009), and social work (Sodhi & Cohen, 2012), less research examines the nature of reflective practice among postsecondary faculty[1] (Lyons, 2006; McAlpine & Weston, 2000). Moreover, much of the research on reflective practices of postsecondary faculty only views reflection as an instrument for instructional improvement rather than a tool to facilitate instructors' critical awareness of broader socio-political concerns (Zeichner & Liston, 2014).

This limitation is considerable because a critical awareness of how these issues shape teaching and learning is essential to improving student achievement (Gay & Kirkland, 2003). In particular, attention to how race, gender, and the unique cultural and socio-economic backgrounds of students influence their experiences in college should ideally be part of the reflective process (Zeichner & Liston, 2014). However, issues of equity and diversity are not usually primary considerations among postsecondary instructional designers and faculty at the (Harper, Patton, & Wooden, 2009; Miyake et al., 2010). Furthermore, because most faculty have never received formal teacher training, they have a tendency to uncritically replicate teaching approaches they experienced as students themselves regardless of efficacy (Mazur, 2009; Oleson & Hora, 2014). These issues collectively point to the need for faculty to critically reflect on their teaching practices as well as on specific organizational, cultural, and political contexts of instruction (Hora, 2016; Lattuca & Stark, 2011).

However, today's discussions about reflective practice in higher education are unfolding in a unique political and technological context that must also be taken into account. Spurred on by the accountability movement and advances in instructional technology and analytics, the data driven decision-making (DDDM) movement has gained prominence in both K-12 and higher education based on the idea that decisions about instructional design and classroom teaching should be informed by numeric evidence and empirical research on teaching and less by instructors' anecdote, hunch, or intuition (Lane, 2014; Marsh, Pane, & Hamilton, 2006). A central idea of DDDM is that reflective practice can be initiated once teachers are confronted

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[1] By faculty we mean all people who hold teaching positions—whether full- or part-time, in a tenure track—in postsecondary institutions.

with data about student achievement and the relative efficacy (or lack thereof) of their own teaching, whereupon reflection and improvements to teaching practice will follow (Mandinach, 2012; Wieman, Perkins, & Gilbert, 2010).

But research on DDDM in K-12 districts and schools has shown that the provision of data alone does not magically transform practice; rather, educators interpret data based on a combination of their personal experiences and routinized practices and cultural norms within their organizations in idiosyncratic and sometimes ineffectual ways (Coburn & Turner, 2011; Spillane, 2012). Furthermore, studies on DDDM in higher education reveal that faculty and administrators rely on a variety of information beyond the typical conception of data (i.e., numbers) and instead draw upon information such as verbal conversations with colleagues and students as part of their reflective process while paying close attention to contextual factors (Foss, 2014; Hora, Bouwma-Gearhart, & Park, in press).

Consequently, research on reflective practice among postsecondary faculty needs to take into account the use of multiple data forms as well as the involvement of critical awareness of the socio-political conditions of learning. In this paper we report findings from an interview-based study exploring these issues among 21 instructors at three California research universities. Using a structured approach to grounded theory (Charmaz, 2006; Strauss & Corbin, 1994) we found that faculty drew upon a variety of data (e.g., grades, colleagues, non-verbal student feedback) to engage in three distinct types of reflection: instrumental (i.e., rapid assessment of technical issues), structural-critical (i.e., in-depth assessment of institutional issues affecting teaching/learning), and social-critical (i.e., in-depth assessment of underlying factors influencing student outcomes), all of which were strongly influenced by the local organizational and socio-cultural context.

In addition to providing new evidence regarding the nature of reflective practice among faculty, our study contributes to the understanding of reflection itself by interpreting results using two analytic frameworks not commonly used in the postsecondary literature. We draw upon culturally responsive frameworks from K-12 education (González, Moll, & Amanti, 2013; Ladson-Billings, 1995; Villegas & Lucas, 2002) as well as insights from dual process theory in psychology (Evans & Stanovich, 2013) to interpret the data. Ultimately, we found that although faculty in our sample drew on similar forms of teaching related data to regularly engage in reflective practices, the subsequent outcomes of this reflection was severely limited by both individual bias and institutional constraints. Therefore, we argue that in order to substantively change implicit biases, spark professional growth, and promote student learning, a more holistic notion of "data" that recognizes the value of non-numeric information is needed. Likewise, we urge faculty to examine these data with a more critical eye, particularly with respect to the learning outcomes of diverse and historically underrepresented student populations. Finally, we argue that adult education institutions play a significant role in facilitating this critical examination and must provide faculty the necessary space, time, and resources to engage in critical reflection as well as the appropriate institutional mechanisms to voice concerns and enact change.

Background

Many regard John Dewey (1933) as the first U.S. educational theorist to view teachers as reflective practitioners. For Dewey, reflection signified a systematic and disciplined process of thoughtful, open-minded inquiry that subsequently ended in a sustainable conclusion. However, some scholars (Fendler, 2003; Jordi, 2011) have pointed to Cartesian rationality, where objective self-awareness is seen as a valid way to generate knowledge, as the root of reflectivity. Ironically, the more recent revival of reflective practice came in the 1980s through a critique of this objectivist perspective (Schön, 1983). Following this revival, scholars and practitioners from a variety of disciplines began to take up the notion of reflection. The field of education, in particular, has widely embraced reflection and has come to a general consensus that all teachers should be reflective. Still, the precise definition of "reflection" remains unclear and highly contested (Zeichner & Liston, 2014). Because of this, we provide Table 1 to summarize the scholarly conceptualizations of reflection that we drew upon to inform our work. Following this table, we discuss four ideas within the reflective practice literature that played key roles in our analysis, and we describe prior work on reflective practice conducted in higher education.

