How University Instructors See Student Engagement and Risk Status:
Constructing Definitions with Information from
Instructional Practices and Learning Management Systems

By

DANIELLE ELIZABETH HAGOOD
DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Education

in the

OFFICE OF GRADUATE STUDIES

of the

UNIVERSITY OF CALIFORNIA

DAVIS

Approved:

_____

Lee Martin, Chair

_____

Cynthia Ching

_____

Megan Welsh

Committee in Charge

2021

0 Abstract

This dissertation studies how teachers in higher education use learning management systems (LMS) to see and understand student engagement and risk status. Educational technology such as LMS are designed with implicit conceptualizations and instantiations of learning related concepts. This study focuses on the concepts of student engagement and risk status as they are prominently featured in LMS metrics and marketing. Based on interviews and surveys from a cross-disciplinary sample of 21 professors at a North American university, this study answers two research questions. First, how do instructors define engagement and risk status? This study showed that instructors define engagement and risk status in rich way. The instructors in this study described engagement in terms of student actions related to deeper thinking about class content and stereotypical class participation. The instructors in this study described risk status in terms of both fixed and changeable risk factors. In a thematic qualitative analysis these conceptual understandings are compared to how the LMS instantiated these concepts. The second research question asks: How does the LMS inform teachers about students' engagement and risk status? The instructors in this study described the LMS informing them through its online activity logs, work submissions, and gradebook. However, most of the participants reported that the LMS had limited usefulness and instead relied on personal interactions with students. To conclude, these findings are interpreted in the contexts of increased demand for constructivist pedagogy, accountability, and datafication. Specific questions are proposed for LMS developers and adopters. These questions center on the argument that throughout the LMS adoption process, from development to use, it is critical to consider conceptual definitions and their alignment if LMS deeply support instructional practice and student learning.

1 Introduction

Nearly all US universities now rely on learning management systems (LMSs) to deliver instruction, with a third of higher education institutions using Canvas specifically (Feldstein, 2018; Hill, 2021). Because these systems provide the organizing framework in higher education, their use has resulted in changes in learning and instruction. In some cases, LMSs facilitate more self-paced learning and supplement instruction with diverse forms of media (Chaubey & Bhattacharya, 2015), even replacing direct instruction entirely in "flipped" classrooms (Wang, 2017). Additionally, the global COVID-19 pandemic has required instructors to rely further on online platforms, including their LMSs, to deliver instruction (Manev et al., 2020). In addition to instructional changes directly precipitated by LMS use, LMSs may also indirectly influence instruction by shaping how instructors think. One way that LMSs can frame thinking is through their instructor-facing dashboards: the primary tool instructors consult to learn about what students do—socially, behaviorally, and cognitively—in LMSs (e.g., Mazza & Dimitrova, 2004). As LMS dashboards frame constructs such as student success and engagement (Macfadyen & Dawson, 2010), they can also frame instructors' consequential perceptions and decisions.

This dissertation study considers these indirect impacts of LMS and their analytics on instructors' understandings and decision-making about their students. I argue that LMSs, as companions to instruction, foreground specific concepts to instructors. Concepts such as student engagement and risk status. By highlighting specific data about students related to given concepts the LMS defines student engagement and risk on its own terms. Through this study I try to understand how these concepts of engagement and risk status are understood by instructors and how the LMS frames these concepts. To sketch the wider context surrounding this study, the following section outlines several trends surrounding widespread LMS adoption in higher education, including shifts in pedagogy, accountability, and data availability. These trends illustrate

the roles multiple LMSs take on and contextualize the multiple ways that LMSs inform instructors' thinking about their students.

1.1 Current Context

The first trend driving LMS adoption is the increasing preference and demand for constructivist instruction. Over the last century, the didactic model of instruction has fallen out of favor, being supplanted by more constructivist forms of teaching (Bain, 2011; Nathan & Sawyer, 2014). In constructivist approaches to teaching, traditional lectures are supplemented or replaced by more interactive, collaborative, and personalized activities (e.g., Tenenbaum et al., 2001). While many educators welcome this shift to more collaborative and engaging instruction, incorporating such constructivist practices has also produced a shift in workload. For example, comparing lectures with small-group discussions in physical and virtual environments, in both environments the effort to plan and implement a lecture remains static as class size increases. In contrast, the amount of work planning and facilitating small-group discussions or activities increases steeply as the class size increases. The same plan that works for a small class may need to be redesigned and facilitated differently in a large class. Unlike lectures, constructivist pedagogical approaches such as student-led activities and discussions take more work to develop and lead in larger classes.

Further, the growth in instructional workload may be amplified as more students attend college—more than 4 million since 2000 (McFarland et al., 2018). Despite increased enrollment corresponding with a corresponding increase in teaching staff, there is a perception that class sizes and teaching loads are increasing (McFarland et al., 2018; U.S. Department of Education, 2020). The real or perceived increased enrollment in higher education has spurred discourse around the effects of class size on instruction and student learning. In response to these concerns, a commonly reported finding is that larger classes lead to deleterious instructional changes resulting in worse student outcomes (Kara et al., 2021; Monks & Schmidt, 2011). As McKeachie writes, "in general, large classes are simply not as effective as small classes for retention of knowledge, critical

thinking, and attitude change" (McKeachie, 1980). However, the research reporting such negative effects has relied on small samples, non-causal methodologies, and only student grades as an outcome measure of performance (e.g., McKeachie, 1980). In contrast, studies with more complex controls and broader samples tend to find variable- or no-effects based on class size (Troth & Montagna, 2002; Ake-Little, 2020; Shi, 2019). Regardless of the real effects of class size on instruction and even whether class sizes are increasing, adopting LMSs provides a solution to two perceived problems: larger classes and demand for constructivist pedagogy.

LMSs provided a solution to both issues as they are designed to support constructivist pedagogies such as collaborative discussion and interactive media and provide a technical framework to deliver instruction to many students at once ("Course Structure", 2016; Huguet, 2018; Wise & Quealy, 2006). LMSs also offer tools that facilitate large group instruction. For example, returning to the example of facilitating small-group instruction in large classes, using a LMS an instructor could assign students to virtual discussion groups, join their discussion board conversations asynchronously, and even view metrics on student participation rates. Further, while this example focused on in-person instruction; LMSs are even more instrumental in online learning, which now accounts for between 15% (online only) to 33% (including 18% part-online) of college students (Lederman, 2018). In sum, both increasing online learning and overall college attendance stretch instructors tasked with delivering constructivist, personalized instruction so that LMS adoption promises to provide a partial solution to both pedagogical and student demographic shifts.

The second trend driving LMS adoption is accountability culture in higher education. The accountability culture in higher education is not new—and it has long been propelled by the growing student body, or "massification" of education, the first driver of LMS adoption (Alexander, 2000; Huisman & Currie, 2004). Presently, accountability has culminated in an institutional culture that demands performance data to report outcomes internally and to outsiders (e.g., Prinsloo &

Slade, 2014; Tello & Motiwalla, 2010). In response to increasing oversight, LMSs offer an indispensable system that collects, coordinates, and shares performance data (e.g., Davis, 2018). As examples, Khairudin and Hamid (2015) describes administrators making course and exam scheduling decisions based on LMS data and Enwefa and colleagues (2018) studied LMS analytics as management tools to address issues including graduates' skill deficiency or retention. Blackboard, in particular, provides many reporting features for accountability and oversight ("Outcomes reporting," 2018). In sum, the structure and features of LMSs support the data collection and reporting needs of an expanding administration in a culture of accountability.

The third trend driving LMS adoption is the trend towards datification. In education, datafication is the transformation of educational activities (e.g., reading a textbook, turning in an assignment) into active digital data (Williamson, 2017). Using a variety of ever-present technologies, the practice of datafication involves capturing everyday activities and recording them as digital records (Lycett, 2013). In the context of LMS, an example of datafication is OnTask which is a tool that aggregates student clicks and actions in the LMS in a database along with institutional and survey data which instructors can then use to identify and send nudges to different segments of their course (Pardo et al., 2018). Tools like LMSs have made datafication of education more possible, while demand for more personalized and accountable college systems have made it desirable. Implicit in datafication, and similar trends like evidence-based instruction, is a sense of enhanced objectivity: knowledge gained through digital traces and data trends is supposed to be more trustworthy than human observation and intuition (Kitchin, 2014). From this perspective, data exists free from selective choice or bias. In reality, data are always created through a series of choices, even if those choices are not explicit (Simmons, Nelson, & Simonsohn, 2011). The role of LMSs in a datafied paradigm is twofold: first, they transmute educational activity into data; second, they provide reports for many purposes, including personalizing instruction (as in constructivist pedagogy) and accountability. Given the trust increasingly bestowed on metrics that arise from a

datafied educational landscape, it is critical to inspect the tools of data construction, such as LMS dashboards.

1.2 Research Questions

Through this dissertation study, I will consider these three issues of pedagogical shifts towards constructivism, accountability, and datafication through the lens of instructors' thinking about student engagement and risk status and how these understandings are informed by their LMS use. In this study I two questions. The first question is:

RQ 1: How do instructors define engagement and risk status?

To answer this question, I interviewed professors about how they understood and defined these concepts in relation to their own teaching. I compare the resulting definitions to the way these concepts are defined in the theoretical literature and the way the LMS advertising discusses these concepts. The second question I ask is:

RQ 2: How does the LMS inform teachers about students' engagement and risk status?

I addressed this question through interviewing instructors as well. My focus is on considering how the LMS frames these concepts, whether the LMS promotes deeper understanding, and if the way the LMS presents these concepts aligns with instructors' understandings. I then discuss these two questions within the context of the three trends raised in this introduction—pedagogical shifts towards constructivism, accountability culture, and datafication. For instance, related to pedagogical shifts, I consider how the obligation to instruct many students at once while simultaneously taking the "pulse" of the class and delivering personalized instruction, makes LMS features that summarize students more necessary. How do instructors think about concepts like engagement within this context? Or related to accountability culture, how does the demand for quality control and accountability at the institutional level make instructors more aware of student risk status or does it foreground specific aspects of being at risk? Finally, related to datafication, how does valuing "objective" education-relevant data promote the use of LMS metrics above

instructors' perspectives and observations? These discussions illustrate how the contexts of pedagogical shifts, accountability, and datafication tools to realize these necessities are relevant to understanding how instructors think about student engagement and risk status and how they use the LMS to do so.

2 Literature Review

This chapter describes the existing research and historical contexts precipitating my dissertation study. First, I survey what LMSs are and do and summarize prior LMS research related to LMS development, adoption, use practices, and outcomes. In this section I introduce LMSs as designed objects. Understanding how they are made can reveal the ways they may influence instruction. I also discuss research on how they are used as background for what to expect from the participants in this study. Second, I describe analytic dashboards and metrics. Here, I am interested in understanding the logic behind providing instructors analytics through dashboards and how such tools typically relate to instructional practice. In particular, I focus on the design of early warning systems because they relate closely to defining specific students as at risk. Third, I return to the concepts of engagement and risk and outline their scholarly conceptual definitions. I discuss the multiple definitions and any conceptual murkiness that exists, when applicable.

2.1 Learning management systems in higher education

Learning management systems encompass an array of information and communications technologies. While LMSs have gone by various names—including integrated learning systems, virtual learning environment, course management systems, and learning content management systems (Irlbeck & Mowat, 2007; Moore et al., 2011; Watson & Watson, 2007)—they can generally be defined as applications that "automate the administration, tracking, and reporting of training events" (Ellis, 2009) or "assist in teaching learning process and helps in effective delivery of instruction, training and development program" (Chaubey & Bhattacharya, 2015). These definitions of LMSs are necessarily broad because of the diverse features included in different LMS platforms.

Such features range from storing documents, disseminating messages or announcements, facilitating user-to-user collaboration, hosting forums, editing asynchronously, submitting and storing documents, to assessing students (Ellis, 2009; Watson & Watson, 2007). The specific tools which are included depends on the LMS' intended learning context. For instance, among LMS supporting in-person learning, a core feature is coordinating and communicating data from multiple management or student information systems (Ellis, 2009). Such LMSs help centralize and automate administrative tasks. In contrast, LMSs emphasizing online learning place more emphasis on tools such as video lecturing and self-paced materials (Moore et al., 2011). But across contexts, most LMS exist to record information (e.g., assignments, participation, and grades) and deliver information (e.g., instructions, video lectures, assigned materials; Conde et al., 2012). My research primarily focused on these latter, information-delivery aspects of LMSs designed for in-person learning.

Given the wide range of features and tools offered by LMSs, early LMS research focused on defining and categorizing LMSs, often comparing platforms based on lists of features (e.g., Bremer & Bryant, 2005; Gibbons, 2005; Lewis et al., 2005; and Sampson & Karampiperis, 2006). However, defining LMSs based on shared features becomes difficult as new features are introduced and non-standard platforms such as Facebook and Outlook 365 are proposed (e.g., Laura et al., 2018; Wang et al., 2012). Additionally, such studies have a limited lifespan because LMSs adoption changes over time. For example, many early LMS studies focused on WebCT, a once widely adopted and researched platform (Falvo & Johnson, 2007; Ngai et al., 2007; Lu et al., 2003). Later, however, WebCT largely disappeared following its acquisition by Blackboard, as corporate support and adoption patterns shifted (Edutechnica, 2017; Lederman, 2005). Recent LMS adoption trends, as indicated by 2018 market reports, indicate that most US institutions rely on either Blackboard Learn (31%) or Instructure Canvas (25%); respectively, these two platforms are used at over 1100 and 890 institutions (Edutechnica, 2018a; see also McKenzie, 2018). It should be noted, though,

that platform popularity also varies by region. For instance, in the US only 18% of institutions use Moodle, but in Australia, Canada, and the United Kingdom between 30% and 50% of institutions use Moodle (Edutechnica, 2018b). In this study of LMSs, I focused on Canvas, which holds the largest market share—34%—among higher educational institutions (Hill, 2021). Canvas was also practically available, as it was the LMS in use at the institution where I conducted this study. And to augment rather than retread past work, my focus is not typifying LMS dashboards based on their features, instead, this study evaluates how LMS features inform instructors about instructionally relevant concepts.

In my review of LMS research, I found it helpful to organize the existing LMS research around the stages in an LMS adoption: from LMS selection to its use, and finally outcomes related to using the LMS. Reviewing previous work associated with these stages emphasizes the key concerns that have been considered as LMSs were designed, implemented, and evaluated. By organizing prior research with this framework, I noticed how little work to date has considered whether key concepts are interpreted in meaningful and useful ways. I return to this gap subsequently after summarizing the stages of LMS adoption.

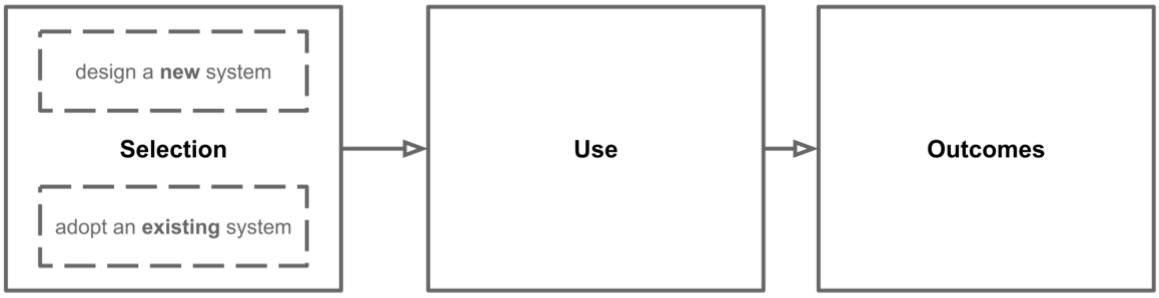


Figure 2.1 — LMS Adoption Stages

The first step in the LMS adoption is selection, which requires either choosing between existing platforms or designing a custom system. Early research often focused on comparing platforms to inform LMS selection, producing studies that simply categorized the types of LMS and their features (e.g., Bremer & Bryant, 2005; Gibbons, 2005; Lewis et al., 2005; Sampson &

Karampiperis, 2006). While many comparison studies have compared LMS based on their features (Kljun Vicic, & Kavsek, 2007), several studies have contrasted LMSs to explore a specific issue, such as the availability of communication features (Cavus & Zabadi, 2014), whether to adopt open-source or proprietary systems (Ülker & Yılmaz, 2016; Wainwright et al., 2007), or identifying necessary technical requirements including accessibility, code infrastructure, cost, documentation, and security (Al-Ajlan, 2012). Such LMS comparison studies have ranged in complexity from two decision-makers keeping reflective journal (Bremer & Bryant, 2005) to more systematic reviews of all available LMSs (e.g., Al-Ajlan, 2012; Cavus & Zabadi, 2014), and considered concerns at various teacher-, school-, and system-level (Buabeng-Andoh, 2012).

While such work has emphasized feature comparison, which is outdated quickly, other work has identified cross-platform feature categories (Al-Ajlan, 2012) and outlined important questions to consider during LMS selection (Ülker & Yılmaz, 2016). Notably, Cuvas' (2009) developed an eight-step LMS evaluation process that included a fuzzy-logic algorithm to systematically compare, weight, and rank multiple LMS attributes. However, beyond Cuvas' work, no framework for administrators selecting between LMS has been developed. To date, most comparison studies have focused on specific features, rather than broader theoretical or conceptual issues, such as the implicit concept definitions created by LMSs. My study adds to LMS selection research by offering an analysis of one LMS and the way professors understand underlying constructs identified by the LMS. I hope that similar work with other popular LMSs will allow future comparisons of how concepts are instrumented by LMSs and presented to instructors in the future.

Still within the selection stage, there is an alternative to selecting from existing platforms, which is to develop a custom-built LMS. One such early LMS-development study described the development of Moodle, a still popular platform (Dougiamas & Taylor, 2003). In this study, Dougiamas and Taylor (2003) focused on designing a system that reflected their need for constructivist instruction and tools to support reflection. The result, Moodle, was a pedagogy-

focused and open-sourced tool. Likely, the wide adoption of Moodle was due to its open-source accessibility; similar work using proprietary systems failed to spread (e.g., Hoic-Bozic et al., 2009). In addition to cases describing the development of specific LMSs (e.g., Dougiamas & Taylor, 2003; Hoic-Bozic et al., 2009; and Yueh & Hsu, 2008), LMS design research has also generated frameworks to guide LMS development.