Table 1. **Scholarly Conceptualizations of Reflection**

Scholar	Concept
Schön, 1983	Reflection is the cyclical act of thinking about what one is doing, during or following the action, to facilitate the learning process.
Mezirow, 1990	The act of reflection allows space for investigating one's beliefs and engage in problem-solving.
Brookfield, 2000	Reflection is different from critical reflection. Reflection focuses on technical decision-making while critical reflection is rooted in critical theory and examines power dynamics and embedded assumptions.
Fendler, 2003	The distinction between "critical reflection" and "reflection" is false because even critical practitioners may engage in technical reflection if "they believe that the efficient mastery of subject matter by their students is the most effective means of redressing social inequities" (p. 21).
Jordi, 2011; Sodhi & Cohen, 2012	Reflection has been conceived of too narrowly as only cognitive and needs to be expanded to more "embodied" forms of knowledge.
Zeichner & Liston, 2014	Reflection is a collaborative process that enables teachers to examine their thoughts and actions to work toward a more socially just world.

Tacit Knowledge

In 1983, philosopher and organizational theorist Donald Schön wrote *The Reflective Practitioner* in response to the dominant view of professional knowledge and practice as overly specialized and technical. In contrast, Schön argued that in practice, problems are frequently ill-defined and contain factors the problem solver must interpret in real-time. He argued that competent practitioners utilize what he called *knowledge-in-action*, a form of tacit knowledge that over time becomes an automatic response, to solve in-the-moment situations and problems.

He also argued that when tacit expertise is insufficient, the problem-solver should reflect in the moment (reflection-in-action) or afterward (reflection-on-action) to assess the decision and adjust practice accordingly. Educational researchers have built on Schön's ideas by emphasizing the importance of the practical wisdom from school leaders (Halverson, 2004) and classroom teachers (Zeichner & Liston, 2014). This approach indicates the importance of viewing the everyday experiences and tacit knowledge of teachers as significant sources of "data" in improving student learning while still recognizing the need to interrogate that knowledge through reflection.

Critical Reflection

Many scholars (Brookfield, 2000; Larrivee, 2000; Mezirow, 1990; Zeichner & Liston, 2014) distinguish simple "reflection" from "critical reflection." However, while most agree that critical reflection is the deliberate examination of one's underlying assumptions and beliefs, scholars disagree on the ultimate purposes of such a reflective practice. For some (Brookfield, 2000; Zeichner & Liston, 2014) the purpose of critical reflection is to lead one to a greater understanding and promotion of emancipation, empowerment, and social justice within educational contexts, while others emphasize the elimination of bias to attain a more objective and self-aware perspective (Mezirow, 1990). We situate our understanding of "critical reflection" with Brookfield's and Zeichner's perspectives as we see the purpose of critical reflection is to work toward a more equitable and inclusive educational environment.

Role of Context, Emotion, and the Body

Another critique of the literature on reflective practice is the predominant focus on reflection as a cognitive or "in-the-head" phenomenon that overlooks the role of context, emotion, and the body itself. Alternatively, some have proposed more "embodied" perspectives that explore forms of meaning-making that implicate the body as a site of knowing (Jordi, 2011; Sodhi & Cohen, 2012; Tremmel, 1993). For example, Sodhi and Cohen (2012), in an interview-based study of 10 social workers, found that participants often relied on physical manifestations of knowing with the stomach (i.e., "gut reaction"), breath, and fatigue as primary areas of focus. They concluded that the body served as a source of feedback likening physical symptoms with Schön's *reflection-in-action* as an indicator for needed reflection.

Insights from Cognitive Science on Reflective Practice

Insights from the cognitive sciences have also shed light on the processes that may underlay reflective practice itself. First, dual-process theories of cognition posit that the brain processes information in two distinct ways: the peripheral route (i.e., Type 1 processing) is fast, automatic and involves cognitive heuristics to arrive at decisions with little effort, whereas the central route (i.e., Type 2 processing) involves higher order reasoning that is slow, logical and deliberate (Chaiken & Trope, 1999; Evans & Stanovich, 2013). Reflection is decidedly a Type 2 process, evident in neuroscience studies where reflection implicates different parts of the brain (prefrontal, frontal cortical) than Type 1 (limbic system). While Type 1 can draw on expertise, cognitive heuristics developed through countless hours of practice and experience, it can also

include implicit biases and incorrect assumptions (Kahneman, 2011). In an analysis of how these ideas may apply to issues of educational reform, Gregoire (2003) argues that when reform messages are seen as not implicating the self, a Type 1 process of decision-making ensues. Thus, change in one's teaching practices and/or transformation in one's underlying beliefs about teaching and learning requires a Type 2 process where the decision-maker views him or herself as part of the problem and subsequently engages in a sustained period of self-examination.

Reflective Practice among Postsecondary Educators

While the literature based on reflective practice among postsecondary faculty is limited, several studies do shed light on its prevalence and characteristics. Early work exploring this topic included Biggs (1999), and McClean and Blackwell (1997) who argued that "teaching excellence resides in a reflective, self-critical" approach (p. 85). Kane, Sandretto, and Heath (2004), in their investigation into the practices of 17 award-winning faculty, found a "common characteristic…was that these excellent university teachers engaged in regular, purposeful reflection on their teaching practice" (p. 300). Kane, Sandretto, and Heath classified their participants' types of reflection their participants engaged in as technical (i.e., decisions about immediate issues), descriptive (i.e., analyzing and explaining performance), dialogic (i.e., considering alternatives for action), and critical (i.e., considering effects of self on others, socio-political forces at work). They found that faculty most frequently engaged in technical (16 faculty) and descriptive reflection (16) followed by dialogic (13) and critical (3), with critical reflection referring to reflection that considers the social, political, and historical context. Finally, Lyons (2006) advanced the definition of reflective engagement by exploring the use of reflective teaching portfolios by university faculty. Beyond these studies, however, little empirical work exists on the prevalence of reflective practice among postsecondary faculty.