For instance, Wilson et al. (2007) outlined a design framework to move away from centralized software solutions to combine many authentic tools (e.g. blogs, social media) and formal educational information into a "personalized learning environment." Like Dougiamas and colleagues' original work, Wilson's framework emphasized constructivist aims such as symmetry of contributions between instructors and learners as well as individualized learning contexts. More recently, Chung, Pasquini, and Koh (2013) formulated a design model based on human-computer interaction theory, that provided broad guidelines for designing five categories of features: transmitting course content, evaluating students, evaluating courses and instructors, creating class discussion, and creating computer-based interaction. Such development frameworks and previous design efforts can inform LMS development, but, more recently, most LMS development has been led by the major corporate platforms (Chung et al., 2013). This is another reason to study design-related topics among existing platforms—to consider the implications of adopting such platforms and consider where their design choices lead.

Research at the second stage of LMS adoption, after an LMS has been selected or developed, focuses on how LMS are used. I categorized this type of research as use studies, which encompasses work described as studies of integration, implementation, or utilization. Such work centers around two main issues, first, describing use rates and, second, identifying factors contributing to LMS usage. My study fits within this type of LMS research.

The first focal point for use research has included descriptive studies that identify which LMS features are used (e.g., Ifenthaler, 2008). As LMS usage rates are highly context and platform

specific, I do not review such work in depth. Further, exploring how users used LMS was more common over a decade ago when LMS adoption was a newer phenomenon and less familiar. Across such work, a common finding was that a small handful of LMS tools receive most of use—for instance, Griffiths and Graham's (2009; see also Lonn & Teasley, 2009) found that only six tools generated 90% of student activity and Malikowski (2008) found that half of the faculty used one LMS feature or less. More recent work has found that this trend continues, with instructors using the LMS primarily as a repository and making infrequent use of many of the available tools (e.g., Awad, 2019). Some scholars, such as Fathema, Shannon, and Ross (2015) framed low usage rates as a concern. Their work investigated faculty beliefs and attitudes as predictors of actual usage rates using and identified system quality, perceived self-efficacy, and facilitation conditions as significant predictors of faculty attitudes towards LMS, which, in turn, predicted LMS usage rates.

Fathema and colleagues' work also illustrates the second focal point of LMS use studies: identifying internal and external barriers or catalysts that impact LMS use frequency and amount (Asiri et al., 2012). LMS adoption involves both internal factors like attitudes towards LMS, beliefs about e-learning (e.g., constructivist pedagogy) and LMS competency as well as external factors like demographics (e.g., gender, training) and organizational, technological, and social barriers (Asiri et al., 2012). Such usage-determining factors are often organized in the technology acceptance (TAM) model (Sezer & Yilmaz, 2018; Venter et al., 2012). Among faculty, LMS-use use studies have explored implementation issues ranging from user experience (Machado & Tao, 2007; Weaver & Nair, 2008), LMS use in distance learning (Rapuano & Zoino, 2007), LMS platform incompatibility with existing practices (Bisaso, 2009), to motivational factors impact on adoption (Gautreau, 2011).

To date, while LMS-use studies have explored LMS use patterns and identified successful practices and pedagogy (e.g., Govindasamy, 2002; Awad, 2019), they have not historically explored instructors' sense-making around concepts defined and presented by LMSs (e.g., Aguilar et al., 2014; Thacker et al., 2014). My study addresses this gap in LMS use research, considering the

interpretations and decisions instructors make when using LMS. I ask in what ways the LMS informs instructors overall and through their dashboards specifically.

Research addressing the third stage of LMS adoption includes studies focused on the outcomes of LMS use. This work tends to be evaluative. How LMSs are used, and, how instructors design courses in the LMS, has been associated with students' online activity, perceived value (Roll et al., 2015), and satisfaction (Weaver & Nair, 2008). Similar work has considered the perceptions and attitudes of faculty and IT personnel (Dahlstrom et al., 2014). This type of research has primarily evaluated LMS outcomes through self-report; however, how students or faculty feel about using a LMS may not correspond to the effects of using that system.

Lonn and Teasley (2009) considered this disconnect, comparing log and survey data from two years of LMS use. They found that instructors and students alike highly valued document and communication tools over interactive tools, and that these preferences were consistent with usage patterns. In addition to self-reported outcomes, several evaluation measures have been developed to assess the outcomes of LMS use, including ease of use, feature utilization, and task-technology fit (Kim & Lee, 2008; McGill & Klobas, 2009; Onacan & Erturk, 2016). To date, several outcomes of LMS use have been studied, including user perceptions, attitudes, and use practices. Less attention has been paid to the more pressing outcome of student learning. In these studies of LMS outcomes, there has been less attention on student outcomes. This may be because student learning is less directly related to LMS than the usage of such systems. Or as LMS may have weak influence on student learning, as Tempelaar and colleagues (2015) found in their analysis of system-use data from LMSs that such data did not predict grades. Similarly, McGill and Klobas (2009) found that LMS' task-technology fit influenced the perceived but not the actual impact of LMS on grades. While students' use of LMS may not relate strongly to learning, if LMSs impact instructors' thinking, teaching, and advising, then LMSs may influence student learning through instructors' pedagogical practice (Bain, 2011). My study does not look at outcomes of LMS use at the student level, but it

does ask instructors to reflect on how the LMS may impact their instruction, both in framing how they think about students and how these understandings impact their teaching practices.

Taking an overview of these stages of LMS research and the present study, I am focused mostly on LMS use, with some discussion of the effects of LMS use. This fits closely with the current gaps in knowledge along the LMS adoption framework. Regarding LMS selection, some have argued that such research is saturated and "done" (e.g., García-Peñalvo et al., 2011). However, it is only relatively recently that a handful of platforms have emerged as the primary systems, not to mention that these systems introduce new features that now impact most institutions (e.g., Laura et al., 2018). Given this, I argue that research on LMS continues to be important for studying learning. What is needed now, however, departs from describing which features are used most or attitudes towards adopting specific platforms. The current stability of platform popularity signals a need to study the implications of using LMS in instruction more deeply and critically.

2.2 Metrics and dashboards for teaching and learning

Learning management systems present metrics, analytics dashboards, and data visualizations to convey information about students quickly and simply. Such displays aggregate a great volume and variety of data to instructors in a format that purports to provide both instant and incisive information about student activity. Schwendimann and colleagues (2016, 2017) described such instruction-focused dashboards as a single display that aggregates multiple visualizations of different indicators about learners, learning processes, and learning contexts. In essence, while all analytic dashboards consolidate the information required to accomplish a task into visual metrics available for at-a-glance monitoring (Few, 2003, p. 26, 34; Harel & Sitko, 2002, p. 6), LMS dashboards communicate instruction-relevant information such as which students have viewed an assignment or class-wide performance distributions. This process of concretizing abstract trends in learning environments is predicated on the premise that making such data accessible will inform the instructor and possibly change instruction for the better (Aljohani et al., 2018; Card et al.,

1999). Learning analytic dashboards deal with consequential issues related to learning, performance, and behavior (West, 2012), whether they face instructors or students (e.g., Park & Jo, 2015; Verbert et al., 2013). This is one reason to study LMS dashboards: they are designed to influence instructors' thinking and, by extension, teaching and learning.

Existing LMS dashboards have been designed primarily for teachers in the university setting (Park & Jo, 2015; Schwendimann et al., 2017; Verbert et al., 2013). In this context, most dashboards report metrics summarizing data from learning management systems (Schwendimann et al. 2016). In their review of 15 dashboards, Verbert and colleagues (2013) found that metrics reported document and tool use (10 dashboards), artifact production (10), exercise or quiz results (9), time spent on activities (9), and social interactions (8). Several reviews have catalogued and compared instructional dashboards (see Park & Jo, 2015; Schwendimann et al., 2016; Verbert et al., 2013; West, 2012; and Yoo et al., 2015). Such work identifies two motivations for dashboard creation: alerting early warning symptoms and facilitating online learning. An example of early warning dashboards is Course Signals, a dashboard designed and implemented at Purdue, which identified at-risk students and presented a traffic-light metric gauging student risk (Arnold & Pistilli, 2012). The design of dashboards like Course Signals overlaps with efforts to develop predictive models that identify which students are likely to fail, labelled as at-risk (e.g., Hu et al., 2014; Macfadyen & Dawson, 2010). An example of online-learning dashboards is CourseVis, a dashboard that visualizes web log data to inform instructors' understanding of what happened in distance learning courses (Mazza & Dimitrova, 2004). CourseVis is representative of early instructional, dashboard-design efforts focused on online learning, in that it lacks many of the in-person interfaces used in a traditional course setting.

Designing a dashboard involves identifying how to capture relevant data and then present data in a relevant display (Duval, 2011; Podgorelec & Kuhar, 2011). In addition to these concerns, designers must also consider how human perception and technological platforms mediate

information visualization. The reference model for visual analytics addresses such concerns by highlighting the representation technique available to summarize unprocessed data, describing how to use space and time to display various representations, and considering how users will interact with displays (Spence, 2007). In addition to aspects of visualization—the goal of which is to create a mental model of information (Spence, 2007, p. 1, 29)—the design of educational dashboards has been informed by specific learning goals and principles. Since design concerns include explicitly identifying or implicitly developing a conceptual mental model that dashboards and metrics communicate to their users, I am interested in asking what is communicated by the Canvas LMS to professors about the concepts of engagement and risk status.

Beyond the reference model, other theories have informed educational dashboard design. Related to motivational concepts, Jivet and colleagues (2017) found that, out of 95 student-facing dashboards they reviewed, 26 had been designed to support self-regulation or metacognitive awareness and reflection. These were mostly student-facing dashboards; instructor-facing dashboards are more often designed to summarize student performance or risk status, not motivational concepts. Often however, dashboards are designed to summarize available student data rather than to present a specific concept or in-line with a theoretical foundation. Illustrating this, Schwendimann and colleagues' (2017) review of 55 dashboards discovered that only three included a theoretical framework and only four defined concepts presented by the dashboard. Overall, the reference model—that is, focusing on the technical and perceptual aspects of data visualization—has dominated design concerns for educational dashboards.

This study goes beyond data visualization concerns to sense-making questions to understand how instructors learn about students and understand key concepts through their LMS metrics and dashboard. To date, considering these issues has been limited to development studies, such as the design of Moodle (e.g., Dougiamas & Taylor, 2003), which excludes commercial LMS like Canvas. While evaluation of LMS dashboards is another prominent area of research, it has focused

primarily on systematic literature reviews of dashboards from scholarly studies (Jivit et al., 2017; Schwendimann et al., 2017; Verbert et al., 2013; Yoo et al., 2015). As I noted, less work has focused on commercially available LMS. Because such work analyzes publications, it has focused on purpose-created, not-widely-adopted dashboards. This was, in part, because these studies were published before the current LMS industry leaders emerged. This study adds to such review studies by analyzing the use of a current industry leader dashboard.

Most evaluations of analytic dashboards to date have focused on usability and user satisfaction issues (Schwendimann, 2017; Verbert et al., 2013). For instance, evaluations of the LOCO-Analyst, a tool designed to inform instructors of students learning activities and performance, focused primarily on refining data visualizations and user interfaces (Ali et al., 2011). Such work is necessary to develop a successful dashboard, but not sufficient. As noted in their attempt to synthesize dashboard design principles, Yoo and colleagues (2015) concluded that while dashboards incorporate visualization techniques to present information well, few consider other outcomes like users' reactions, sense-making, goal achievement or impact. Thus, it is necessary to look beyond the reference model to other theoretical frameworks and conceptual understanding in relation to analytic dashboards. As Verbert and company (2013) concluded, learning analytic dashboards are intended to promote awareness (e.g., summarizing of course activity), reflection (e.g., considering teaching practice), sense-making (e.g., identifying at-risk students), and ultimately impact teaching and learning. Thus, dashboards should be evaluated in how well they achieve these goals, not solely on the quality of their data visualizations.

Though sense-making is a stated purpose of analytic dashboards, most studies have not explored instructors' sense-making around LMS dashboards (e.g., Aguilar et al., 2014; Thacker et al., 2014). Possibly, because dashboard design has focused on issues emphasized in information visualization through the reference model (e.g., Thomas & Cook, 2005) as have evaluations like the work of Yi and colleagues (2008) who studied how users gleaned insights from dashboards through

processes of providing an overview, adjusting, detecting patterns, and creating a mental model. It is concerning that while many educational dashboards are designed to promote sensemaking as well as awareness and reflection, few studies draw on relevant learning theories in the design process (Jivet et al., 2017; Verbert et al., 2013). The same issue arises for evaluation, in a systematic review of dashboards, Schwendimann and colleagues (2017) identified only two studies that offered a model or theoretical framework for dashboard evaluation. So, as discussed subsequently, dashboards focus on concepts such as engagement and risk-status but are not explicitly grounded in a theoretical framework, whether cognitive, constructivist, humanist, or other relevant perspective (Jivet et al., 2017). This is one reason the proposed study seeks to better understand the theoretical constructs as they are communicated to instructors by the LMS and its metrics. As such, my work will add to growing consideration of the interpretations and applications instructors make based on using analytic dashboards (e.g., Aguilar et al., 2014).

2.3 Defining Engagement

This dissertation considers how instructors use LMS and learn about students using LMS metrics. As such, in the previous sections I surveyed research LMS and educational dashboards. In this section, I turn towards a conceptual definition of engagement and risk status based on scholarly research. I identified engagement and risk status as key concepts to study related to LMS through the preceding literature review and initial review of Canvas materials. In the subsequent sections I give the definitions of these concepts from research. I also summarize how these concepts are described in relation to LMS. For both engagement and being at-risk various theoretical models and their constituting dimensions are reviewed. By doing so, I hope to provide the scholarly understanding of these concepts to which the conceptual understandings of instructors, once identified in this study, can be compared.

Engagement is important in learning because it leads to actions that promote learning and academic success: engaged students put forth more effort, persist longer, self-regulate their

behavior towards goals, and accept challenges (Klem & Connell, 2004; Fredricks et al., 2004). As Reschly and Christenson (2012) characterized engagement—it is the necessary cognitive and behavioral action necessary for success in learning. By definition, then, engagement predicts academic success and delineates groups at high- and low-risk of failing or dropping out (Finn, 1993; Finn & Rock, 1997). In fact, regardless of which specific definition of engagement is employed, engagement has been positively associated with desirable academic, social, and emotional learning outcomes across levels of education (Klem & Connell, 2004).

Among the many existing models of engagement there is a lack of consensus on the definition and dimensions of engagement (Reschly & Christenson, 2012). However, there is agreement that engagement is a multidimensional construct capturing an alterable state of being that is influenced by school, family, and peers' environments and interactions (see Christenson et al., 2012). Of course, what aspects of engagement are relevant also depends on the level of education in question. For example, compulsory and graduate education happen at different stages of life and are undertaken for different motivations, so it is unsurprising that, respectively, in kindergarten anger is relevant for engagement (Bryce et al., 2018) and in graduate school career aspirations are relevant to engagement (Russell et al., 2018). Additionally, the several major models of engagement differ on the number of engagement dimensions (two to four), the relationship between engagement to motivation, and whether engagement is a process or an outcome (Appleton et al., 2008; Fredricks et al., 2004; Martin et al., 2017; Reschly & Christenson, 2012; Skinner et al., 2008). In the classic participation-identification model of K12 school engagement, Finn (1989, 1993) identified a chain of events resulting in either completion or dropout, characterizing engagement as the long-term process of behavioral and affective disengaging or engaging with school. Expanding the concept of engagement beyond school dropout, Fredricks and company (2004) posited a model of engagement for all students that included behavioral, emotional (i.e., affective), and cognitive engagement. Subsequent models have also included a cognitive dimension

to engagement (e.g., Appleton et al., 2006). For instance, Reschly and Christenson (2012) outlined a model of student engagement that identified affective (e.g., belonging, connectedness) and cognitive (e.g., self-regulation, valuing, perceived relevance) processes that precipitated various behavioral (e.g., attendance, participation, disciplinary incidents) and academic (e.g., time on task, homework completion, grades) activity. Some have even suggested that engagement is a meta-construct encompassing both the contexts of participation (e.g., school, family, teams) and individuals cognitive, affective, and behavioral responses to it (Renninger et al., 2018). In sum, engagement comes to be seen as a multi-dimensional concept over time.

I want to highlight the tripart model of engagement. This common model of engagement identifies behavioral, emotional, and cognitive aspects of engagement (e.g., Ben-Eliyahu et al., 2018; Reschly et al., 2020). I adopted this model as an analytic framework to consider three relatively straightforward conceptual dimensions of engagement. This provided an analytic structure when summarizing the various aspects of engagement in the participants' responses. Further, these dimensions can apply to both engagement and risk status as it relates to disengagement. As such, I describe the three parts of engagement in this model.

First, in the tripart model of engagement, behavior includes aspects of school engagement related to students' active participation in school-based activities (Finn, 1993). These facets are often operationalized as positive conduct and participation in learning activities (Li & Lerner, 2013). Typically, behavioral engagement is closely related to the concept of participation; for instance, it includes involvement in academic and social or extracurricular activities and is considered crucial for achieving positive academic outcomes and preventing dropping out (Fredricks et al., 2004). Fredricks and colleagues (2004) summarized three ways of characterizing behavioral engagement: first, positive conduct such as following rules and avoiding trouble such as skipping school; second, students' effort, persistence, concentration, attention, asking questions, and contributing to class discussion; and third, doing school-related clubs or extracurricular like

athletics or model government. In short, the behavioral aspect of engagement is "doing the work and following the rules" (Fredricks et al., 2004).

Emotional aspects of engagement include students' affective reactions in the classroom and toward school in general (Connell & Wellborn, 1991; Li & Lerner, 2013). Emotional engagement includes both the positive and negative reactions towards teachers, classmates, assignments, and school overall. But only the positive responses are related to academic success and an increased willingness to do the work (Fredricks et al., 2004). In their survey of past research on engagement, Fredricks and colleagues (2004) included interest, boredom, happiness, sadness, and anxiety. In short, emotional aspects of engagement include students' "interest, values, and emotions" (Fredricks et al., 2004).

Finally, cognitive aspects of the tripart model include the parts of school engagement related to how students think during learning and education. Cognitive engagement is closely related to metacognitive strategies and is typically described within an information processing perspective. As Fredricks and colleagues described this: "cognitive engagement draws on the idea of investment; it incorporates thoughtfulness and willingness to exert the effort necessary to comprehend complex ideas and master difficult skills" (Fredricks et al. 2004). The cognitive emphasizes the motivational origins of engagement as a concept as well, as it has been described as the "psychological investment in learning" and "desire to go beyond the requirements, and a preference for challenge" (Fredricks et al., 2004). In their literature synthesis, Fredericks and colleagues (2004) pointed out that cognitive engagement is similar to intrinsic motivation and mastery goals, self-regulation, and control. So rather than focusing mainly on information processing strictly in terms of learning content, cognitive engagement covers "motivation, effort, and strategy use" related to learning (Fredricks et al., 2004).

The cognitive dimension of the tripart model of engagement highlights a theoretical connection between engagement and motivation. Indeed, a variety of motivational theories have

been used to frame what engagement is and how it relates to learning, including expectancy-value theory (e.g., Wigfield & Eccles, 2000) achievement-goal theory (e.g., Elliot, 2005), self-determination theory (e.g., Ryan & Deci, 2000), and attribution theory (e.g., Weiner, 2010), as well as principles from social-cognitive theory including self-efficacy (e.g., Bandura, 1997) and self-regulation (e.g., Zimmerman & Schunk, 2001)—work by Christenson et al. (2012) and Martin and company (2017) has summarized the contributions of these theories to the study of engagement. While theory has grounded engagement research, multiple theoretical perspectives have also fragmented the construct (Leaper, 2011). As Christenson and co-authors (2012, p. vii) write: the "conceptual clarity and methodological rigor (e.g., use of psychometrically sound measures) have not been achieved; they are considered a prerequisite to advance the emerging construct of student engagement."

The fuzzy construct distinctions between engagement and its dimensions have complicated efforts to measure student engagement (for reviews of engagement self-report questionnaires, see Fredricks & McColskey, 2012; Greene, 2015; and Henrie et al., 2015). This issue is amplified when assessing engagement in analytics for LMS dashboards or online learning because analytics designers first fail to define engagement as a construct and instead then take log data at face value, labeling features such as log-in frequency or completion time as measures of engagement without establishing how such behaviors relate to an underlying model of engagement. This approach is especially concerning since Gašević, Jovanović, Pardo, and Dawson (2017) found that trace-data and self-report measures of engagement are often misaligned, indicating that in some cases using log data as a measure or proxy of engagement is missing the mark.

Additionally, existing models of engagement were defined in the context of in-person schooling and may not transfer to online learning platforms (Fincham et al., 2019; Joksimović et al., 2018). For instance, in MOOCs, an online learning environment that relies on a LMS-like system to deliver instruction, the primary data source are activity logs which capture learner activity in the

online environment. Fincham and colleagues (2019) argued that existing models of engagement did not include relevant MOOC behaviors, and as such the existing models of engagement with strong validity evidence backing them up do not transfer well from self-report measure to log data and linguistic features of discussion posts. In a complementary vein, D'Mello and co-authors (2017) considered how engagement as a mental state (e.g., flow) could be inferred from activity log (e.g., click-stream) and physiological sensor data (e.g., eye tracking). Their study illustrated how learning in online environments is not necessarily comparable to learning in traditional school settings. In general, engagement models are defined in the context of school and not online learning systems like LMSs. Given this, if LMS data are used to define engagement, these data need to be linked conceptually to a model of definition. Existing models of engagement may not be compatible with this effort. Not to mention that, the design of most analytics for engagement provides neither evidence about construct validity establishing how their log-data can be linked to a conceptual model nor evidence about external validity based on how log data correlates to existing measures (Fincham et al., 2019).One reason I chose to study engagement in the context of how professors learn about their students when using the LMS is because LMS vendors often advertise that their platforms foster engagement. For instance, Blackboard specifically promotes their LMS as a tool to "drive participation and engagement using tools like announcements, push notifications and content preview" ("Blackboard instructor," 2018). Further, Blackboard offers an entire suite of tools—including accreditation, assessment, and enrollment—in and beyond the LMS that aim to promote engagement ("Increasing student success with learning analytics" 2018). Similarly, D2L suggests that their tools "help faculty create engaging learning experiences to keep students interested and progressing through the course" ("Brightspace for higher education," 2018). Notably, D2L's website describes their platform promoting both affective and behavioral engagement. While these vendor claims are largely unsupported, some limited research has

investigated these claims. For instance, Bongey (2012) found that a LMS intervention using Blackboard did not, as proposed, increase student engagement.

I am also interested in exploring how instructors distinguish between different aspects of engagement, including the emotional, behavioral, and cognitive aspects of engagement. Particularly because, as I argue, LMS dashboards conflate behavioral engagement and academic performance metrics with the concept of engagement as a whole. Across platforms, such metrics typically include activity completion status, grade reports, submission content, and platform activity ("Analytics for learn," 2018; "Brightspace core," 2018; Canvas Doc Team, 2018; and "Tracking progress," 2018). Platforms vary in their representation of such engagement metrics. For instance, Moodle represents activity completion with attained badges and competencies and an activity completion checklist, ("Tracking progress," 2018). Both Canvas and Blackboard represent interactions with the platform and compare usage between students. Blackboard also represents activity with a scatter plot between activity and course grade ("Analytics for learn," 2018). And while, in general, most LMS dashboards present metrics that are related to behavioral engagement, LMS simply refer to such metrics as measures of engagement without differentiating various forms of engagement.

This dissertation studied how engagement, as a concept, is understood by instructors for several reasons. First, engagement is important to successful learning. How instructors think about engagement will inform their instructional design and how students are expected to engage in their learning. Second, I also studied how instructors are informed about student engagement through the LMS because I want to better understand how LMS present and define engagement through their design and metrics. Through this study I hope to have clarified which dimensions of engagement LMS dashboards are important to instructors and which dimensions of engagement are captured and presented by the LMS. I give special attention to distinguishing between cognitive and behavioral dimensions of engagement. And areas of misalignment between the theoretical dimensions of engagement presented here, instructors' understandings, and the LMS' models of

engagement. Presently, trace-based measures, like those in analytics dashboards, are becoming increasingly common, in part because they are more convenient to develop compared to the validation process of self-report measures. But when log-based measures are created are they aligned with theory, and do they communicate valuable information to instructors? This study considers these concerns.

2.4 Defining At-Risk Status

At-risk status and engagement are closely related concepts. As mentioned previously, in the seminal participation-identification model of engagement (Finn, 1993) both behavioral (participation) and cognitive (identification) forms of engagement lead to academic achievement; in turn, disengaged students are at risk of school failure. This model presents a single dimension of engagement, where low engagement is a behavioral risk factor. The surveyed LMSs treat engagement similarly, with engagement metrics including activities that result in course success: participating in course activities, submitting assignments, and even grades directly. Thus, when students demonstrate low engagement, they are, by definition, at risk of failing. This relationship implies that, for LMSs including Blackboard, Canvas, and D2L, at-risk status flags students at risk of failing a course. Moodle is slightly different, at-risk is explicitly defined as “dropping out" or "no student activity in the last quarter of the course” rather than receiving a failing grade (“Students at risk of dropping out,” 2018)—likely because Moodle supports many online courses.

In general, the term at-risk is a classification indicating an increased risk of failure in school (Natriello, 2014). The term suggests a possible future outcome, based on the presence of various alterable and unalterable individual, family, and school factors (Reschly & Christenson, 2012). In fact, the associations between such factors and success are better understood than concept of being at risk, as one report concluded: “there seems to be more consensus on [what are] risk factors than on the definition of ‘at risk.’” (Canadian Education Statistics Council, 2000). In practice, this means that at-risk classification is an umbrella term describing the presence of other behavioral, cognitive,

or contextual factors associated with failure. Such factors predictive of failure, or risk factors, can be categorized in various ways: internal or external, malleable or unalterable, proximal or distal, and cognitive or behavioral. Further, what qualifies as a risk factor depends on intervening factors like location, age, learning context, and various demographics. In the following paragraphs, I discuss some of these risk factors to illustrate how being at-risk is not a homogenous set of characteristics, behaviors, or contexts but rather a fuzzy and context-specific designation.

Low socioeconomic status and poverty are major factors associated with school failure. Income is a complex risk factor because it impacts students in multiple ways and contributes to other risk factors, such as high rates of absence, high mobility, and high pupil-teacher ratios—impacting the student at multiple individual, family, and school levels (Reschly & Christenson, 2006). Further, socioeconomic status is enmeshed with other risk factors such as being an ethnic minority, English learner, and in a single-parent family (e.g., Rosenthal, 1998; Christenson, 2008). Within the U.S. and other wealthy nations, income risk factors are indicators of relative poverty (Foster, 1998). In contrast, globally, indicators of absolute or subsistence-level poverty (also known as eradicable poverty)—including malnutrition, unsafe water, exposure to air pollution, and poor sanitation—threaten educational success (Blakely et al., 2005). Income illustrates how risk factors are defined in relation to a specific context (e.g., country of residence) and may be inseparable from other characteristics or contexts.

Different factors impact success at different stages of development. In the K12 grades, failure is identified as youth delinquency and performing below expectations (de Vries et al., 2015). Risk factors particularly salient to adolescents include external factors such as poverty, community violence, lack of school resources; family factors such as living with a single, teenage, or no parents, physical or emotional maltreatment, high mobility, permissive parenting style, low educational expectations; and individual factors such as gender and adopting adult roles including pregnancy or employment, or substance abuse (Richardson, 2007; Koball et al., 2011; Rosenthal, 1998; Reschly &

Christenson 2006). Some of these are stable, demographic factors such as being an ethnic minority and not speaking English as a primary language; others are or persistent psychological characteristics like having a learning disability (Finn & Rock, 1997; Knight et al., 2017; Koball, et al., 2011; and Whiting, 2006). In comparison some risk characteristics are temporary behaviors like cannabis or alcohol use, violence, and risky sexual behavior (Knight et al., 2017). Taken together this array of non-school and demographic factors make identifying and intervening in at-risk adolescents particularly complex (see de Vries et al., 2015).

Among college-age students, failure is also defined as failing to transition to college (or, dropping out), adulthood, or economic self-sufficiency (Horn & Carroll, 1997). Risk factors are cumulative, so factors impacting success in adolescence continue to impact the academic trajectory into college and beyond. Echoing the factors that impact younger students, Horn and Carroll (1997) identified coming from single parent household, changing schools two or more times (other than in the normal progression like between elementary and middle school), being from a low socioeconomic status (SES) family, or repeating an earlier grade as risk factors among college students (see also Heisserer & Parette, 2002). Factors such as holding outside employment, being a first-generation college attendee, and being a minority are particularly salient (Heisserer & Parette, 2002). And, unsurprisingly, prior academic performance is a strong predictor of success in higher education (Horn & Carroll, 1997; McKenzie & Schweitzer, 2001). This is one reason early-warning dashboards often include data from student information systems to include additional risk factors beyond LMS behavior (e.g., Arnold & Pistilli, 2012).

Given the complexity and multiplicity of risk factors some researchers have deemphasized identifying risk factors and emphasized understanding what protective factors are associated with resilience (e.g., McMillan & Reed, 1994; Whiting, 2006). This approach acknowledges that fewer students at-risk may succeed, but that being at risk does not guarantee failure. Such work has identified factors that contribute to success, including encouragement, high expectations, support

system, recognition, and fostering scholarly identities as pathways of positive influence on at-risk students (McMillan & Reed, 1994; Whiting, 2006). This perspective can lead to proactive interventions because, while many risk factors are intransigent, most protective factors are actionable. For instance, parents may provide academic and motivational support by talking about expectations and monitoring progress through schools. Instructors can implement fair discipline policies, provide caring instruction, and foster a high locus of control (Reschly & Christenson, 2012). Thus, though some protective factors are related to student behavior such as completing homework and preparing for class, most protective factors are external to students, which means that factors that "pull in" rather than "push out" students are related to policies and practices which educators can control (Jordan et al., 1999).

Such findings suggest that dashboards designed to flag at-risk students should devote as much, if not more, attention to flagging instructional practices and course design that impact student success—beyond identifying individual, behavioral or demographic risk factors. Current LMS dashboards identify at-risk students using both descriptive and predictive methods. Adopting the descriptive approach, Blackboard and Canvas dashboards present user engagement and performance statistics and suggest that they identify at risk students. Describing their course analytics, Canvas states their dashboard allows instructors to "see which students are at-risk and need help" (Canvas Doc Team, 2018). In contrast, taking a predictive approach, Moodle uses a machine-learning model to identify at risk students ("Features," 2018). Underscoring the link to engagement, Moodle predicts at-risk status based on low student engagement ("Analytics," 2018). Also offering predictive methods, Blackboard and D2L both predict risk status using external data sources. Blackboard offers an institution-wide platform, Blackboard Predict, that identifies students at risk and facilitates early alerts and intensive advising ("Blackboard predict," 2018). Similarly, D2L offers Performance Plus, which includes an adaptive learning engine (which links concepts and tailors assessments) and a dashboard that diagnoses at-risk students ("Performance plus," 2018).

In these various tools, however, it is unclear what factors contribute to defining at-risk status—the term is used as a categorization independent of specific risk factors.

The concept of risk is an umbrella term to represent many contributing and interrelated factors, dashboards present at-risk classification as a categorical or binary. In response to such categorizations, some scholars have questioned whether the term at-risk is useful at all (e.g., Natriello, 2014). For example, Ladson-Billings (2007) has argued that the term at-risk is harmful, creating a self-fulling prophecy of failure for students designated at-risk. Taking a different approach, other scholars have moved away from the deficit-laden term at-risk, instead using the term at-promise (e.g., Whiting, 2006). Regardless of whether at-risk or at-promise is used, it identifies students by what they are not: likely to meet educational milestones, complete college, or finish a course without intervention. Such deficit thinking, categorizing students as at-risk, is not productive unless it marks a path to intervention. As Placier (1993) noted, in a review of Arizona policy, the term at-risk was as a strategic identifier to provide some subgroups resources and intervention. Similarly, in LMSs categorizing students as at-risk must be accompanied by an understanding of what at-risk means in that context and a model of what interventions are necessary.

In summary, the term at-risk emerged in the 1980s with the "A Nation at Risk" as an alternative to language that placed the blame on failing students themselves (Gardner et al., 1983). Since that time, most states and educational institutions have developed overlapping but different definitions of at-risk students (Natriello, 2014). The term is typically used to flag students at risk of failure due to a variety of factors. In LMS, at-risk status is often operationalized as low behavioral engagement. I have chosen to include studying risk status, in part, because it is often described as the absence of engagement. In this sense, it is an important conceptual corollary to student engagement.

Additionally, I have questions about how LMS metrics frame and communicate about risk status. Are engagement and risk status conflated by instructors, LMS, or both? This interests me because only some theoretical models of engagement define being at-risk as an outcome of low-engagement, other models include two separate dimensions of engagement and disengagement rather than describing engagement and disengagement as opposite ends of the same spectrum (e.g., Skinner et al., 2008, 2009; Martin, 2008, 2009; Martin et al., 2017). So, does the underlying model of risk include maladaptive forms of engagement in addition to disengagement? Further, how useful are the definitions of being at-risk and the risk factors presented in dashboard metrics? Are such metrics presenting malleable factors under instructor or student control? This is important given the critiques of risk as a concept.

To conclude, this literature review has surveyed both the historical and more recent studies of LMS development, adoption, use, and outcomes. Through this review I have argued that LMSs are designed objects and that studying how they are made and used can reveal influences beyond which features are offered. I also summarized research on analytic metrics and dashboards to illustrate how this dissertation study adds to an ongoing, decades-long discourse about educational technology and its role in defining and framing information about students. In particular, I focus on the design of early warning systems because they relate closely to defining specific students as at risk. In summarizing past and present LMS work, I identified engagement and risk status as key concepts and outlined their scholarly conceptual definitions. These conceptual overviews of engagement and risk status identified theoretical debates and conceptual murkiness. The next chapter outlines my research study, designed to address some of the concerns and ongoing questions identified through this literature review.

3 Research Design

This study focuses on two related research questions. The first question asks how instructors conceptually define the concepts of engagement and risk status. These concepts are

commonly employed in the discourse around the uses and benefits of learning management systems. Additionally, these concepts also have complex theoretical definitions in scholarly literature where they are identified as important to learning outcomes but defined in varying and sometimes conflicting ways. Whether or not instructors are aware of these technical or academic definitions, these concepts may be important for how they think about their students and instruction. As such my first research question has two parts. First, how do instructors define student engagement? And second, how do instructors define being at risk? The second research question concerns how instructors use the LMS system to learn about student engagement and risk status. How are their understandings of these concepts informed by working with the LMS and its analytics? Below I outline the interview-based study that I conducted to answer these two questions.

3.1 Participants

Participants comprised faculty that taught at UC Davis and used Canvas regularly. As participants were recruited through snowball sampling, an effort was made to recruit participants that differed in the types of classes they taught, experience, and field. Altogether, 21 instructors participated in this study; all 21 provided interviews and 20 responded to the survey. In this section I describe how they were recruited, their background, and their demographic characteristics.

The participants were identified based on their experience with the LMS across a wide range of disciplines. My goal was to recruit a diverse group from multiple fields with a range of abilities in the LMS. I received participant recommendations from department leaders, educational technology consultants, and participants. Two department leaders from writing and social science departments recommended four writing professors and social science professors, respectively. These department leaders served as project advisors and so knew the intent of my research and recommended instructors they thought would provide valuable insights. From the campus'

education technology unit, two consultants recommended participants that they had worked with on the LMS previously. Together, the two consultants put me in contact with eight professors across multiple departments. Additionally, three participants recommended colleagues that they anticipated would want to participate, this added eight participants to the sample.1 In addition to these participants, 15 other professors were recommended and contacted but they chose not to participate. In total, 58% of the recommended participants that I contacted ended up participating. Figure 3.1 summarizes the snowball recruitment process.