Researchers have also focused on the importance of organizational contexts and situations in shaping how faculty engage in reflective practice, such as insufficient time (Kuit, Reay, & Freeman, 2001) and de-motivated, overworked staff (Davis, 2003). Likewise, McAlpine and Weston (2000), in their study of the reflective practices of six "successful" university professors, found that improving one's teaching requires a desire to teach, recognition of and motivation to develop pedagogical knowledge, a supportive environment, minimal constraints, opportunities for practice, and formal teacher training. These features highlight the individual and institutional characteristics needed to improve teaching. Still, more research is needed to better understand the nature of reflective practice, particularly critical reflection, in this population, especially in the current climate of accountability that centers on numeric data.

Therefore, given the importance of deliberate, reflective practice in improving postsecondary teaching and learning, it is important to understand how faculty are actually engaging in reflection. Moreover, we need to understand not only *what* faculty do in terms of reflection, but *how* and *why* they do what they do. Descriptive insights into these processes not only increase the ecological validity of observations, but also shed light on the factors that may act as "leverage points" that appear to be supporting or inhibiting particular practices (Coburn & Turner, 2011; Spillane, 2012). In an era of increasing pressures for accountability and mandates

for instructional change and improvement, such insights can be an important tool to improve interventions by ensuring that they align with or respond to the norms and practices of specific organizations, as opposed to a "top-down" approach that is a far less effective approach to reform (Fullan, 2010; Spillane, Halverson, & Diamond, 2001).

Methods

Sampling and Data Collection

This study was conducted at three large, public Research 1 universities in California to investigate faculty use of instructional data. The sites were selected on the basis of similarities in their geographic, political, and socio-economic settings. Two of the study sites were campuses in the 10-campus University of California (UC) system, and one was in the 23-campus California State University (CSU) system. It is important to note that the CSU campus was one of two polytechnic institutions in the system. We are referring to the two UC institutions as UC San Miguel and UC Beachfront and the CSU institution as Cal State Parkside.[2]

Another important part of the study context is that the UC and CSU systems have been significantly affected by budget cuts over the past several years. These cuts have led to increased workloads for instructional staff, more courses taught by contingent (i.e., non-tenure-track) faculty, less funding for graduate assistants, and more online programming and instruction. In fact, according to the 2015 UC Accountability Report, "UC's student faculty ratio is at the highest level it has ever been and is also high relative to research universities of comparable quality" (p. 129). Further, in the UC system both the student to faculty ratio (from 19:1 in 2004 to 21:1 in 2014) and the amount of student credit hours taught has increased. These cuts, however, are not unique to California, which makes investigation of faculty decision-making and reflective practices during these uncertain times of budget struggles, reduced state support, and increased institutional constraints on teaching activities all the more important.

The goal for the larger study upon which this paper is based was to capture DDDM processes in science and engineering disciplines, given the focus of the funding agency for the study (the National Science Foundation). At UC San Miguel, four science disciplines were included (biology, physics, chemistry, geoscience) as no engineering department existed at this campus. To compensate for the lack of engineering participants at this study site, engineering departments at the other two sites were the principal focus.

A non-random purposeful sampling strategy was used to recruit faculty and administrator participants for the study. The sampling frame for instructors was compiled using each institution's course catalogue for the Winter 2015 term, and for administrators using institutional websites for salient colleges and departments. Of the 115 instructors who were contacted via email to participate in the study, 21 instructors and nine administrators ultimately participated (an 18% response rate). Only the 21 faculty participants were included in this analysis, who

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[2] All school and instructor names are pseudonyms to protect confidentiality.

represent the following disciplines: biology (n=5), physics (n=1), chemistry (n=2), geoscience (n=1), mechanical engineering (n=8), and industrial and manufacturing engineering (n=4). Demographically, these instructors were predominately white males, with about one-third of the participants being female. This situation is important to understand because while this sample is comparable to STEM faculty across the country (UC Davis Advance, 2015) it highlights the lack of diversity among faculty in these departments. Finally, of the 21 instructors, 13 were full-time professors while six were lecturers and two were post-doctoral fellows. Thus, work experience, course loads, and additional benefits and responsibilities varied among participants.

A team of three researchers[3] conducted all data collection activities during the Winter term of 2015 (January-March). Data collected for this study included interviews and documents from institutional webpages, accreditation reports, and minutes of internal meetings. A Critical Decision Making approach was utilized for the interviews, which included questions focused on a single decision and/or activity, followed by in-depth probes that elicit respondent accounts about their thought process regarding decision steps and considerations of influential factors (Crandall, Klein, & Hoffman, 2006). Respondents were asked about their most recent instance of reflecting upon teaching-related data, their reasons for doing so, the nature and origins of the data, and the outcomes of the reflection process. Follow-up questions elicited information about other salient types of data or information used in their overall course planning and/or teaching activities, and specific policies within their institutions that encouraged the use of teaching-related data. Interviews took place in respondents' offices or nearby conference rooms and lasted approximately 45 minutes.

Data Analysis

All interviews were transcribed and entered into NVivo qualitative data analysis software, whereupon two analysts segmented the raw data into smaller, more manageable units. The segments pertained to three core topics central to the study: individuals' data routines, the existence of continuous improvement systems, and contextual factors related to data use. Data segments that contained references to reflective practice were analyzed using a structured approach to grounded theory, which involves the inductive analysis of data while considering the research questions and external theoretical frameworks (Charmaz, 2006; Strauss & Corbin, 1994). The analysis began with an open-coding process, where codes were created from the data and each successive instance of a particular code was compared to previous instances of that code (i.e., the constant comparative method) (Glaser & Strauss, 1967). Additionally, throughout the coding process, analytic memos were written to assist the development of a coding system as well as to document moments of insight regarding patterns or themes in the data (Saldaña, 2013). Analysis focused on references to the data participants reported using as part of their reflection, the reflection process participants described, and the results participants reported from their reflection. From this process, themes emerged that elaborated on the meaning of codes'

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[3] Matthew T. Hora (University of Wisconsin–Madison), Jana Bouwma-Gearhart (Oregon State University), Hyoung-Joon Park (University of Wisconsin–Madison)

"truncated essence" (Saldaña, 2013). All codes and themes were discussed at length between the researchers to ensure reliability.

Limitations of the study include a small, self-selected sample at specific types of postsecondary institutions such that generalization to larger populations of faculty within and/or beyond the study institutions should not be made. An additional limitation is the reliance on self-reports about reflective practice on teaching-related data that may or may not reflect respondents' actual behaviors. Consequently, we encourage researchers to build upon our results by conducting research with larger samples at diverse institutional sites, and by using techniques such as think-aloud tasks to capture reflective practices as they unfold in real-time. In addition, future research should focus on the nature of reflective practice among other types of adult educators, particularly those working outside of large university settings.

Results

Data Used in Reflective Practice

When asked what types of data they regularly reflected upon, faculty discussed six distinct categories of data ranging from exams to conversations with students (see Table 2). Four of these categories are non-numeric sources of information that may not be thought of as "data" in most of the DDDM literature. However, we consider these sources valid and important because respondents considered them to be key to their reflective processes. This emphasis points to the need for proponents of DDDM to broaden their understanding of "data," which is also supported by information scholars who argue for the inclusion of non-numeric forms of information within complex organizations because of their salience and importance to organizational actors (Pentland, 1995).

Table 2. **Types of Data used in Reflection**

Type	Definition
Grades	Students' course grades or scores on assignments and exams
Formal evaluations	Institutional student course evaluations or peer evaluations
Research literature	Pedagogical literature, teaching blogs, or professional development materials
Colleagues	Communication with peers within the university, colleagues who teach the same discipline at other universities, or university academic learning coaches
Direct student feedback	Direct conversations or communication with students
Non-verbal cues	Students' physical reactions during class (e.g., bored or engaged expressions)

Of the types of data faculty reported reflecting upon, all respondents listed examples of exam scores, homework grades, and formal student or peer evaluations. However, many found institutional course evaluations to be insufficient and unhelpful, and took it upon themselves to create their own evaluations that were administered either mid-semester or at the end of the course. Several respondents also reported reflecting upon the research literature and online resources such as teaching blogs. Additionally, some instructors noted that discussions with colleagues provided important information and insights that were then reflected upon as part of their efforts to become better teachers.

Interestingly, direct student feedback was arguably the most highly valued type of information used during reflective practice. Many instructors went out of their way to elicit student feedback through informal surveys and conversations. For example, Professor Narayanan (UC Beachfront) stated that she heavily relied on conversations with students and her own teaching assistants. She stated:

> Talking to them [the students] and getting information out of them really helps… I spend a lot of time in conversations with students about, 'What do you think about the class so far?'…and every week I ask my TAs, 'Okay, what did they learn? What did they not learn? What are the students getting? Did you ask them what they think?'

Similarly, Professor Walsh (UC San Miguel) claimed, "One of the most important sources (of information) are students just conveying their thoughts directly." These sentiments underscore the importance of personal communication between teachers and students in the reflective process.

However, some instructors observed that students whose voices were loudest, meaning the ones who volunteered feedback in the classroom or who came to office hours, were the ones whose comments were most likely to be heard and reflected upon. For example, Professor Sullivan (UC San Miguel) noticed that her office hours were typically attended by a small group of the same students, observing that, "It's a self-selected group of students, so one difficulty is that with a class of 200 students there are many students that I never get to know or talk to unless they are willing to put themselves up and say 'I need help.'" Therefore, the concerns of struggling students outside of this self-selected group may go unnoticed unless students directly communicate with their instructors.

In addition, we encountered two examples of what Sodhi and Cohen (2012) refer to as "embodied knowing," or information that takes a physical manifestation in the body. Professor Bowden (UC Beachfront) and Professor Bauer (UC San Miguel) discussed examples of physical reactions students have in the classroom as a way of knowing whether their students are learning. For example, Professor Bauer described an important type of information as, "The immediate reaction of students when you see the lights go on." This type of nonverbal communication was also discussed by Professor Bowden, who claimed that the most meaningful information that informed his teaching was "the reaction of the students" and whether they were bored, interested,

or paying attention. Thus, even though only two of our 21 participants discussed this type of knowing, we still reported it as playing a significant role in reflective practice. These examples speak to the idea that reflection cannot be conceptualized as a purely cognitive act.

Types of Reflective Practice

In our analysis of faculty's reflective observations, we drew upon critical reflective practice theories (Brookfield, 2000; Mezirow, 1990; Zeichner & Liston, 2014) to interpret our data and distinguish among three distinct types of reflection. First, instructors discussed reflections focused on *instrumental* or technical issues related to their courses, such as textbook or syllabi issues. Second, instructors also reported a more intensive reflection process that we call *structural-critical*, whereby structural issues such as class sizes were considered in a critical light as one of several factors influencing teaching behaviors and student outcomes. Third, instructors discussed issues related to the socio-cultural and economic contexts of students' lives, a reflective process we call *social-critical*. The following sections discuss in depth these three types of reflective practice.

Table 3. **Types of Reflective Practice**

Type	Definition	Example
Instrumental	Reflection that centered on technical teaching tasks	Too much text on PowerPoint slides
Structural-critical	Reflection that centered on institutional issues that affected teaching and learning	Large class sizes
Social-critical	Reflection that critically examined sociocultural issues that affected teaching and learning	Historically underrepresented student populations doing more poorly in class than dominant populations.