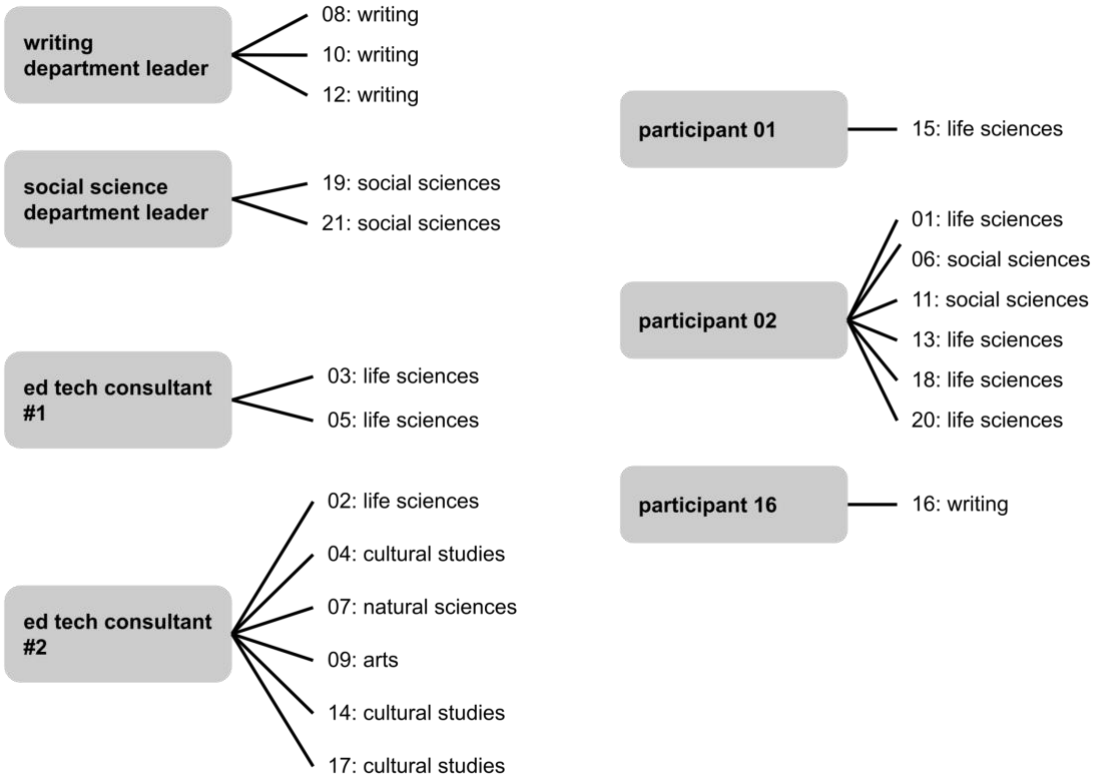


Figure 3.1 — Snowball Recruitment

The participants came from a variety of disciplines and teaching contexts. As figure 3.1 shows, the participants came from a variety of fields, including the arts (1), cultural studies (3), life

1 Participant 16 recruited themselves. They overheard an interview I was doing and asked to participate in the study.

sciences (7), natural sciences (1), social sciences (4), and writing (5). Their specific departments are not given to promote confidentiality of the interview responses. The participants held various job titles, including adjunct professors or instructors (3), assistant professors (7), associate professors (5), full professor (3), and lecturers (3). Additionally, the participants also held different two types of contracts across these job ranks, being either research (14) and teaching (7) focused. Research focused employees have a traditional professorship with their work including research and teaching in an area of specialization. The teaching focused employees had contracts with mostly teaching and research on teaching in their field—this type of contract is sometimes called lecturer with security of employment. I highlight that seven of the participants held this title because they were highly connected to the educational technology community and reflective about their teaching practices given that it was a topic of their research. Also, as class size can impact how relevant the LMS is for instruction, I asked whether the participants taught large classes over 200 students. Two participants taught only large classes, 13 taught at least one large class, and six taught no large classes. My hope in recruiting participants from different fields and teaching contexts was to get perspectives from multiple educational contexts.

The sample was recruited with an effort to include multiple professors from a department to provide a range of responses within each field. I did not explicitly recruit participants based on gender, ethnicity, or age, but I want to present these demographics here to compare this sample to the campus-wide academic employee demographics (data source from "Diversity, Equity & Inclusion", 2020). The participants' genders included 15 women and six men. My sample included more women than the campus' academic employees which are between 37%–50% women, depending on who is counted as an academic employee. The participants' ethnicities included White (14), Asian (3), Black or African American (2), Hispanic or Latino (2), and others (1). Similarly, the campus' faculty members are majority white (72%) and Asian (17%)—according to the most recently available data from 2016. Roughly, this ethnicity composition of participants

over-represents Black and African faculty by 6% and White faculty by 9%, while it under-represents Hispanic or Latino faculty by 3%, Asian faculty by 5%, and American Indian or Alaska Native by 1% (reference). The participants' ages, summarized as generational ranges, included one 18–34-year-old participant, eleven 35–50-year-old participants, and seven 51–69-year-old participants. (Academic employee ages are not reported by the university.)

3.2 Data Collection

3.2.1 Interview Data

I designed a one-hour, semi-structured interview that covered three topic areas: general construct questions, general LMS questions, and engagement and risk status in the LMS (see the protocol in Appendix A). In practice, the interviews ranged from 38 to 71 minutes long and followed the protocol closely but flexibly. For example, if a participant already addressed a prompt later in the protocol, I did not ask it again. Below I describe the three topics areas of the interview and the corresponding questions.

General construct questions. In the first part of the interview, I directly asked the interviewees about their personal definitions of engagement and risk status. These questions included the prompts “What does student engagement / risk status mean to you in your teaching?” or “How do you define student engagement / risk status?” and “Do you see a connection / relationship, if any, between these concepts?”. I also asked the participants about how they formed these understandings with questions including “How do you learn about your students’ level of engagement or disengagement / at risk status?”, “What does an engaged / disengaged student look like?” and more evaluatively “Can you tell which students are engaged / at risk?”. These latter questions asked instructors to reflect on whether they can or cannot tell who is engaged or at risk, as well as describe how they learn about student engagement and risk status. This latter element would be probed in more specificity in the third part of the interview.

General LMS questions. In the second part of the interview, I asked the interviewees about their use of Canvas. This part of the interview was brief asking "How do you typically use the Canvas?" and where I would probe about how often they used Canvas and specifically which tools were used. Similarly, I asked, "Do you typically use the LMS dashboard?" and "What are the ways you use the dashboard?". As many instructors did not use the analytics dashboard, this section of the interview ended up focusing more on the various Canvas tools and pedagogical practices related to student engagement and risk status. In particular, based on earlier interviews, I asked some interviewees "Do you do anything to increase student engagement?" to query how their use of instruction and use of Canvas were intended to promote engagement.

Engagement and risk status in the Canvas. In the third part of the interview, I asked the interviewees about how using the LMS did or did not inform their understanding of engagement and risk status. The purpose of this section bridged the more general information provided in the first two parts of the interview. I probed engagement and risk status individually with an overall question of "What does the LMS show you about student engagement / risk status?" and follow-up questions including "Does Canvas help you learn about student engagement / risk status?" and "Can you tell me a story about how the Canvas helped you learn about student engagement / risk status? What did you do based on that information?". If faculty mentioned using third-party platforms, I also asked these questions about that platform. Based on early interviews, I also asked the interviewees if they used the terms engagement or risk status in their own thinking or preferred other terms.

3.2.2 Survey Data

I also used a survey to collect information about the participants. The survey was emailed to participants to be completed before the interview. All but one of the interviewees completed the survey. The survey included three sections about instructional experience (e.g., career level, field, number of large lecture courses taught), LMS experience (e.g., duration of use, frequency of use,

features used), and general demographics. First, the instructional experience questions included job title, courses taught, course sizes, and average time allocated to teaching. Second, I included questions about the participants' technological expertise because past work has shown that experience with technology mediates how LMS are used (Schoonenboom, 2013; McGill & Klobas, 2009). The participants rated their general technological skills, experience with the LMS, and perceived usefulness of the LMS (see questions in Appendix B). Perceived usefulness of the LMS was addressed with five items I modified from the Computer Acceptance Scale (Binte & Rahim, 2013; Selwyn, 1997) based on the Technology Acceptance Model (items in Table 3.1). These questions included five-point agreement scales in which the participants endorsed how much they agreed whether the LMS helped improve instruction, perceived students' studying efficacy, promoted creative instruction design, or saved time and effort. The scale included five points, ranging from strongly disagree to strongly agree; I adopted this format to remain consistent with prior work using this measure. Table 3.1 below shows the original and modified versions of the Computer Acceptance Scale items.

Table 3.1 — Survey Question Development

Original (Selwyn, 1997)	**Online modified (Binte & Rahim, 2013)**	**Questions used in this dissertation**
Computers help me organize my work better.	MC Online helps me improve my instruction to the students.	The campus LMS helps me improve my instruction to the students
Computers make it possible to work more productively.	MC Online makes it possible for students to study more effectively.	The campus LMS makes it possible for students to study more effectively
Computers can allow me to do more interesting and imaginative work.	MC Online can allow me to design more interesting and creative lessons.	The campus LMS allows me to design more interesting and creative lessons
Most things that a computer can be used for I can do just as well myself.	Most things that MC Online can be used for, I can do just as well in a traditional classroom.	Most things that the campus LMS can be used for, I could do just as well without the LMS
Computer can enhance the presentation of my work to a degree which justifies the extra effort	MC Online helps me save time in designing and using resources for teaching and learning.	The campus LMS helps me save time in designing and using resources for teaching and learning

3.3 Data Analysis

This section describes how the interviews were collected and coded. This process involved transforming the data from semi-structured interactions between me and the participant to individual text segments. Throughout this process the interviews were instantiated, decontextualized, and ultimately reorganized into the themes which constitute my findings. For clarity, I describe this wholistic process as three distinct processes, including transcription, analytic coding, and theme development. This organization simplifies the iterative and messy qualitative process but, hopefully, makes this analysis more accessible to the reader.

3.3.1 Transcription

The first step in my analytic process is transcription, which begins during the interviews and ends with cleaned and edited transcripts. The interviews were audio-recorded in person (except for one interview conducted and recorded through Zoom). The audio files were machine transcribed using otter.ai, which I then reviewed and corrected. I organized the transcripts using MAXQDA (Kuckartz & Rädiker, 2019); initially organizing these transcripts following the flexible coding approach (Deterding & Waters, 2018). In this approach, the participant details from the survey were attached to interviews using attributes. These details included teaching experience, LMS experience, and personal demographics (see Appendix B). This allowed for quickly sorting or segmenting the interview transcripts. Additionally, before analytically coding I indexed the transcripts by speaker and interview question by applying code variables. This provided me the ability to segment and organize the transcripts to more easily code within a given question or topic during coding.

3.3.2 Analytical Coding

The second step in my analytic process was coding the interviews. I coded the transcripts using the constant comparison approach, drawing on the approach developed in grounded theory (e.g., Corbin & Stauss, 2014; Merriam, 2009). To start, I first familiarized myself with the data while

cleaning each transcript (as described in the first analytic step) and by writing memos to add to the notes taken while conducting the interviews. From these memos, I identified several topics of interest in addition to my research questions. For example, through these memos I noted the ways professors' personal experiences—like a history of disordered eating—informed their conceptualizations of student risk status. Once I was familiar with the data, I coded across all interviews one topic or question at a time. That is, I did not code one interview end to end. As an illustration, I coded all the participants' responses where they defined engagement before moving on to code the segments where participants defined risk status. This builds on the flexible coding strategy I set up in the transcription phase, as I had segmented the transcripts based on interview question, response, and topic (see Deterding & Waters, 2018). This allowed me to code all the parts of an interview related to a topic at once and do this across all the interviews. This approach led me to develop unique descriptive codes in each pass, with each pass focusing on a specific topic or interview question. Once I developed codes, I did recode some segments of the interview to ensure I was identifying all the relevant segments. But this occurred later in the coding process.

In general, in my first coding passes I developed data-driven, descriptive codes. These descriptive codes were "in vivo" in the sense that they represented what the interviewee was saying directly; and were identified through open coding (Houlton, 2007). After generating descriptive codes through the open coding process, I added additional codes when I coded the transcripts with deductive codes (e.g., instances of key words like engagement or at-risk). These deductive codes were identified organically during the interview process. For example, I used the deductive codes of behavior, emotion, and cognition to explore how my interviewees' perspectives mapped to the tri-part model of engagement. At this coding stage I also made use of key-word search tools. The results of the inductive and deductive code development passes were subsequently refined, elaborated, or discarded, through multiple coding passes, until I identified a set of relevant and stable descriptive codes (Böhm, 2004). The codes resulting from these efforts

were descriptive codes that flagged concepts and ideas within what the interviewees said that occurred across participants. This approach to coding aligned with my analysis goals as I was interested in the conceptual understandings of the participants; and such understandings involve multiple ideas interrelated in some way.

3.3.3 Theme Development

The third step in my analytic process was developing, relating, and organizing codes into themes that reflected the data as well as answered my research questions. Figure 3.2 illustrates my general process for theme development. I started with coded segments from each interview transcript. I then tried shuffling, combining, and comparing these segments in various ways. I gave these boxes dashed lines because the provisional themes are flexible and ultimately temporary. However, the process of creating such themes was formative, even if not directly, for developing the themes that I report in the findings section. The themes I developed are a way of analytically organizing and making connections among the codes identified through descriptive coding. Put simply, developing themes is a process of abstraction (Böhm, 2004; Holton, 2007). For me, abstraction through theme development was not a straightforward nor an easy process. In the figure below, I had trouble at the provisional theme stage, illustrated by dashed boxes. Such uncertainty or difficulty when developing thematic summaries of qualitative data is a well-established aspect of this methodology (e.g., Holton, 2007). As such, below I briefly recount how I navigated one such analytical blocks as a way of summarizing the analytical progression that resulted in the themes reported in my findings section.

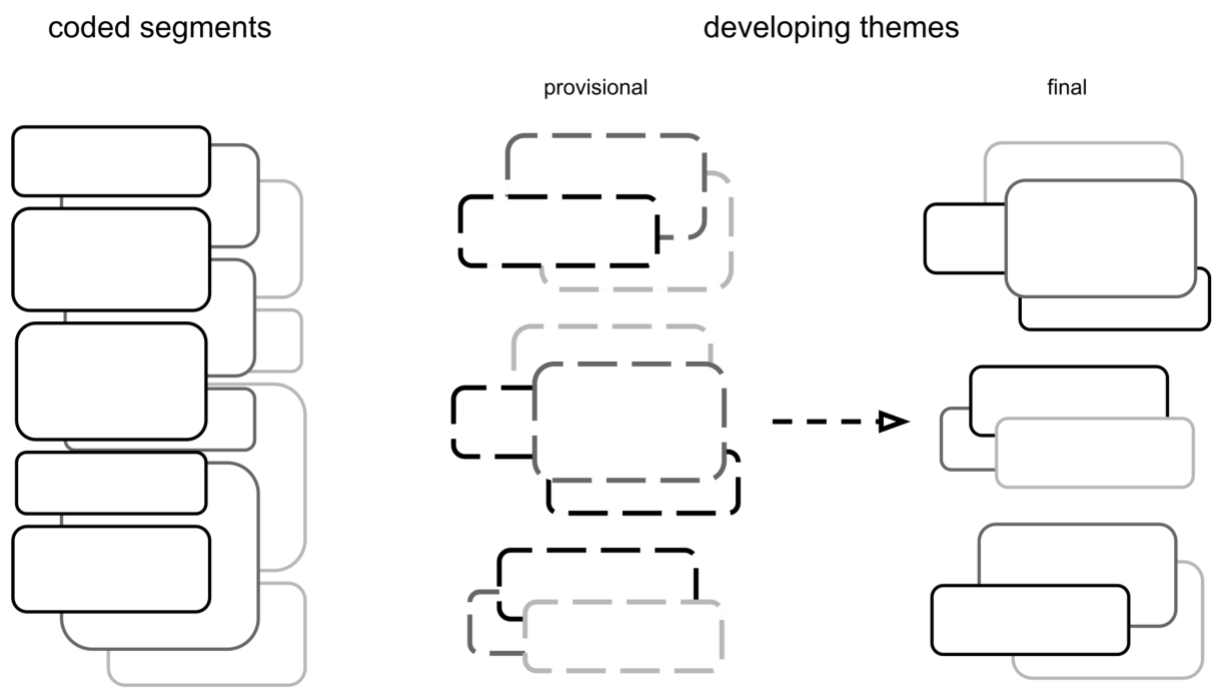


Figure 3.2 — My Theme Development Process

When I began developing a way to organize the descriptive codes that described the participants' definitions of student engagement, I first tried organizing the descriptive codes by assigning them to either behavioral, emotional, or cognitive categories. These categories correspond to the common organizing model of engagement behavioral, affective, and cognitive aspects of engagement (e.g., Reschly et al., 2020), and seemed a natural topical fit. However, I found that the descriptive codes tended to fit into more than one of these three categories. Navigating this analytical block, I changed approaches and instead developed a student-action focused analysis. I posited that student actions were an appropriate analytical lens because engagement is something students do. By comparing and contrasting the descriptive codes related to participants' definitions of engagement, I outline eight broad categories labelled with student action "ing" verbs: completing work, participating, paying attention, thinking about course content, questioning, making connections, developing interest, and interacting with peers. I used these eight categories to sort the descriptive codes. This approach led to the themes I report in the findings section.

However, continuing this example of how coding is not always straightforward, after I had developed the schema that helped me sort the descriptive codes related to defining engagement, I returned to the tri-part model of engagement. Now instead of being stuck I found that the eight codes I had developed related easily to the tripart model of engagement. I took the eight student action categories and considered how each one fit into either behavior, cognition, or emotion categories. This proved useful as a way of interpreting my data in relation to the tripart model and allowed me to add to an existing scholarly discourse. I give the preceding example to illustrate that my coding activities were varied and nonlinear. Though I did not initially find success with applying the tripart model of engagement in my analysis, through iterative coding activities I ultimately did find a way to apply that framework.

The example above describes how I developed themes related to instructors' definitions of student engagement. For definitions of risk, I developed themes in a different way. For risk status, I identified more varied descriptive codes than with engagement. I resisted collapsing these codes too much as I developed themes because the instructors gave very personal and individual answers in their definitions of risk. These details struck me as important. So, to organize the ways instructors described students being at risk I created the thematic frameworks of changeable and fixed risk factors. My motivation here was to create a generative framework aligned with critical scholarship about risk as a deficit label.

So, to summarize the theme development related to my first research question—how instructors define student engagement and being at risk—I focused on identifying the dimensions of engagement that were shared among the participants. These themes were framed as student actions and included completing work, participating, paying attention, thinking about course content, questioning, making connections, developing interest, and interacting with peers. And, finally, as described in the coding instance above, I compared my thematic codes for engagement and risk status with a tripart model of engagement.

For my second research question—how the instructors used the LMS and analytics to learn about student engagement and risk status—I used a more a priori, categorical coding approach. I adopted this approach because it developed naturally in the writing process. When writing about my findings, I wanted to sort each participant into whether they did or did not use the LMS to learn about students for completeness. In the process of sorting individuals into one of several groups, I identified several concepts and then wanted to describe all these concepts, again for completeness. How I proceeded through this process, started when I identified the segments where the participants described using the LMS to learn about a given concept. I then sorted these segments into three categories based on whether what the participant said strongly endorsed or strongly rejected the LMS' utility for learning about engagement or risk status or fell somewhere in between. Within these subsets I looked for topical themes. At this stage I identified the overarching concept of misalignment related to engagement. The resulting themes of how concepts and the LMS are mismatched, or a subset are described for engagement and risk status respectively provided an answer to the research question. Additionally, based on the coding and memoing I had identified three codes that described the LMS usage data, which included online activity, work submission, and grades. I returned to the data to identify all segments related to these topics. These thematic codes also worked for risk status, where I added the additional thematic code of emails.

In sum, my thematic coding efforts were an attempt to summarize across participants by describing the understandings of engagement and risk status across participants. I also include individual-level figures to compare between individuals. But my focus is on general definitions and uses not individual cases. This coding approach is informed by claims analysis (Buckingham Shum & Hammond, 1994; Knight & Buckingham Shum, 2017; Knight et al., 2014). In this perspective, thinking and actions are interpreted by considering what underlying perspectives and epistemologies such thoughts and actions reveal. In terms of the second research question, I summarized how, in practice, the instructors' conceptual definitions worked with the LMS. This

analysis focuses on tensions to add to discourse that promotes discussion and development around LMS use.

4 Findings related to Research Question 1

4.1 Understandings of Student Engagement

As I outlined in the literature review, scholars have defined engagement in multiple, sometimes conflicting, ways. While there is relative consensus around a tripart model of engagement—engagement made of cognitive, affective, and behavioral components—there are other multidimensional models of engagement in use. Given the lack of conceptual clarity in the research on student engagement, it is worth examining the clarity or ambiguity of professors' understanding of student engagement as well. I am interested in exploring whether the multiplicity of engagement in research mirrors understandings of engagement in practice. I analyzed the interviews to evaluate the participants' conceptual concreteness and convergence. These analyses include two lines of inquiry. I approached the analysis for each of these lines of inquiry with a bottom-up, data driven analysis. First, I considered whether a participant understood or used the term engagement. Second, whether a participant expressed that they viewed engagement as a multifaceted concept. These findings frame the collective conceptual clarity among these participants' understanding of engagement. After presenting findings around conceptual clarity and structure in this section, the next section presents the specific ways the participants conceptualized engagement.

4.1.1 Concept Familiarity

I asked 18 of the 21 participants about whether they used the term engagement in relation to teaching (excluding participants 05, 11, and 17[2]). The majority of participants, 13 of 18, did use

[2] As these were semi-structured interviews, my conversation with each participant was slightly different. When I report how many participants responded to a given prompt, this indicates how many participants I explicitly asked. Participants I did not ask may have already commented or contravened the question

the term and found it useful in thinking about their teaching. Those using the term reported using it frequently. As interviewee 15 put it, “Engagement? I use it all the time. All the time!” The instructors using the term engagement also highlighted its relevance to their teaching. Interviewee 03 summarized this view, stating “I think [engagement] is a piece of feedback that can be very valuable for a faculty member. Why is this student engaged in this and not this?” Similarly, interviewee 07 indicated that engagement was an explicit consideration in their teaching: “engagement is part of our daily goal. And I am thinking, constantly, how I can engage students.” Interviewee 05 framed engagement as an instructional design consideration: “I see it more as my job to set up the conditions for engagement rather than the students need to be engaged. [...] I feel like I've done my job if engagement is possible and I'm not going to overly worry about whether someone chooses to be engaged or not.” Overall, engagement was instructionally relevant to those that were familiar with and using the term engagement. None of the participants expressed that the concept of engagement was obligated or mandated into their teaching.

When expressing why they did or did not use the term, multiple instructors mentioned that engagement can be defined in a variety of ways. For instance, interviewee 01 said, “I can imagine that everybody has some very different definition of that, like, whether it's [the students] engaging with each other, engaging with the text, engaging with the material, [or] engaging with the professor.” Similarly, interviewee 02 also mentioned the variation in how engagement is understood across instructors, observing that “engaged is a term that's floated around a lot” and adding “I think that people have different perceptions about what engagement means definitely—I know that mine's probably different than someone else's.” These professors' observations of how engagement is used in practice mirrors the research literature’s multiplicity of concept definitions. I identified this definitional variety in the literature review, for a summary see also Reschly and Christenson (2012).

The interviewees that commented on the multiple definitions of engagement tended to report that the term was useful for them. It seems that the multiple conceptualizations of the term did not impact its utility for these instructors. For instance, interviewee 12 was comfortable defining engagement in many ways in their own teaching: "engagement I use a lot and I think about student engagement, I think about it in a lot of ways." However, there were two exceptions. Interviewee 21 found it difficult to define engagement as any one thing because, for them, the concept of engagement because the term could mean many different things. They felt that the term did not have a unified, specific meaning:

> I'm not uncomfortable with the idea of engagement. I think it looks like so many things, though, you know, so I mean, as long as everyone understands that this is just a giant bucket that we're dealing with. I mean, I don't have a problem with engagement.

Interviewee 16 also struggled with the lack of conceptual agreement, but specifically because they had difficulty separating the terms engagement and participation. They passionately described the struggle as an existential crisis: "It's like something I wrestled with a lot. And I have an existential crisis about once a year." Still interviewee 16 chose to use the term because they viewed engagement as important to student learning; in contrast interviewee 21 avoided using the term because it was too vague.

In general, the five instructors that did not use or find useful the term engagement typically did so because they prioritized a different concept. Interviewee 04 emphasized paying attention and participation:

> I don't use the word. If I was thinking about a classroom and teaching, I think of engagement as partly the amount of attention a student is paying in class. They're actually actively participating. [...] Yeah, it is because, to me, engagement is just a word I never use. I'm not sure I think about anything in its place. I think about teaching, which is different, and learning, which is different to me than engagement.

Interviewees 08 and 09 emphasized interest over engagement in two different ways. Interviewee 08 said “I mean, engaged, I'd probably prefer interested, you know, because if they're interested, they will be engaged, you know.” Interviewee 09 highlighted the inverse of interest, boredom: “No, I don't think about [engagement]. But I think I try to ensure it. I think well, are they bored? Okay, better do this or that.” The concepts highlighted by these instructors could be construed as attributes of a multidimensional definition of engagement: participation could be characterized as behavioral engagement, paying attention could be characterized as cognitive engagement, and interest could be characterized as emotional engagement. Though the participants did not express this explicitly, their preference for other concepts over engagement echoes the multidimensional characterization in theoretical literature.

4.1.2 Concept Dimensionality

The theme of defining and assessing engagement in multiple ways was a theme identified during analysis of the definitions of engagement. I coded this topic and identified it in six of the interviews (04, 21, 02, 12, 16, and 20). I highlight these instances separately from the subsequent section that describes how the participants defined engagement because these were explicit references to engagement being multidimensional.

Just as some interviewees commented on the multiple definitions of engagement, multiple interviewees noted that engagement looks like multiple things. Not only can engagement be understood in various ways, but given a common understanding of engagement, engagement may take many forms. As interviewee 21 put it, “I think engagement can look like a lot of different things. [...] I'd say student engagement for me is really like a personal individual thing.” This view indicates an awareness that engagement may be difficult to assess or measure. Like interviewee 12 said, “[Engagement] looks like a lot of different things. [...] There's a lot of variety about the ways that people demonstrate engagement.” These multidimensional perspectives were more common

than viewing engagement as a binary: “I [think about engagement] in terms of whether or not they're engaged, you know, in that sense” (interviewee 20).

The instructors also discussed actively responding to the fact that engagement may be indicated in various ways. For example, interviewee 16 gave their students permission to be engaged in different ways:

> Explicitly telling students like, you don't have to make eye contact with me, you know, or things like that. Um, you know, I understand like, people take notes in different ways, you know, like, they might take them on hard paper, they might take them on a laptop. So, I try to keep an open mind as possible about engagement.

This instructor tries to think about engagement as a set of varied student behaviors, not a uniform set of behaviors. They tied their multidimensional definition of engagement to their strategies for assessing engagement as well, suggesting that. As they said:

> So, I mean, I think I've tried to, like, the longer I teach, the more broadly I try to define student engagement. [...] And I also just, like, try to remember, there were classes when I was in college, where I probably looked super disengaged, like, I might have been staring, you know, somewhere else in the teachers, I'm in that, but my brain was actually working really hard, what was going on in the class. So I try to assess engagement or think about engagement in multiple ways.

These professors are examples of those that allow their students to be engaged engagement in different ways.

The idea that engagement differs by context was also mentioned by multiple professors. Putting it briefly, interviewee 18 said, “Um, it kind of depends on which course.” Interviewee 04 elaborated on this view more:

> I've had classes that [...] engage really differently. [...] There are classes where you just think “oh, my goodness,”—it's completely difficult to manage. It's very noisy; people are talking at

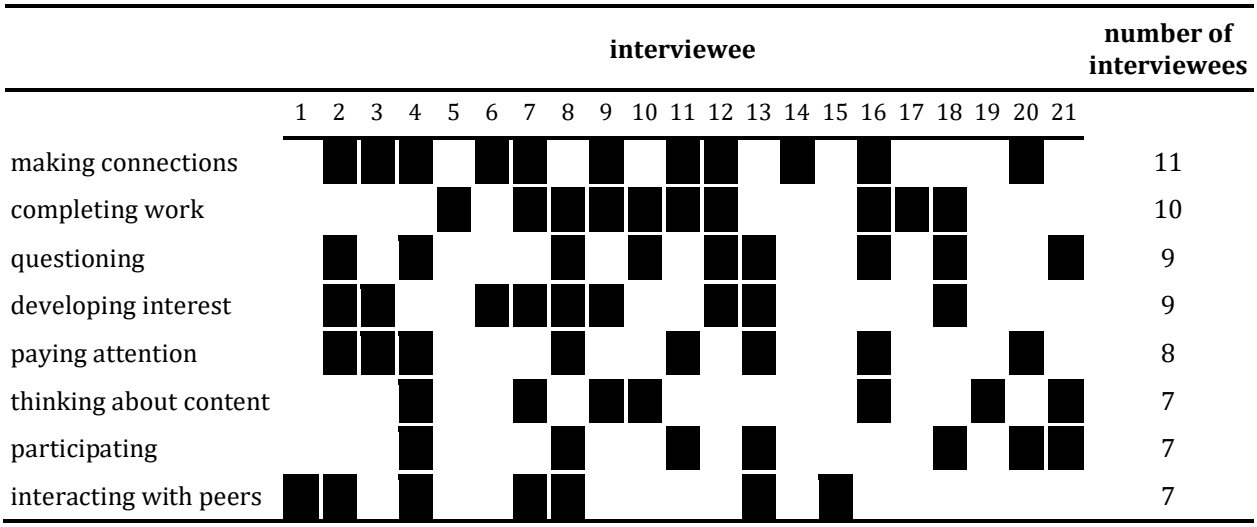
> the same time you're talking. But they happen to be talking about the content of the class. They were talking with the neighbors, and they became very competitive about doing in class presentations. [...] I really don't actually like to try and speak over many people talking in general, that's not my preference. But they were engaging in a very particular way.

In describing this course that was, according to the teachers' assessment, engaged. Interviewee 04 acknowledges that the students were engaged, just not in the way anticipated or preferred. This willingness to accept multiple types of behavior as engagement may promote open mindedness about what constitutes engagement (as interviewee 16 suggested) and it may have further reaching impacts such as promoting universal design. In this context I will return to this perception of multidimensionality and varied understandings of engagement when analyzing how instructors learn about and assess student engagement. As the next section shows, all the participants had multidimensional understandings of engagement. even when the instructors did not describe their conceptualizations using this term.

4.1.3 Definitions of engagement

In this section I describe the multiple dimensions of engagement that participants referenced in their definitions of engagement. My goal is to summarize the various understandings of engagement shared by the instructors. The student actions comprising engagement include completing work, participating, paying attention, thinking about course content, questioning, making connections, developing interest, and interacting with peers. I will describe each in turn below. I developed these themes through a student-centric approach to understanding how professors understand engagement. I consider this appropriate because engagement itself is characteristic of students and their learning experience. So, each of the concepts that I coded as a gerund verb (i.e., a verb ending with "–ing") to ground the interviewees' concepts of engagement in students' actions, thinking, and feeling. As Table 4.1 shows, these concepts are shared among a plurality of the interviewees and summarize each individual's understanding of engagement.

Table 4.1 — Dimensions of Engagement in Participants Definitions



Completing Work. The topic of students completing work appeared in 10 of the 21 participants' definitions of student engagement. Across multiple instructors' definitions of engagement completing work was described as doing assigned work and readings on time. Clear examples of completing course readings include interviewee 11 who defined engagement as whether students "have done the reading" and interviewee 18 who suggested engaged students need to "read and write a term paper at the end of the quarter." Interviewee 17 described their goal of engaging students through assigned readings specifically, stating, "So they require a great deal of reading and since the classes are large at 250. [...] The idea is to keep the students engaged, focused on, you know, the readings that are coming every week." Readings are assigned to engage students and so completing readings is an indicator of engagement. I find it interesting that the instructors did not discuss observable methods for telling whether students did readings or not. Since readings take place outside of class, they may serve as a foundation for other forms of engagement in course activities and assignments.

Beyond reading, completing assignments were also mentioned. Interviewee 09, an instructor of large courses with a lot of TAs, put it, "I can only comment on their engagement insofar as they turn in their in class writing assignments to their TAs." As coursework can be done both in

and outside class, the type of work related to engagement depended on the course structure. For instance, interviewee 08, a writing instructor, defined engagement in relation to completing both in-class and out-of-class work. In their course, students completed writing assignments but also participated in writing exercises and peer-review workshops in class. Regarding out of class work, interviewee 08 said:

> So [engagement] would be that they do their assignments on time. That they look at, you know, they look at the class prep page early as opposed to late. [...] So the students who email me on Friday and say, “I can't see the article I'm supposed to read.” I'm like, you're doing what you're supposed to be doing.

For interviewee 08, doing assignments and readings on time was a form and indicator of engagement. They also discussed in-class work and further emphasized completing activities the way they were designed:

> Sometimes [in class] I give them an assignment; I may give them five questions. And instead of working together and talking about each one and finding the answers together for each one, I find that they'll go "Okay, you do number one, you do number two, you..." and I'm like, "No, no, no, no, no." So, I have to walk around. I have to make sure that they're not doing that. Because then what I see is silence, instead of talking. So, then they may be engaged, but they're not engaged with each other. They're just engaged in the question. And so, then they're not getting the full impact of each question, because they're really only focused on one.

Interviewee 08’s definition of engagement illustrates how completing work can take different forms in and out of class. Additionally, online work is another way to observe engagement. Interviewee 10, a writing instructor like interviewee 08, emphasized this, noting that “for students who, maybe are less talkative in class or engaging in online discussion boards and things like that, [seeing engagement] can be a little bit more challenging.” They highlighted the potential for misattributing

engagement in class, and described how they might rely on whether students were completing assignments to gauge engagement:

> It can be misinterpreted, as they're not engaged, when in fact they are, it's just their individual preferences or personality that makes it harder to read. So, for those students who, right, I'm looking for assignments and in class activities and anything that I can do in terms of teaching methodologies or activities that will give me an opportunity to check that, right?

These examples illustrate how doing work—in class, out of class, or online—were viewed as opportunities for student engagement as well as chances for instructors to observe whether their students were engaged in the way they hoped.

Completing work was often discussed as essential but not sufficient to fully describe the concept of engagement. The above experts from interviewee 08 illustrate this idea. Interviewee 08 describes how completing work was related to peer interaction (a theme that I describe fully later). For them, when students completed the activities but in a way that omitted peer interaction, the students were not seen to be as engaged. The pattern of linking completing work to other aspects of engagement occurred in multiple interviewees definitions. Interviewee 07 linked making connections to completing work, describing their course design as "we just give them lots of assignments, so homework assignments, worksheets, and some videos and other things that we try use to engage them outside the class." But completing work was not the end form of engagement this professor cared about, they noted the purpose of engaging work was "so the main engagement idea actually goes with them [the students], their minds with them, so as long as they are thinking about these topics to me, that's the best engagement ever." In a similar vein, interviewee 16 said that engagement could be "doing like daily work for the classes" but added that "doing daily work for the class shows that, you know, they're understanding the concepts and are thinking about applying them to the work that we're doing." These examples suggest that while completing work is

important, none of the participants considered busy work engaging. Completing work usually indicated some deeper activity and the deeper activity was more core to the professors understanding of what student engagement is. Interviewee 5 encapsulated this perspective saying: "So at a baseline, [engagement is] that they are doing the work. But that's not what, I guess, it really means to me. [...] They have some sort of motivation in doing the work that's beyond a grade that they have to earn, right?"