Instrumental reflection. Most respondents discussed their reflective practice in terms of technical issues related to their course curricula and/or instructional strategies that were ultimately altered or corrected. The majority of these changes would be considered "technical" (Brookfield, 2000; Zeichner & Liston, 2014), "instrumental" (Mezirow, 1990), or "practical" (McAlpine & Weston, 2000) by reflective practice scholars. For example, several participants reported lecturing less often while others reported trying to vary course topic order after a period of reflection. In this study, we are referring to this sort of everyday decision-making to improve isolated classroom practices and learning as instrumental reflection.

The majority of instructors' instrumental reflection resulted in discrete classroom changes instructors individually made. For instance, if all students in the course consistently struggled with a particular exam question, the instructor would alter his or her instruction to spend more time discussing the topic pertaining to the exam question. Respondents consistently reported ways they personally had made instrumental changes with examples ranging from "I changed the

way I lay[ed] out my course" (Professor Wagner, Cal State Parkside)" to "I have learned to speak louder [and] have less text on my slides" (Professor Sullivan, UC San Miguel).

Structural-Critical and Socio-Critical Reflection

While the everyday troubleshooting involved in instrumental reflection is an essential part of teaching, and illustrates the time and concern these instructors have for their classes, teachers are not "mere technicians" (Zeichner & Liston, 2014, p. xvii). Teaching is situated is a complex web of broader contexts ranging from institutional norms to the lived experienced learners and instructors bring to the classroom. Thus, instrumental reflection, alone, cannot account for the larger power dynamics that ultimately affect learner achievement. In fact, several scholars (Brookfield, 2000; Mezirow, 1990; Zeichner & Liston, 2014) have distinguished instrumental reflection from other forms of more "critical" reflection that require deeper consideration. Many of our instructor participants did engage in such reflection, which pushed beyond the instrumental and towards more structural and social concerns. In this study, we refer to this sort of reflective practice as *structural-critical* and *socio-critical reflection*.

Structural-critical reflection. Several respondents discussed structural issues within their institutions that appeared to influence their teaching strategies and/or student outcomes. The primary structural issues faculty discussed included large class sizes, a lack of time to "cover" the content in a course, and ineffectual online learning systems. While these factors may not be considered data by most of DDDM literature, they are included in the analysis because respondents considered them to be important variables that shaped how they interacted with students and engaged in their work as educators. However, instead of directly trying to address these problems, instructors either accepted them as givens or sought coping mechanisms to "make do" with what they had. These concerns draw attention to the limits of reflective practice as well as to the institution's role in student success.

Through their reflection, several instructors noted classes were often too big, creating an inevitable distance between students and instructors. Instructors lamented at not being able to learn all of the students' names, get to know students individually, or assist all students with coursework and projects. In response, some instructors sought alternative ways to manage large classrooms and promote student engagement. Professor Walsh (UC San Miguel), for example, explained that despite not knowing all of his students' names, he still tried to connect with students by "Just throw[ing] out questions in a big hall or … randomly pick[ing] someone…to get them engaged." Professor Narayanan (UC Beachfront), on the other hand, prided herself on memorizing the names, and even the handwriting, of all 75 of her students even though it was rather difficult. Finally, Professor Altman's (UC San Miguel) strategy was to group students into pairs, saying,

> What really drove [putting them in groups] was that the enrollment in the class doubled and it just became impossible. The issue is really the final projects. All the students do final projects. When there are 25 students in the class, it's possible to supervise 25 projects. Once there are 45 students, it's impossible.

Thus, even though numerous instructors noted the issue of crowded classrooms, none of them reported trying to directly affect enrollment policies and practices. Instead, they "made do" by trying to manage in other ways.

Faculty also discussed not having enough time to sufficiently cover all required course materials or provide necessary review. Several respondents noticed that there were often topics that some or even all students struggled to grasp, but because of time constraints they were unable to allocate additional class time to these subjects. In response, some instructors coped with this problem by offering copies of their lecture slides before class. For example, Professor Walsh (UC San Miguel) stated that he, "Can't do anything about time, [but] I can do something about providing lecture slides." Thus, through reflection, instructors recognized time constraints as a salient issue affecting student learning, but were only able to enact minor workarounds to address the problem. Likewise, faculty also reported that the lack of time affected their ability to prepare lessons, update course curricula, or experiment with new instructional strategies. For example, Professor Sullivan (UC San Miguel) stated that she would like to experiment with active learning techniques but that it "requires time I don't have."

Additionally, some instructors noted that certain online learning systems seemed to be burdensome and ineffective, but they were unable to stop using the system and could only try to troubleshoot as best as possible. For example, Professor Douglas (Cal State Parkside) claimed that the online learning management system at his institution "hinders" student learning because it is "confusing." As a result, he reported spending valuable instruction time explaining to his students how to use this system. Likewise, Professor Mulder (UC San Miguel) stated that the biggest student complaint from the previous year was the web assignment system. He observed that they began using the online automated system because of cuts to graduate teaching assistants who used to do most of the grading. The biggest problem with the system was that if students "don't type [the answer] in correctly, it can register as wrong," which has led to students being extremely frustrated with the system. Even though students identified this problem as a significant concern, Professor Mulder admitted that he "can't help them too much on it" besides providing a list of common word errors. Thus, even though both students and faculty noticed significant, practical flaws with the online system, institutional constraints prevented them from discontinuing their use.

One of the commonalities among these structural-critical forms of reflection was that they involved the critical consideration of organizational factors that inhibited instructional innovation and/or student success. Yet, despite engagement in such reflection, faculty ultimately felt nothing could be done about structural issues besides minor workarounds. Consequently, the reflective process resulted in the consideration of new information or data, but the outcomes of the reflection were limited to identifying creative solutions to work around these factors instead of addressing the root cause of the situation. This state of affairs draws attention to the limits of reflective practice as well as to the considerable role organizational context plays in shaping teaching behaviors and student experiences in the classroom (Hora, 2016).