The discussion I had with interviewee 12 around completing work is worth considering in full. They defined engagement, in part, as completing work. But they also emphasized how the same forms of completing work can indicate engagement for one student but disengagement for another student. Interviewee 12, a writing instructor, started out describing student engagement as completing work on time: "[engaged students] can look like a highly self-motivated person who, you know, just gets everything done on time and is always on point." But later in the interview they reflected that the same behavior could describe their disengaged students:

> I think that some students, like I said, a student who is super on-point and gets everything in on time, that can be a disengaged student too, right? That can also be a student who's like, "I'm just, you know, I'm doing it." They don't resonate with the work, but they can check it off. They can, they're, you know, they function in a way that makes it so that they are capable of completing these tasks, but that doesn't necessarily mean that they are truly engaged in the process.

Interviewee 12 described completing work in a way that highlights how it is seems as important but the end goal for the professors in this study was not the work itself but what students gained from it. Because of this, completing work could be an indicator of student engagement but is not a conclusive metric of whether students are engaged or not.

Participating. The topic of participating appeared in 7 of the 21 participants' definitions of student engagement. Overall, participation is a process which varies by class requirements but

often entails actions like joining in-class activities, labs, or discussions. Some participants simply referenced participation and did not describe it further, like interviewee 20 who simply defined engagement as "Are they participating?" and interviewee 11 who said engagement was "participation in some broad sense." I considered consolidating the ideas of participation and completing work into one theme because work is also a form of participation. However, while the excerpts in the previous section share similarities with how instructors described participation, I chose to separate these two concepts for two reasons. First, participation is often conflated with engagement (Harris, 2011). Given this trend, I wanted to give special attention to how the participants talked about participation when asked to define engagement. Second, students' participation subtly differs from completing work in that it does not necessarily produce tangible work. Participating, compared to completing work, is observed more as a process rather than a product. That said, completing work and participating do overlap conceptually.

The form participation can take depends on the modality of the course. In their in-person course, interviewee 21 suggested that engagement involved "vocal participation," saying, "when you're in the face-to-face space, a lot of times people look at it as a certain kind of participant. Oftentimes, it's like a very vocal participation." Interviewee 21 tends to teach smaller courses in social science and dedicated time to student discussion. In contrast, interviewee 20, who taught large lecture courses in the health sciences, emphasized forms of participation they could see while lecturing:

> I mean [engagement], you know, is 80% showing up, I think. But certainly, there are students that come and are not engaged. I don't know why they come. And I asked them to sit in the back rows because I welcome them to use electronics. And I always say in the first class, you know, if you're going to be on Instagram and doing other things, I don't want you to be in the front part of the class because it certainly distracts everyone else so you can sit

> in the back. And so those students aren't engaged, aren't engaged. I don't know why they come to class.

This instructor asked students that were not participating in the class because they were doing something else on their computer to sit in the back. Those students, according to interviewee 21 were not engaged because of their lack of participation. These two examples of participating—vocal discussion and avoiding distracting websites—were responses to the different participation opportunities afforded by different styles of classes.

The instructors described other forms of participation as well. For instance, interviewee 04 connected participation to asking questions and making connections:

> [Engagement is when] they're actually actively participating. And that includes things like questions are asked whether they're taking notes, whether they are participating in activities, whether they are understanding, taking, taking the information further than its, as stated either in readings or in lecture. I guess it would mainly be active participation would be a way of thinking about student engagement.

Interviewee 08 connected participation to motivation and interest, describing their view of engagement as, "I think when I think of student engagement, the first thing I think about is that the students are interested and they're participating because they're interested not just because they have to for a grade." These examples from interviewee 04 and interviewee 08 connect participation to other topics (i.e., questioning, making connections, and developing an interest) that I identified as stand-alone themes during coding. But I highlight these excerpts here because the interviewees explicitly referenced participation in conjunction with these ideas. This underscores the interconnectedness of these various dimensions in constituting an instructor's overall understanding of engagement.

Another point of similarity between completing work and participation is that they are required in many classes. For example, interviewee 18, a health science instructor that taught large

classes noted that, “I will say definitely that their participation is required. [...] Yeah, that's the kind of engagement I'm expecting.” Their course had labs that required interaction and participation with the lab activities. But in the same way that interviewee 12 noted that the objective of completing work was not important for its own sake, interviewee 18 commented that “But I hope [students] can ask us some questions beyond what we just teach. Really, I mean, show more interest in different lab techniques.” So, while participation was required and viewed as a form of engagement, this professor hoped that participation would lead to interest in the course topics.

Paying attention. The topic of paying attention appeared in 8 of the 21 participants' definitions of student engagement. The interviewees descriptions of paying attention were exclusively related to in-class engagement. Here are several brief examples in the interviewees own words: “I think most of the time about engagement in terms of student focus during class time” (interviewee 03); “If I was thinking about a classroom and teaching I think of engagement as partly the amount of attention a student is paying in class” (interviewee 04); “ I think [engagement] means, in an everyday sense, just are they paying attention?” (interviewee 11); and “During the class? So, for me, [engagement] would be a student who's looking in my direction when I'm talking. Who isn't looking down on their phone or on their laptops?” (interviewee 08). These excerpts all emphasized in-class paying attention as a facet of student engagement. Seeing whether students are paying attention may be one of the only observations an instructor can make of student engagement, especially in lecture classes. For example, interviewee 02 noted they could observe engagement in their lecture courses by students’ body language: “So when you're teaching in a face-to-face setting, you can look at and read the body language of the students more so to see, okay, do we have active listening going on?” Similarly, interviewee 16 described engagement as “[engagement] could be, you know, looking at me and nodding.”

Professors seemed to treat paying attention as a lower threshold of engagement, describing engagement as “Are they kind of putting in the basic amount of time and attention needed to absorb

the material?" (interviewee 11) and not falling asleep (interviewee 13). Interviewee 11 directly noted that paying attention is rather passive and superficial:

> I think there's a superficial definition or meaning [of engagement] and a deeper one. So, the superficial one, I think we mean in an everyday sense is just are they paying attention? Have they done the reading? Are they kind of putting in the basic amount of time and attention needed to absorb the material? You know, or, or even participation in some broad sense. Which are all things that can be quantified or measurable, at least theoretically.

This viewpoint echoes completing work and participating which are necessary but not the entirety of engagement.

Lastly, one interviewee strongly linked paying attention to the idea of interest. I discuss the topic of interest subsequently, but I highlight their connection here because it further supports the interpretation that paying attention is not an end goal, but a goal to achieve other means. Interviewee 03 described engagement as "are [students] interested and paying attention." They mentioned this perspective again, elaborating:

> I guess on the surface, most of the time when I'm using the word engagement, I'm talking about student interest, like whether they're paying attention, whether they're interested in whatever the course is talking about, whether they're awake.

This excerpt suggests that paying attention is a precursor to aspects of engagement like developing an interest in course topics.

Thinking about course content. The topic of thinking about course content appeared in 7 of the 21 participants' definitions of student engagement. Mastering course content is a primary goal for most instructors. In research, engagement is often described in relation to its correlation to learning outcomes. Given this, defining engagement, in part, as thinking about course content makes sense. Several of the interviewees alluded to this connection between engagement and mastery when defining engagement as thinking about course content. For example, interviewee 07

described “the real goal” of engagement as “engaging their minds, and encouraging them to learn the material, better and better.” Similarly, interviewee 19 noted that “engagement, to me, means that they're doing something with the content that they are learning. Preferably something I can see. [...] So in that context, engaging for me means that the student is engaging with the content that's set up in the alchemists at a sustained level.” Interviewee 19’s comment also highlights how thinking is indirectly observable.

The professors did describe several strategies for observing students thinking about the course content. Some participants described this somewhat vaguely, like interviewee 09 saying that students should “show” them their thinking: “They need to be showing that they understand the material and that they're willing to address it.” Or interviewee 21 saying that students showed them in “some way”:

> So, I think, you know, for me student engagement is when students are showing in some way, they're active, they're active thinking, their thought processes, whether it's in the moment or later on.

Others, however, described their approach more specifically. Interviewee 16 noted that they listened to students talking in small groups during class: “I'm kind of going on eavesdropping, you know, [where the students are] showing that they're, you know, thinking about these issues.” Students commenting or questioning also help, as interviewee 10 put it:

> But for some students who are really vocal, I can hear that in their comments and even in their questions, students ask a particular question. I can tell that that question is informed by this sense that they're moving in the right direction with a particular assignment or a particular concept.

Another way students demonstrated thinking about course material could be regular interaction in an assignment and content platforms. Interviewee 19 said that:

> Engaging for me means that the student is engaging with the content that's set up in the alchemists at a sustained level. [...] So engagement, to me, means that they're doing something with the content that they are learning. Preferably something I can see.

So, depending on the course format, the professors described using different approaches for observing students thinking about course content. These proxies informed their understanding of whether students were engaged or not.

While the participants described how they learned about students' thinking and highlighted it as a desirable facet of student engagement. How it came to be or how to promote it was not discussed. Granted, I did not ask the interviewees about this. But one instructor, interviewee 04 commented that they were not sure what separated students that engaged from those that did not engage in terms of thinking about course content:

> And so, people are pretty good at repeating things back to you or even writing, as they have been done, but in asking people in critical thinking to take a leap of faith that goes somewhere beyond that, but some people manage and others don't. And that's a different kind of engagement also, and that I'm not really sure what the thing that allows them.

Interviewee 04 teaches humanities courses with a critical lens. So, I see why critical thinking was particularly important in their courses. But if differences in engagement can be noticed but instructors feel uncertain how to impact levels of engagement, the concept may not be particularly useful. This was the case for interviewee 04 who reported that they did not use the term engagement.

Questioning. The topic of questioning appeared in 9 of the 21 participants' definitions of student engagement. Asking questions is a straightforward activity, the interviewees all described asking questions in the same way. But the instructors emphasized different reasons for why questions were being asked and what asking questions indicated about students' learning. These reasons students ask questions include things like getting clarification, making connections, or

getting interested in course topics. (Questioning was closely related to the ideas of making connections and developing interest that are described in subsequent sections.) Questioning had prime importance in understanding engagement for several of the interviewees, being emphasized as "the main thing I'm looking for" (interviewee 08) and "the biggest thing for me [...]—asking questions that show that they're there" (interviewee 10).

This importance of questioning was also emphasized for the professors that described designing their teaching environment to engage students by promoting questioning. In addition to inviting students' questioning, interviewee 20 mentioned asking their students questions to engage them, noting "in my classes, you know, I welcome them to ask questions. It shows that they're thinking, I also try to engage them by asking questions." Interviewee 18 also employ this strategy in their lecture course:

> I will say for engagement regarding the lecture course I will, my way of teaching is trying to raise several questions throughout the lecture and hope students will be really actively, interactively answering those questions. And they'll ask me questions in the middle of the lecture. That's what I see as engagement for a lecture course.

Both interviewees 20 and 18 taught larger lecture courses in health sciences and promoted questions by questioning the students informally during lectures.

Interviewee 16, a writing instructor with smaller courses used a more structured approach to promote engagement through questioning:

> I have them do this in every class [...] once a week. They write down on an index card or a piece of paper three concepts or ideas that they learned that week or that day in class, and then a question that they have. So that's also just kind of a way for me to gauge like, okay, what are they noticing in class? What do they have questions about?

This practice gave interviewee 16 a measure of student confusion and understanding. They reported using this to adjust their instruction. In this way understanding engagement as

questioning can be informative for instruction as well as promoting engagement. As interviewee 16 elaborated on their question-generating activity: “when students see you actually taking their questions seriously and responding to them and the next class period, they get excited about asking more questions. So, I really feel like for me, that's been like, huge with like engagement in the classroom.”

What interviewee 16 noted about engagement and its connection to students’ interest came up in other interviews. For instance, interviewee 02 thought when their course was more interesting, they got more questions:

> But then there's like questions that come up. So, I feel like pieces of a course that are more engaging to students, we get more questions. And it's not just simple memorization questions or something, or do we need to know this for the exam type of question or anything like that. It's more so questions that They're coming up with that are related to different areas of their life.

Interviewee 02 emphasized questions that connect to students' interest, not simple clarifications. In the above instance interviewee 02 is describing their in-person classes. They also described their online learning in a similar way:

> I think that for online students engagement comes with that they're putting greater effort into answering our ungraded questions that come up in the videos, and that they're reaching out to our instructional team if they're confused or have a follow up question about something in the content, so it's a lot more on them to show me, okay, like the students really engaged in talking about like nutrition and athletic performance or something because they wanted to discuss more about this topic.

For interviewee 02, in both their in-person and online classes, questioning indicates the depth of student interest. Interviewee 02 positions student questioning and interest as a response to course content—whether the student has an interest or not. Interviewee 13 also positioned engagement in

this way, saying, "[students] come in with a common interest and passion for what we're talking about. So, I think maybe they're more, you know, likely to ask questions or be engaged or have comments on the subject matter." In these excerpts because of interest has more to do with individual student characteristics rather than what the instructor does.

Questioning was also described as something students did because of challenging content or struggling to succeed in the course. As interviewee 10 described engagement as when their students were "reaching that point where they struggle with an assignment because the assignment challenges them, and they know what kinds of questions [...] I think that that's probably how I'm working with the concept of student engagement." Interviewee 18 echoed this understanding of engagement, describing their engaged students as that that "will drop by during the office hours with some other questions that they don't understand during the class—that's some engagement I would expect the student to do during lecture course." This perspective on engagement shows an instance where engagement and course success do not need to be linked. Interviewee 12 noted this, describing an engaged student as:

> A person who's a little bit behind and really self-conscious and really uncertain. [... A student who says:] "I watched the video, I read the prompt, and I'm still not totally sure." That is an engaged student in my mind. They're involving me in their process of inquiry and seeking to resolve any issues that they might have.

Unlike themes like participating or paying attention, which were always described in a context associated with course success, asking questions could be a response to struggling in a course.

Making connections. The topic of making connections appeared in 11 of the 21 participants' definitions of student engagement. Making connections involves students applying course content to other aspects of their lives, beyond the course: "engagement in terms of linking course concepts with their everyday life sort of thing" (interviewee 03). Instructors described the impact of the course inspirationally; ideally the course would have a long-term impact on the

students. Interviewee 14, a humanities professor teaching about race, history, and critical theory described their goal this way: “I hope [students] can apply the larger lesson, the larger takeaways, from what I'm teaching them and apply them in other contexts both in the past and the present. My hope is that it will shape their behavior in the future.”

Making connections was sometimes described as a form of deeper engagement. From this perspective paying attention was described as a shallower form of engagement while making connections was deeper. Interviewees 03 and 11 in particular made this comparison. Interviewee 11 defined engagement with a spectrum: “I think there's a superficial definition or meaning and a deeper one.” For them, paying attention and completing assignments were superficial, measurable aspects of engagement. At the deeper end of engagement was making connections:

> I think engagement in a deeper sense [...] would be students really understanding how they apply these concepts to other areas outside of the course. Whether it's in their own lives or another material or within the discipline or outside.

This deeper form of engagement was positioned as the goal of learning.

How students would make connections differed slightly among the interviewees. Some of the instructors emphasized students applying course content to themselves. An example of this perspective was interviewee 02, who said:

> They're coming up with [connections] that are related to different areas of their life. So, then that tells me, okay, like they're engaged in this material, and they want to know how to apply it for themselves or they have a thought. And that's sort of what signals to me that a student is engaged in a face-to-face setting.

But other professors emphasized how students making connections would impact students’ actions in the broader world. This perspective emphasized students' civic roles and actions in society. For instance, interviewee 04 said, “I expect that all the class material is about our engagement with the rest of the world and engagement on a daily basis” Similarly, interviewee 12 described the need for

the course to be “relevant to them and their experiences sort of in the world.” The professors emphasizing connections to the wider world happened to be humanities or writing instructors. their courses, perhaps, lend themselves to seeing engagement as applying learning in the wider world. In contrast, the instructors emphasizing students making personal more internal connections were teaching natural and social science.

This difference in societal and personal connection between humanities and science courses may be because the humanities courses in this sample deal with large concepts and topics like racism, culture, and social justice. In contrast, the science courses emphasize more technical topics in research methods or lab work. Interviewees 20 and 06 illustrated this difference in focus, describing how students might make a personal connection as a form of engagement. Speaking about health science courses, interviewee 20 said:

> Personally, I think for them, they may feel more engaged in that "Oh, That's right. My uncle has cardiovascular disease. I want to pay attention," you know, or, yeah, "Oh, that's right. My dad has hypertension," you know, or something. And then they, in terms of the relevance to them, then as I'm lecturing, is more personal.

Describing a social science course, interviewee 06 said, “I hope that they can think, well, this really affects me beyond this classroom. Beyond the subject matter.” In interviewee 06’s course, students were learning research techniques. Interviewee 06 described making connections to personal life as a way for their students to make research skills relevant, even if the students did not become scientists: “So I try to really relate [research methods] to their everyday life, knowing that not all of our students are going to be researchers. And knowing that not all of our students are interested in graduate school.”

Some instructors described making connections more in terms of cognitive activity, like interviewee 07 who said:

> [Students] should decide how this new piece of information fits to [their] existing known system. So, when we are just teaching something, and especially by using active learning methods, we want them to think about it. [...] But the real goal should be engaging their minds and encouraging them to learn the material better and better.

But for most of the interviewees, making connections was specific to their course content. The instructors described how they hoped students would make connections in relation to their course's topics. To illustrate this, I want to share extended examples from two of the interviews.

Interviewee 06 taught a social science course where students learned research methods. As I discussed about this interviewee previously, this professor did not expect all their students to go into research. So, for them, the challenge was finding ways research skills would be useful in many contexts. Interviewee 06 said:

> [Students] say things like, you know, I'm not going to be a researcher, I'm not going to go to grad school. So, I don't need to know these things. And then I'll ask, "Well, what are you planning to do?" And a lot of them will say, "Oh, I want I want to be a writer, I want to be a journalist. I wanted to go to marketing, I want to be in business." And then I'll say: "Great. So what happens when you're a top level business executive and you get presented with a study that says that your business needs to go in this direction? Because the study claims that if you don't do so is that the demise of your organization?" And then they'll go, "well, then I go in that direction." Well, what if you find that the sample size was actually a very small sample, and you've made a decision based on information from five people and they go, "what's the sample size, right?" So then, we start to, I hope to engage with them that research affects all of them.