Social-critical reflection. After instructors had made instrumental classroom changes and developed workarounds based on their structural reflection, some students struggled. However, instead of attempting additional action or changes to assist those students, faculty rationalized the situation through the notion of an "acceptable failure rate." This idea speaks to larger social issues that center on embedded assumptions instructors hold about students and about student failure and success in general. Several instructor participants openly expected that there would always be students who struggled, were unmotivated, or unprepared. This expectation means that instead of interrogating the numerous reasons for why a student is not succeeding (i.e., home issues, work commitments, health problems, pedagogical disconnects), instructors accepted student failure as an individual problem that inevitably occurs with a certain percentage of students. These issues speak to the need to shift the reflection paradigm from focusing on instrumental issues to more critical reflection (Brookfield, 2000; Zeichner & Liston, 2014) to better support learners and promote equitable education.

Although all instructors listed numerous instances of using student exams scores and direct feedback as part of their reflective practice, they also provided other instances where that data was discredited because of biases toward students and learning. For example, several instructors discussed the notion of sifting through reliable and unreliable student feedback. This meant that instructors found feedback from students who were doing reasonably well in the course to be reliable while feedback from failing students was discredited. For instance, Professor Kuzmich (UC San Miguel) claimed that in an introductory class of 300 to 400 mostly first-year students,

> There is a percentage that just fail miserably for nothing to do with what you've done. They don't come to class, they don't stay, they don't prepare, they don't take it seriously, and you got to realize that you can't factor those people into feedback.

He went on to explain that although he and his teaching assistants try to discern which students are "truly" struggling from those who just are not trying, he still believed his "12 to 15 percent" failure rate was "acceptable." As for the students deemed failing due to lack of effort, he claimed that they were there only "because they don't know what else to do with their lives," so "you can't be too wrapped up with wasting energy" on them. Likewise, Professor Mulder (UC San Miguel) discussed how he made sense of students perpetually failing as "some people have struggled so much that [no] amount of either effort they're putting in or resources we would have to put into that person" will help because "some people just aren't going to be good scientists." In these cases, instead of considering the numerous reasons why a student was not succeeding, instructors accepted student failure as an individual problem that inevitably occurred with a certain percentage of students. Therefore, while student motivation may certainly have affected learning, faculty dismissed the role of instructors to engage students and investigate underlying reasons for a lack of student achievement. However, this situation begs the question whether faculty have the structural support, time, and pedagogical tools to engage in such an investigation.

In fact, the only instance where the idea that student failure may be caused by forces external to the student was brought up by Professor Han (UC Beachfront), who framed it as an excuse rather than a legitimate explanation. He stated,

> Some people [students] think it's just too much work and they've got other stuff going on. They've got jobs, they compete in sports… And if they do well, they love it. They get an A on the midterm, they love the course! … But for me, I've done this a few times so I kind of know when to take some comments seriously and when not to.

The discrediting of certain students' experiences frames learning as a personal responsibility dependent primarily (if not completely) on the individual's own efforts and motivation. However, education researchers have long argued that learning and academic success is much more complicated than that as it involves numerous socio-cultural and structural factors, such as poverty, race/ethnicity, peer networks, and language differences that affect student outcomes (Anyon, 1997; Bank & Banks, 2003; González et al., 2013; Ladson-Billings, 1995; Villegas & Lucas, 2002). This complexity is particularly true for first-generation students or students of color who do not generally have the same financial or social capital as their white, middle class peers and who may be more likely to hold out-of-school jobs or responsibilities.

However, one professor in our study sample challenged the dominant narrative of an acceptable student failure rate. Professor Sullivan (UC San Miguel) highlighted issues of educational disparities among traditionally underrepresented populations at her institution. She explained her department had begun collecting student performance data in introductory courses to notify students whether they were on track to completing the major in four years. The department developed various metrics to predict later success in the major. However, she noted that, "the downside is that those metrics differentially affect underrepresented students," which goes against the department's efforts to increase the proportion of these students in their programs. Therefore, although neither Professor Sullivan nor her colleagues have come to any firm solutions, she reported trying to use more "active learning techniques" because she had read that "it helps underrepresented students." She also engaged in more critical reflection on the topic by asking the question, "why historically, have our underrepresented students performed poorer," suggesting that the poor educational outcomes may have something to do with uniform teaching styles, especially extensive periods of didactic lecturing. In this way, through her reflective practice, Professor Sullivan made a connection between failure rates and historically underrepresented populations, while considering the cause was not due to individual student deficits but could instead reside within the instructional practices of the faculty.

Discussion

Critics of postsecondary education in the United States argue that faculty must change how they design and teach their courses for a variety of reasons: Students are simply not learning enough (Arum & Roksa, 2011), the nation needs more critically thinking (Bok, 2009; President's Council of Advisors on Science and Technology, 2012), and the college experience plays a strong role in determining the ultimate success (or lack thereof) of underrepresented students

(Miyake et al., 2010). At the heart of many strategies to effect improvements in educational practice is the notion, fueled in part by the DDDM and learning analytics movement, that the provision of numeric data will transform practice by sparking a process of analysis, introspection and eventually, behavior change (Lane, 2014; Mandinach, 2012).

Yet the data we report in this paper support prior work in K-12 settings indicating that data use is a complex and varied process shaped by cognitive, cultural, and contextual factors at the local level (Coburn & Turner, 2011; Spillane, 2012). Further, the data also support earlier work on faculty reflection that found among university faculty a lack of an important type of reflection: critical reflection that involves intentional and substantive questioning of one's own practice and the socio-political conditions of learning (Kane et al., 2004). Our findings reveal that a group of faculty in three California research universities drew on a wide-range of teaching related data and information to inform reflective processes that were primarily technical in nature, with subsequent solutions delimited by contextual factors such as workload, resource availability, and class size.