Adding to this career focused example, interviewee 06 also gave an example focused on personal application:

> Another example I use is that you're sitting at a coffee shop, and you've just heard, and on the nightly news that the recent research shows that coffee is good for you. So, you're like, "great, I'm going to increase my coffee intake." And then two weeks later [and read] "coffee is bad for you." How do you know which study to go by? Well, if you can't assess the research, you can understand the research. You're allowing a media entity to decide for you what you do, and you do what you do and don't know. So, it impacts you. So, I try to really relate [research] to their every day, knowing that not all of our students are going to be researchers knowing that not all of our students are interested in graduate school.

Instructor 06 described their understanding of engagement in terms of their instructional design which included many attempts to personalize the content for students. In this instance, the instructor was taking on a lot of effort to help students make connections.

Developing interest. The topic of developing interests appeared in 9 of the 21 participants' definitions of student engagement. Developing an interest describes students wanting to learn or do something with course content, often above and beyond the basic requirements of the course. As interviewee 12 put it: "student engagement to me means that my student not only understands the tasks that I'm asking them to engage in, but also that they are interested in, included in, and motivated by the tasks I'm asking them to do." In interviewee 18's words, "show more interest in different lab techniques—that's the kind of engagement I'm expecting." Developing interest is similar to making connections, in that it was positioned as a deeper form of engagement. But I separated these two ideas because making connections focused on what students did beyond the course whereas developing an interest focused more on learning and actions during the course. Interviewee 03 gives an example of this distinction, while talking about student interest and how it relates to students personally, they emphasized interest within the course: "Like interest in the moment in class, interest in the concepts that you're teaching, you know, like seeing that it's

relevant to their career, their interest or their major or whatever. But just like being interested in what you're doing in the class."

Developing interest was also linked to the concepts of participating and paying attention. Interviewee 08 described interest in the context of participation: "When I think of student engagement, the first thing I think about is that the students are interested and they're participating because they're interested, not just because they have to for a grade." Motivation seems to link interest to these concepts; students are more motivated to participate or pay attention because they are interested. In this context, engagement comes because students have an interest. As Interviewee 03 put it: "I guess on the surface, most of the time when I'm using the word engagement, I'm talking about student interest, like whether they're paying attention, whether they're interested in whatever the course is talking about, whether they're awake." The motivational aspect of developing interest was also described as promoting better or harder work. As interviewee 06 described engagement:

> I'll have students that come in here, and they'll say, "Oh, I'm in such and such major. And I really need [...] this course. But I just have no interest in it. But I know that I need to fulfill it in order to move forward." And they find that challenging because there just isn't an interest. So, although they know it's necessary, they're simply not interested. So, I still find that in order for a student to be engaged you need an interest in the material.

The professors linking interest and engagement put interest before engagement, motivationally but still define engagement as composed, in part, of students developing interest.

Developing interest is not directly observable. But professors tended to be confident they would observe this aspect of student engagement. Interviewee 02 described observing engaged students through body language in class: "So when you're teaching in a face-to-face setting, you can look at and read the body language of the students more so to see, okay, do we have active listening going on?" Lack of engagement they noticed in terms of interest: "Do they seem interested in the

material? Or are they disengaged? Doing other things, like turning off or talking to their peers, would signal to me that that's disengagement." Interviewee 09 described engagement as being observable based on "how their faces look, if they look engaged, they seem to enjoy the classes." But also reflected that how students look may not genuinely reflect their interest, adding, "They could be sitting there smiling, but maybe they're fantastically bored over their minds. I, I don't know." Given this, instructors may gauge interest by students' presentation in class and interpret this as a metric of engagement. But, as interviewee 09 pointed out, there is a chance this observation is incorrect.

In contrast with making connections, where multiple professors described how they tried to help students build applications. Interest was not always described as something instructors actively tried to cultivate. Interviewee 09, for example, did describe trying to help students get interested in their arts course by telling jokes and making the material fun. But, for contrast, interviewee 13 described interest as something students would come into their science course with: "So [students] come in with a common interest and passion for what we're talking about. So, I think maybe they're more, you know, likely to ask questions or be engaged or have comments on the subject matter." If interest is something more fixed versus something developed, this makes the relationships between interest and motivation and ultimately course success less malleable.

Interacting with peers. The topic of interacting with peers appeared in 7 of the 21 participants' definitions of student engagement. Students interacting was an essential form of engagement for several professors; interviewee 04 said, "I think of it very much in personal interactions in class" and interviewee 13 said, "student engagement, to me, is having students interact in class." Interviewee 01 even described students "engaging with each other" as their "number one" goal. For interviewees 04 and 14 student interactions were essential parts of small courses as they taught a critical theory humanities and specialized animal science courses respectively. But student interactions were also important for interviewee 01, who taught a large

lecture course in the natural sciences. Overall, prioritizing student interaction spanned multiple disciplines and course sizes.

With one exception, most interviewees described interacting with peers as having discussions. The one exception was interviewee 01, who described their students completing work in small groups:

> So, I try to do in every classroom in every day, try to do individual small group and big group work and then whole group work. Because I don't know that's how I feel like, when students engage with each other and then I'm just there as that, you know, scaffold for really complex things. Then I think that's the best learning that happens.

Interviewee 08 also described interacting with peers as doing work, but the objective of doing that work was having discussions:

> I give them an assignment; I may give them five questions. And instead of working together and talking about each one and finding the answers together for each one, I find that they'll go "Okay, you do number one, you do number two, you..." and I'm like, "No, no, no, no, no." So, I have to walk around. I have to make sure that they're not doing that. Because then what I see is silence, instead of talking. So, then they may be engaged, but they're not engaged with each other. They're just engaged in the question.

Interviewee 08 illustrates the idea most interviewees shared, that learning through discussion is the goal of interacting with peers. The value placed on having these discussions was supported by the belief that learning through peer interaction was more effective than learning from instructors. As interviewee 07 put it:

> Like we just asked them to talk to their peers, that seems to be very effective, because at that point, and they just start asking questions, question, explanations and criticize them more easily. When it comes from the professor's usually, they don't do that. And they just

> try to accept everything without filtering them. And that is not just very effective, because then they realized that actually they don't make sense.

This surprised me because interviewee 07 teaches a large lecture course in the natural sciences and a large part of their course was lecture driven. So, engagement through discussion was seen as important in large and small courses alike.

As described above, some instructors designed activities to structure discussion or elicit questions. But even when discussions strayed from course topics, they were still described as a valuable form of engagement. Interviewee 04 described course where students had conversations on topics beyond the course as a form of engagement:

> I had a really nice class last quarter, where the interaction was mainly about people coming, they would ask a question and that would bounce other people to ask other questions. And the questions weren't, they start off having to do with the class, but they have a lot to do with things that people interact with now or thinking more broadly. Well, if that's true, then what about these other things? How do we think about things? So, we were looking at music, and people of African descent. And they were talking about questions of ideas of authenticity, and ownership. And both of those things have these really long, complicated conversations about power. And so, students were saying, "Well, okay, so if this, if we're critiquing this part of it, then where else does this go?" And it was an incredibly interesting class because it was not just a few people talking. It was a lot of people talking and they weren't always the same people. The conversation was often derailed from this specific first question, but always in interesting ways. And I felt that the level and depth of the conversation was really interesting.

However, not all interviewees shared this preference for following student discussion. In fact, interviewee 02 described student engagement as paying attention and not having off-topic

discussions, saying, “whereas for engagement, it sort of looks like [when] the students are more not really having side conversations [during] lectures—kind of silent in that sense.”

Whether or not students can interact with peers depends on how their instructor structures the course. Peer instructions, unlike paying attention or developing an interest, are something instructors can control. Of course, the quality of peer interactions depends on the students' input as well. But adding opportunities for peer interaction is one way instructors described being able to promote engagement. As interviewee 15 put it, “it could be having an open discussion about a broader concept that they would maybe come out of what they're learning, it could be a discussion of a paper that they've read together, you know, because sometimes you need some kind of nucleus to build an engagement around.”

4.1.4 Findings Summary for RQ 1 — Part 1

My first research question explored how the instructors understood the concepts of student engagement and risk status. There was a major difference between how many instructors used the terms engagement and at risk. Overall, most instructors used the term engagement (13) but, in contrast, only two instructors used the term at risk (see Table 4.2). This difference was statistically identifiable looking at the cross tabulation between these terms, on which I conducted a chi-square test (χ^2 = 11.43, DF = 1, p < .001). The following section summarizes how these instructors defined engagement.

Table 4.2 — Interviewees using and not using the terms engagement and at-risk

	Interviewees Using Term	**Interviewees Not Using Term**
engagement	13	5
at-risk	2	16

Engagement was a popular term, with 13 of the participants using the term. The instructors that did not use the term regularly as it related to their teaching described how engagement could be interpreted in multiple ways. When instructors did not use the term engagement, they tended to

emphasize another related concept, like paying attention or participating. These instructors were often aware that engagement is a multidimensional concept and that engagement can take multiple forms. However, the instructors that used the term also described engagement as a multidimensional concept and described looking for engagement in various ways.

Across interviewees, I identified eight ways the instructors talked about students demonstrated engagement, including making connections (11 participants described this), completing work (10), questioning (9), developing interest (9), paying attention (8), thinking about course content (7), participating (7), and interacting with peers (7). These forms of student engagement activities divide into two core concepts illustrated below with their corresponding student actions, illustrated in Figure 4.1.. Deeper thinking, which 17 of the 21 professors discussed, includes students making connections, thinking about course content, developing interest, and questioning. deeper thinking. Stereotypical course participation, which 18 of the 21 professors discussed, includes students completing work, paying attention, participating (particularly in class), and interacting with peers.

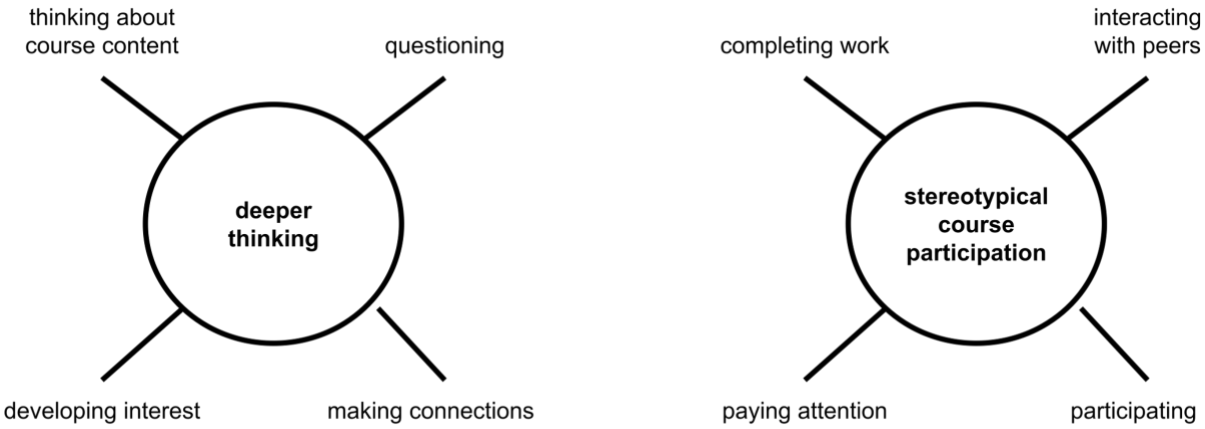


Figure 4.1 — Underlying Concepts Relating the Engagement Themes

Most of the instructors in my study discussed both deeper thinking and stereotypical course participation in their definitions of student engagement. Only three of the professors discussed only forms of deeper thinking and only four of the professors discussed only forms of course

participation in their definitions. Table 4.3 shows how most of the instructors discussed both, for each instructor I show if they discussed that concept with a colored box (a zero indicates they did not discuss that concept); the opaquer the corresponding box, the more forms of that concept that instructor discussed. So overall, professors in this study described student engagement as a concept that involved multiple forms of deeper thinking about course content as well as observable forms of course participation.

Table 4.3 — Prevalence of the Underlying Engagement Concepts Across Participants

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
deeper thinking	0				0										0		0				
typical course participation						0								0					0		

4.2 Understandings of Student Risk Status

As I surveyed in the literature review, there are many ways that risk status is defined in the literature. Because of this, I attempted to capture all of the participants' definitions of being at risk. This coding approach resulted in 39 descriptive codes—a rather unwieldy number of codes. To structure the findings I adopt two approaches. First, based on critiques in the literature of the concept of being at risk, I sorted the descriptive codes into things that students can control and cannot control. My objective is to consider whether the instructors' ideas of students being at risk include things students can change and improve (i.e., generative, formative) or are static (i.e., deficit, summative). Second, I mirrored the engagement concepts of behavior, emotion, and cognition to consider how being at risk relates to facets of engagement. Before presenting how the participants conceptualized engagement from these two perspectives I first describe the instructors general familiarity and preference (or, more aptly, aversion) for the term at risk.

4.2.1 Concept Familiarity

I asked 18 of the 21 participants about whether they used the term at risk (excluding participants 05, 11, and 17). The majority of participants, 16 of 18, did not use the term or did not

find it useful in thinking about their teaching. As interviewee 05 put it, “I don't tend to think of things in terms of students in terms of being at risk or not [...] that's not a concept I use a lot.” Most participants that didn’t use the term at risk gave one of three reasons, including being unfamiliar with the term, focusing on more specific and individual concerns, and avoiding the term because it would stigmatize students. The avoidance of the term at risk was in contrast with how the participants reported using engagement; while 13 of 18 used the term engagement, only two participants used the term at risk. Interviewee 01 favored the term at risk because their research dealt with people at-risk globally:

> That's what my research is on: the most at-risk humans in the world. And so yeah, I think it's a nice way to make yourself cognizant that there are these humans out there who are at risk of something, right? Whether that's not eating their next meal or getting abused or failing out of school. I think that's a fine term.

While interviewee 20 noted that they “definitely” use the term to describe students that might need more support to pass their class.

Four of the participants reported not using the term at risk because it was unfamiliar or irrelevant. For example, interviewee 02 said, “I haven't heard much about like, risk status or anything before” and interviewee 07 said, “I don't use the term at risk a lot. I don't know why I never thought about that.” If the term is unknown, it would not be used. But it may also be consciously ignored. Interviewee 18 was familiar with the term but said they did not think about it, noting, “I didn't really actively thinking about very, like a social economic status. Because, yeah, it's just, I don't think I have access to that information. And never thought about that.” Interviewee 14 also avoided the term intentionally. They felt like the concept of being at risk was more important for advising, which they did not do: “[at risk] sounds like more of an advising term. [...] I think that's more relevant to people who work in advising because when [students] are at risk of being on

probation, that's who calls them into the office. [...] It's not something that I have conversations about regularly."

Six of the interviewees did not use the term at risk, but they described thinking about the concepts involved in being at risk based in more individual and specific ways. Interviewee 15 expressed their concern for students who were not doing well in this way, saying, "At risk. I may not use that term, but I'm definitely concerned about who seems to be doing well and who's not doing well and trying to understand when people don't do well." Similarly, interviewee 21, wanted to know what students were at risk for rather than labeling them: "I don't really use at risk. Because I'm like, at risk for what, you know, what's the risk?" Like all of the professors I talked to, the professors in this cluster all cared about their students, however they focused on more specific or individual needs. For example, interviewee 12 described how the term at risk did not help them meet individual needs in their class:

> I feel like at risk doesn't capture something. [...] I think that it tends to fail students who aren't officially by some definition at risk. [...] I tend to not really not really use that language but just sort of treat everybody in my classes, I try to treat everybody in my classes by their individual writing needs.

To find a more satisfactory term, some of the instructors were in the process of replacing the term engagement, like interviewee 10, who noted, "I am in the process of evolving in terms of that language that I use 'at risk' Because I do think it sort of is monolithic, right, in ways that are not useful."

Finally, four of the interviewees rejected the term at risk because it might stigmatize students. Interviewee 19 put this succinctly, noting "I think at risk is, can get a little bit deficit-y." It is worth noting that interviewee 19 taught education courses and teacher training. Their perspective aligns with discourse in education research that critiques the deficit language around labeling students as at risk. The other professors with a negative view of the term at risk were in

other fields, but expressed a similar sentiment. For instance, interviewee 08, a writing instructor noted: " I understand the reason for the term. But I think, yeah, it does feel kind of negative. I mean, it is sort of negative in terms of what could happen. And I don't know what else we'd call it. But it feels negative." In this viewpoint two of the interviewees discussed how labeling itself can be bad for students. Interviewee 06 observed, "I could see that it would be problematic if the student knows that they're labeled at risk. Yes, I would agree with that. Because a lot of these students who are at risk are already suffering from labeling." Interviewee 03 had a similar concern and added a focus on how students would perceive being labeled as at risk:

> For at risk, I guess some of that stuff I worry about, like how that's communicated to students. Like if I call you anand at-risk student, does that predispose you to thinking you're going to fail, you know, some of that sort of stereotype threat kind of issues. And I worry a lot about that. And I don't want students to ever walk into the room like assuming that they're going to fail or assuming that I think they're gonna fail. You know, like, I just dislike the whole psychological baggage around some of that stuff.

In this perspective, the concern is that giving students a negative label may prevent them from succeeding in school rather than helping them by targeting them for support.

4.2.2 Definitions of risk status

Though most of the participants reported not using the term at risk, most participants also formulated their definitions of what being at risk meant to them during the interviews. Like engagement, these definitions were multifaceted. Overall, the participants closely associated being at risk and negative academic outcomes, like failing a course. I briefly survey examples of this here before analyzing the definitions of risk status in the next session.

Interviewees 04 and 12 summarized the connection between being at risk and academic success, saying: "there are many ways of thinking about [being at risk]; the most common, perhaps, is risk of some sort of academic failure and especially being kicked out of the university" and "I

think a lot of maybe people think of as at risk students is students who are at risk of not graduating or not completing the class successfully," respectively. Similarly, interviewee 05 listed not graduating as a top concern, saying "I guess in my mind address for what I guess at risk for not completing right or not graduating would be kind of high up there in things that I would worry about." Six of the participants echoed this perspective, framing students as at risk when they were at risk for not completing their course of study. The risk of failing and dropping out was usually attributed to some outside forces. For instance, interviewee 01 linked dropping out to income insecurity:

> I just worry about students who are poor and you know, like I hate seeing students I teach standing in line in a pantry, right? It just breaks my heart. Even though the line is so long, and I don't teach all of those students, I think they're more at risk of just dropping out of school for reasons beyond their control, not because they can't do it academically.