In the remainder of the paper we first present a descriptive model of our findings and then discuss these findings and extend previous literature on the topic by drawing on insights from culturally responsive K-12 education frameworks and dual process theory to interpret the situated nature of critical reflection in postsecondary institutions and implications of the absence of critical reflection related to issues of equity, diversity, and student achievement.

Model of Postsecondary Faculty Reflective Practice

Our descriptive model (Figure 1) of our findings that advances a new approach for thinking about reflective practice in colleges and universities. Instead of an unproblematic and simple process of mental reflection on numeric data, this real-world model demonstrates how reflection implicates a myriad of steps, processes, and contextual factors such that reflection is best thought of not solely as a cognitive "in-the-head" activity (Jordi, 2011) nor as an uncomplicated process wherein numeric data can magically transform practice (Spillane, 2012). Rather, our model of postsecondary faculty reflective practice involves a variety of information types, distinct processes of mental activity, and contextual factors that bound the nature of reflection itself and the nature of solutions that result from reflective practice.

Figure 1. **Cycle of Postsecondary Faculty Reflective Practice**
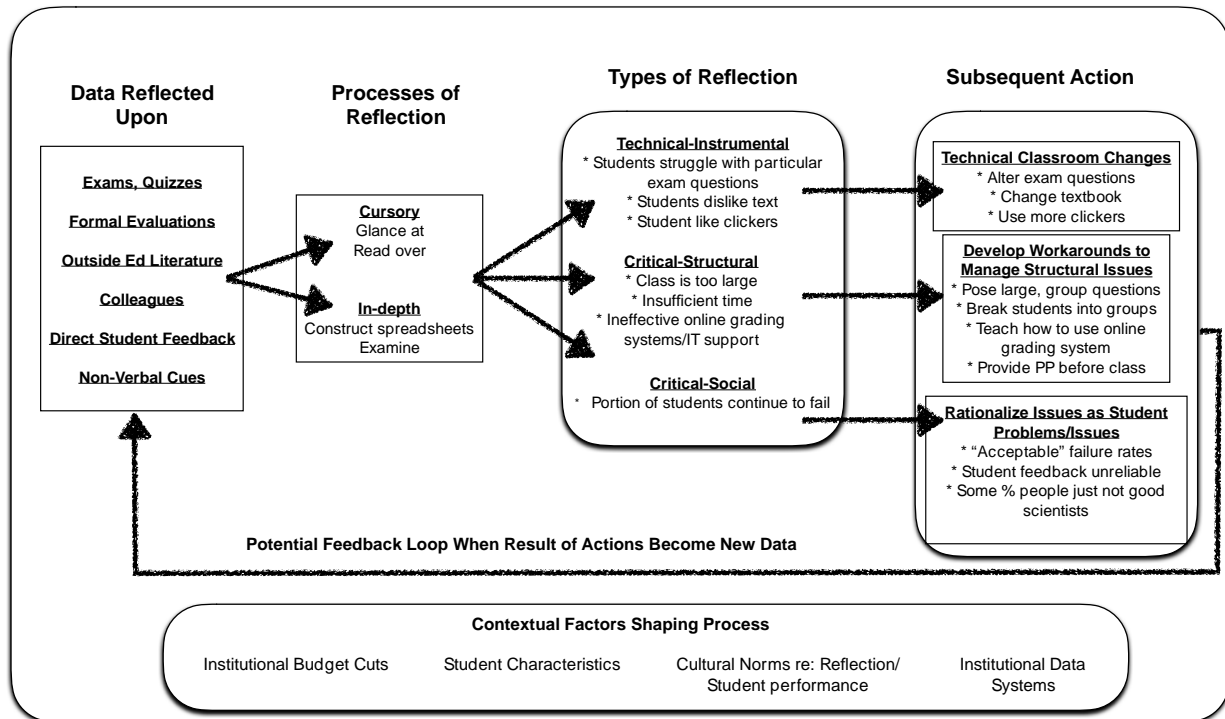
The model begins with the types of data faculty reported reflecting upon. Data sources not only include exam scores and formal evaluation reports, which would typically be considered data in conventional accounts of DDDM, but also social, contextual, and embodied forms of information. After collecting or recognizing these forms of information, faculty engage in cursory or in-depth reflective processes that result in what we have categorized as three types of reflection (technical-instrumental, critical-structural, and critical-social). The subsequent actions that faculty take after reflection is significantly connected to these types of reflection. Instrumental reflection tends to result in changes to technical aspects of classroom teaching, structural reflection results in discrete classroom workarounds to deal with broader structural issues, and social reflection results in a rationalization of persistent student failure rates. Importantly, the subsequent action faculty take upon reflection is not the end of the reflective practice. Rather, faculty may return back to the reflective practice data after taking action and begin the process anew in the spirit of continuous improvement. Furthermore, this process does not unfold in a vacuum but is shaped by interpersonal relationships as well as unique conditions of the organization, department and even individual classrooms. This model of how faculty engage in reflective practice not only provides an account grounded in real-world practices and perspectives, but also broadens the field of higher education's understanding of what "data" are and the nature of reflection itself as a multi-faceted process.

Promoting Critical Reflection and Structural Change in Postsecondary Education

Although our findings indicate that faculty engaged in Type 2 processing (Chaiken & Trope, 1999; Evans & Stanovich, 2013) to reflect on deeper issues, they also suggest a lack of

critical reflection regarding implicit bias and issues of equity and diversity. To analyze these findings, we turn to insights from the K-12 cultural responsive education literature (González et al., 2013; Ladson-Billings, 1995; Villegas & Lucas, 2002). These frameworks promote equity-driven reflection that recognizes, appreciates, and attends to student differences. We argue that as university demographics continue to change, it becomes all the more important for scholars of higher education to utilize this work by incorporating it into postsecondary education research.

Research in K-12 education has shown the importance of critical reflection for teacher professional development (Zeichner & Liston, 2014) and for the equitable treatment of students (González et al., 2013; Ladson-Billings, 1995; Villegas & Lucas, 2002). Critical K-12 education frameworks, such as cultural relevant pedagogy (Ladson-Billings, 1995; Villegas & Lucas, 2002) and funds of knowledge (González et al., 2013), advocate for a critical examination of personal assumptions, beliefs, and biases to dismantle deficit perspectives and promote more inclusive and culturally responsive teaching practices. We argue that these frameworks can be applied to our social-critical reflective practice findings to address issues of implicit bias, such as an "acceptable failure rate."

Although faculty in our sample drew on a variety of data during their reflection, the "reliability" of this information depended greatly on the student from which it came. Data from successful students was highly valued while data from unsuccessful students was discredited. Faculty tried to explain this distinction by discerning the students in class who were "truly struggling" from those who had failed because of a lack of effort, motivation, or prioritization. Faculty made this determination based on how seriously they perceived a student to take a course by using factors such as attendance and homework completion. Students who persistently failed, and who were not deemed "truly struggling," were categorized as part of an "acceptable failure rate." Faculty defined this "acceptable failure rate" as a certain portion of students who always failed because of individual shortcomings, effort, and motivation. Therefore, students who fell into the "acceptable failure rate" were typically those who would also be considered "unreliable" in terms of teaching data.

By discrediting the experiences of certain students and framing learning as an individual responsibility, faculty ignored the numerous situational, contextual, and sociocultural factors involved in student achievement (Anyon, 1997; Bank & Banks, 2003; González et al., 2013; Ladson-Billings, 1995; Villegas & Lucas, 2002). Likewise, faculty also revealed their own embedded assumptions of what "good" student behavior looks like without consideration of possible alternatives. Reliance on this stereotype presents a missed opportunity for faculty to engage in critical reflection to determine underlying causes and issues of student failings. Such critical reflection would involve a reframing of the situation that examines not only the isolated behavior of the student within the classroom, but the broader social and cultural worlds in which that student is situated. For example, instead of assuming a student has poor attendance because he or she does not care about the class, a more critical reflection may reveal that the student has poor attendance because he or she is a parent, works a full-time job, or struggles with transportation to school.

Furthermore, a more critical examination of who exactly the students are within the "acceptable failure rate" may reveal significant achievement gaps among student groups that would indicate a need for pedagogical change that responds to students' social, cultural, and linguistic needs (González et al., 2013; Ladson-Billings, 1995; Villegas & Lucas, 2002). In fact, Professor Sullivan was the only faculty in our sample who made the link among persistent educational disparities in her department, traditionally underrepresented populations at her institution, and outdated teaching practices. This lack of understanding indicates a need for a high quality data source for instructors that relates student demographic data with failure rates. This type of data could provide a tool to draw instructor attention to potential disparities in their classrooms, departments, and campuses. However, we must also be cautious and avoid using such tools to essentialize the experiences of underrepresented groups based on their gender, ethnicity, or economic background. Necessary training for instructors would be needed to properly read and use such data.

Likewise, expecting faculty to have the knowledge and expertise to engage in the sort of critical reflection we have discussed is unreasonable, particularly if they have not been formally trained in teaching and learning. This also highlights the key role that institutional leaders and policymakers must play in training instructors to examine their implicit biases, address students' individual and group needs, and recognize patterns of educational disparities. While such training would require deep commitment and significant resources in a time of considerable budget uncertainties, we argue that it is vital to push against the notion of an "acceptable failure rate" and address the needs of all students. Moreover, after faculty have received training on critical reflection, it is important for them to have the necessary space and time to collaboratively engage in such reflection.

However, as structural issues like budget cuts increase, time for professional development to address these social issues becomes less likely. The same is true for the issues faculty brought up through their structural reflection. The main structural issues faculty discussed were oversized classes, insufficient time, and ineffective online learning systems. Faculty attempted to address these broader structural issues and make their workloads more manageable through isolated classroom workarounds. However, the coping mechanisms faculty developed function more like quick fixes than actual solutions. This finding indicates a significant need for a space for faculty to voice their concerns over such structural issues and explore potential solutions. Such a space would need to value faculty experience, the tacit knowledge they have developed as instructors, in order to be responsive to instructor and departmental needs. This point is particularly important as it speaks against the spread of the sort of top-down accountability policies that have plagued K-12 education since the early 2000s (Au, 2009; Ravitch, 2013) to higher education. Instead we recognize faculty as adult learners who require additional critical reflection training, but still hold considerable knowledge as experienced teaching professionals.

To conclude, our findings point to the need for a more holistic, multi-disciplinary, and critical understanding of DDDM and reflective practice in the field of higher education that

draws upon theoretical and practical insights from disciplines such as K-12 education and cognitive psychology. Continuing to assume that numeric data will magically transform educational practice is untenable given extensive evidence to the contrary (e.g., Coburn & Turner, 2011), and overlooking the political context of DDDM and the socio-political conditions of student experiences in college results in an incomplete understanding of the complex issues facing faculty work and student achievement in U.S. colleges and universities in the early 21st century. If postsecondary institutions truly wish to grow and serve our changing population of learners, we must teach instructors how to educate students who may be much different from them and from students they previously taught. This involves teaching instructors how to recognize, appreciate, and utilize the cultural ways of knowing and learning students bring to the classroom to better facilitate learner success. Therefore, while we recognize the current budgetary plights and accountability pressures many universities across the country are facing, we call on adult educators to advocate for their students and themselves, on state governments of public education institutions to show their valuing of education by fully funding and training postsecondary and adult instruction, and on education reformers to broaden notions of teaching and learning "data."

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