Another form of forces beyond students' control are political issues. Interviewee 14 described students concerned about deportation and family immigration status resulting in leaving the institution:

> But over the years, I've seen more and more of— and then every time Donald Trump does something, it trickles down to my classroom. Because the students are, you know, like the student with the deportation thing today. That's a very real issue. And if the person is panicked that their parents are going to be deployed, well, then, you know, it might make it hard for them to focus on their paper, right? So, yeah, and the thing is, they end up on academic probation or subject to dismissal or whatever, you know.

As these two examples illustrate, the faculty attributed failure to complete a degree to influences beyond the students control.

Failing to complete was not discussed only as dismissal from the university. Several instructors described failing at the class level. For instance, interviewee 14 said, "So, the other risk

might be you see students are just failing your class." Alternatively, interviewee 13 described students that were at risk, not in their class, but in other classes: "Again, most of those kids, they end up, what's funny is they end up doing really well in my class, but they'll be failing another class. I've had that happen with two or three students." These instances where instructors define students being at risk in terms of academic performance is in line with standard definitions. In the sections below my analysis focuses on how risk is conceptualized in addition to this perspective. What facets of being at risk do the instructors emphasize? And, how changeable or beyond students' control are these facets?

4.2.3 Changeable and fixed aspects of being at risk

Coding the participants' definitions of academic risk status yielded descriptive codes like getting behind, not attending, family crisis, or first generation status. I wanted to evaluate how malleable or fixed these aspects of being at risk were. This distinction is motivated by scholars that have been critical of the term "at risk" arguing that it pre-designates students that are expected to fail and is often defined in terms of unchangeable attributes. I sorted the descriptive codes into two categories. The first category includes aspects of being at risk that are, in theory, changeable by the students. The second category includes fixed aspects of being at risk. I divided this category into two parts. The first part includes fixed aspects of being at risk that describe the individual (e.g., low income status). The second part includes the fixed aspects of being at risk that describe institutional factors (e.g., academic term lengths). I want to acknowledge that I have included institutional factors in the fixed category because, while institutional factors are indeed changeable, such aspects are not typically directly malleable by the students. Since being at risk is usually used to describe individual students and their progress, I think it makes the most sense to exclude institutional factors from facets of being at risk that the student may be able to control.

Changeable risk factors. As Table 4.4 shows, 11 participants described both changeable and fixed risk factors; 11 of the 21 participants discussed changeable risk factors and 18 of the 21

participants discussed risk factors. Overall, both the number of participants' definitions and number of coded segments emphasized fixed risk factors over things students could control. Further, none of the participants discussed only changeable factors but seven did talk exclusively about fixed facets of student risk status.

Table 4.4 — Types of Risk Factors in Participants Definitions

	interviewee																					total segments	number of interviewees
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
changeable																							
individual		■	■	■	■	■		■	■						■	■			■	■		36	11
fixed																							
individual	■	■	■	■	■	■	■	■	■	■		■		■	■	■			■			48	15
institutional			■		■	■				■	■			■			■			■		12	8

The descriptive codes I sorted into the changeable category included body language, doing coursework poorly, not doing coursework, getting behind, not attending, not seeking help, not engaging, and over engaging. Table 4.5 shows examples of each of these codes from a variety of interviewees. These descriptive codes are more individual than the engagement codes. As such, some of these risk codes were applied to relatively few participants. I took this approach because I wanted to capture the wide variety of risk factors discussed by the participants. Take for instance the codes doing coursework poorly and not doing coursework. I could have combined these two codes. However, I chose to leave the descriptive codes uncompiled since I am trying to present the varied understandings of risk among my participants. To this end. I will first describe each of the codes individually then I discuss themes across this set of codes I have categorized as changeable.

Table 4.5 — Risk Factors that Students May Change

code	segments	example segments	interviewee
body language[3]	1	So when you're teaching in a face to face setting, you can look at and read the body language of the students more so to see, okay, do we have active listening going on?	interviewee 02
doing coursework poorly	4	It means the student who is consistently underperforming in terms of the overall class.	interviewee 19
not doing coursework	5	That's something I would see is at risk [...] if their work isn't coming in at all.	interviewee 16
getting behind	3	But you could tell that he wasn't doing okay, because he was getting behind on assignments.	interviewee 08
not attending	5	You're not turning up to class.	interviewee 04
not seeking help	10	They're not the kind of student who's going to raise their hand and go, "I'm having an issue." And those are the students I worry about the most.	interviewee 06
not engaging[3]	5	That means a student is not—that student is not engaging.	interviewee 19
over engaging[3]	1	So yeah, so for me that risks are usually the ones that are, if they are engaged, they're a little over engaged.	interviewee 08

Coursework was discussed by seven of the participants in terms of being done poorly or not at all. As student risk status is often described in terms of failing or underperforming academically, it makes sense that doing work poorly or not at all would jeopardize a students' academic standing. In coursework I include exams, assignments, and doing course readings. Illustrating this, interviewee 06 said, "So I can look at an at risk student go, they haven't, especially online, I can look and go, 'you haven't taken any exams'" and interview 08 said "[at risk students] haven't done the reading so they can't really participate. [...] You can see that they're not chatting, you know, with the

[3] I do not describe these codes in this section. *Body language* is fully described in this table. Both *not engaging* and *over engaging* are discussed in the section about the connection between engagement and risk status.

rest of the group. [...] Oftentimes they become isolated in that group." Not doing work was particularly salient in the online setting, because instructors often know their students from the student work. As interviewee 19 put it, the "same basic thing applies in an online setting; an at-risk student [is one] who's not logging in, who's not submitting assignments, or who's not completing the tasks that lead to engagement, or whose consistently underperforming." (Notably, this excerpt also illustrates how facets of being at risk are usually discussed in combinations.) Not doing coursework was also mentioned in terms of a downward trajectory over the term; interviewee 16 described this as being "super invested in the course early on, and then things start slipping."

Doing coursework poorly was typically attributed to outside forces rather than student effort or ability. For example, interviewees 15 and 04 both described students performing poorly on coursework because of family crisis. Interviewee 15 described this as commingling personal life and academic performance:

> So this is maybe similar to just generally academically not performing as well in the class, which isn't a kind of risk to me, but I was separating the personal— But you see they commingle don't they? Yeah. But you know, someone who's just really dealing with something horrible at home and maybe having to be away a lot and stuff versus not performing well.

In this instance, interviewee 15 points out that students are not at risk because they are performing poorly, but rather they are performing poorly academically because of issues in their personal life and because of this their academic performance is slipping. In a similar vein, interviewee 04 described an instance where they reached out to a student after their assignments became "terrible":

> I called the student like, "I don't understand that you've done well and all the stuff I know you can do all this stuff, so what's up here?" And they had just had a massive family problem that had just hit that was derailing them. And so in that case, the student and I were able to

> solve that and say, "Look, okay, so how can you think about these things you need to finish the quarter, you need to do this and that."

These instances illustrate, that while instructors might describe doing coursework poorly as a symptom of being at risk, like interviewee 19 who said that being at risk describes "the student who is consistently underperforming in terms of the overall class," most of the professors also explained why students were doing coursework poorly in terms of outside forces.

Related to assignment completion and quality is when assignments are completed. Interviewee 08 in particular highlighted this aspect of being at risk. They described a particular student they considered at risk, noting this became evident as the student got behind on assignments: "you could tell that he wasn't doing okay, because he was getting behind on assignments." When describing students that were at risk, interviewee 08 said:

> So, for me, it's somebody who gets very behind on the assignments, who when they're in the classroom, they seem frustrated, as opposed to being engaged. [...] There are those who continue through the class but they get further and further behind so that by the time the end of the quarter comes they're extremely stressed out trying to finish it. And they're trying to get all kinds of extensions or trying to make up work or asking if there's anything else they can do to, you know, increase their grade, and it's like, not by now.

For interviewee 08, the compounding nature of getting behind on work was relevant to student risk status because over the term the problem would get larger and larger.

In addition to coursework, another common feature of these changeable aspects is that they were described by the participants as "not" doing something: not doing coursework, not attending class, not seeking help, and not engaging. To analyse this positioning of risk as students failing to do something I looked across all the descriptive codes in the participants' definitions of student risk status. Three other aspects were described as "not": being not academically prepared, not being aware, and not belonging. I categorized these three aspects as fixed and things students do not

control. In contrast, the other four facets described as not doing something were all things that students could control. To me this suggests that often, being at risk, when it is described as something students lack, is referencing student behavior that professors believe, if the students did, would lead to academic success.

In addition to the coursework related activities students may not do, the professors in this study also discussed students not attending and not seeking help as aspects of being at risk. Interviewee 04 put it simply as, students being at risk if they were "not turning up to class." The five faculty who discussed not attending were all describing student behavior in the in person context. Though, interviewee 19 added that not attending was also an issue in their online courses: "the same basic thing applies in an online setting [where] an at-risk student [is one] who's not logging in." In part, not attending could lead to poor academic performance because of the course design, as interviewee 09 noted,"I look for red flags. And if I see that there's some problem or if I see that there's an attendance issue, I do have pretty strict attendance policies." Taken together, attendance was positioned as a prerequisite for success, so missing class, particularly multiple times as interviewee 16 noted—"if students missed two classes in a row without contacting me, [those] students were at risk"—put students at risk for failing.

Not seeking help was the most frequently discussed topic among the codes in the changeable category; eight participants mentioned students not seeking help when needed as an indicator of being at risk. The professors described several reasons why students may not seek help ranging from individual to cultural dispositions. On the individual side, interviewee 02 described students that were uncomfortable advocating for themselves:

> I tend to think of students at risk for would be students that don't feel comfortable with advocating for themselves. So I don't know what the proper term to call this is, maybe a higher sense of self for those students that feel like they're able to reach out to a professor and tell them what's going on with them. And then there's other students that don't feel

> comfortable with letting the instructor know what's happening, that's preventing their ability to be fully engaged in the class.

Both interviewees 06 and 03 mentioned how student ameliorating discomfort or embarrassment were issues being discussed in their positions. As Interviewee 06 said:

> We're having conversations on campus about those students. They're not the kind of student who's going to raise their hand and go, I'm having an issue. And those are the students I worry about the most because they're the least entitled type of students, so to come to you and say, "I need you to do X" and so they're almost invisible.

Similarly, interviewee 03 highlighted embarrassment more specifically, noting "I know that a lot of the students that are at risk that are struggling, are too embarrassed or too shy, or think it's inappropriate to come to me and talk about it. [...] I've debated a lot on how to address that." Embarrassment and discomfort were primary student emotions highlighted as barriers to seeking help. But Interviewee 16 also indicated that fear may prevent students seeking help they needed: "Because I feel like they're also really scared of us. You know, getting in trouble because they're not turning in work and feel like, 'Oh my gosh, I'm gonna get in trouble.' So that makes them like, isolate more." Overall such student embarrassment and discomfort were primarily connected to sensitive topics. Like interviewee 08 described one of their students not reaching out for help because, in their words "it was just such a sensitive thing and [the student] didn't want people to know he wasn't okay."

In addition to students' individual dispositions, one of the instructors highlighted cultural differences between students relating to whether students sought help or not:

> I think the frustrating part is, especially my Asian students, because culturally, they don't reach out, they don't look for help. They're not going to seek out help. They're not going to share things with someone that's not part of the family. The family deals with that. And so they are. I think their needs are unmet. And that's a cultural thing.

In the excerpt above, interviewee 20 underscores a reticence they believe is shared culturally amont their asian students. So reticence could be due to the topic of the issue, individual dispositions, or cultural expectations. But such hesitancy was also described as being due to awareness of options.

Interviewee 16 described their own experience with help seeking in college and illustrated how students may not seek help if they do not believe it is available for their particular issue:

> When I was in college I had an eating disorder and was getting outpatient treatment for it, but I needed support from my professors so that I can have time to go to the counseling I was going to and stuff like that. And I was like, super uncomfortable, like, I didn't really name it for anyone, but someone at the Counseling Center was helping me manage this and get permission from people to miss class once a week or something like that, so I can make regular appointments. You know, so kind of thinking about that, like as a teacher, I'm like, I was at risk.

If students do not know that support for mental health and eating disorders are available, they may not bring such sensitive issues to the attention of their instructors or other university support staff. Given this dilemma several instructors noted that they struggle with how to address such personal issues. Balancing student autonomy and privacy with providing support. As interviewee 03 put it, regarding students failing, “I've debated a lot how to address [students failing]. I know some faculty that [...] individually email every student who fails. I don't do that. Because there's too many of them, honestly. And I don't feel like I can actually invest fairly in what they need.” But, despite wrestling with how to support struggling students, overall the professors wanted to provide support. Like interviewee 04 how shared an instance where a student did seek help and was able to get an accommodation while pregnant:

> I remember a student came to me. She had a baby during the midterm. And then she said, "Okay, I'm going to miss the midterm." [...] But what I thought was interesting is that she

> hadn't told any of the other faculty. And I said, you know, because [those professors] were men, I said, "You know, I think it's a legitimate excuse to, to miss your exams because you're having a baby. So why don't you tell them and ask them if you can take an incomplete." You know, those are things that are provided for by the university in case of illness or whatever, and I'm presuming a pregnancy. But students don't know about it.

This example returns to the theme of students seeking help when they feel comfortable and know what options exist. In the case of the pregnant student, they felt comfortable talking to a female instructor and knew that some accommodations existed.

Lastly, on the topic of not seeking help. Several instructors noted that student engagement like coming to office hours was waning over time. In particular, interviewee 04 described how while they ask students to make contact, saying “I always ask them to come to office hours” they added “nowadays [students] don't” despite the instructor reaching out to students they sawas at risk to invite contact: “I send people email saying: ‘you have missed whatever first assignment, can you come talk to me?’ Nowadays people just don't.”

One theme that emerges across these changeable aspects of risk status is that all of them are behavioral rather than cognitive or emotional. This implies that instructors see their students' behaviors like studying, doing work, and attending class as things the students can control. But perhaps cognitive things like attention and emotional things like motivation or sense of belonging are not.

Fixed risk factors. As Table 4.6 shows, 18 of the 21 participants discussed students being at risk in terms of things beyond students’ control. I sorted 15 descriptive codes into this category I termed fixed. The fixed codes describe aspects that are beyond students control in the short term, though they can change over time. For instance, if a family crisis occurs a student will experience this as a fixed feature of their present learning experience. The student does not have agency to change the existence of the crisis. However, that crisis is not fixed in a permanent, temporal sense.

The first set of individual codes include family crisis, personal issues, physical safety, physical health, and not being academically prepared. These are all personally specific concerns. An additional six individual codes related to student demographics are being an international, first generation, low income, transfer, minority, or female student. I describe these five separately because they are things that students are (rather than things that happen to students like crises or health) and are commonly used at the institutional level to describe students in student information statistics. I will describe these 11 codes in the next section. After that I present the remaining four codes I placed in the fixed category, these concerned institutional issues rather than specific to a person's individual experiences or demographics.

Table 4.6 — Risk Factors that are Beyond Student Control

code	interviewees (segments)	example segments	interviewee
Person Specific			
personal issues	6 (6)	A student who, because of a personal issue or health issue, didn't do well in a previous quarter or a semester. And now from academic probation, that's at risk.	interviewee 06
family crisis	5 (7)	The assignments were terrible. So I'm like "did something happen to the student?" [...] So I called the student like, "I don't understand that you've done well; I know you can do all this stuff. So what's up here?" And they had had massive family problems that had just hit and that was what was derailing them.	interviewee 04
health & safety	4 (4) 2 (2)	There's so many ways you can be at risk. I mean, because you know, you could be at risk in terms of mental health, physical health, physical safety.	interviewee 16
academic preparation	4 (4)	There is an increase in the number of students who are ill prepared to be here. [...] That's a whole different [kind of] at risk.	Interviewee 06
Demographic Categories			
international	2 (3)	I'm also conscious that my international students in particular, like, it's not, it's not just about the writing, it's also about having to participate in class. Right?	interviewee 05

first generation	3 (8)	Like in office hours [or emails] students [...] being like, "I'm really struggling. I'm a first-gen student. I don't know how any of this works or something."	interviewee 03
low-income	3 (5)	I just worry about students who are poor and you know, like I hate seeing students I teach standing in line up a pantry, right? It just breaks my heart. Even though the line is so long, and I don't teach all of those students but, um, and so I think they're more at risk of just, like dropping out of school for reasons beyond their control, not because they can't do it academically.	interviewee 01
transfer	3 (3)	Like I had one student who was a transfer from Sacramento City College, and she was an upper division class, but I think she wasn't ready for that upper division class.	interviewee 08
minority	3 (5)	But if you are low income, if you are first generation, if you are a minority student, you see something prestigious as something that's trying to keep you out, or that is intimidating, or out of reach for reasons that are unfair or aggravating.	interviewee 10
gender	1 (1)	And when I look at the data, we know this facts, but it was very shocking to see that gap for the female students, not only just those females versus male, first-gen versus non first-gen, low-income versus non low-income, it's, it's there, it's always there, no matter what time of the year you teach summer or fall or winter, we have that just the gap.	interviewee 07

The first set of codes I defined as fixed or unchangeable aspects of being at risk include person specific concerns. While the interviewees did discuss several topics by name, the instructors also referred to personal issues as a more general catch all. For example, interviewee 19 described how personal issues were impacting a graduate students engagement and making that student at risk:

> I have a student currently in one of my graduate classes that I'm worried about. The students reached out and expressed some stuff going outside of class, but despite accommodations for that particular student, they're still not engaged. When they do engage is not engaging to the level I would expect to see. So there's something else going on there so that even [given] the accommodation that I'm making, based on something going on in their life, they're still not reaching that level of engagement that I would expect to see.

The instructors referred to these external personal issues often when they were not clear about what was happening to students. Often, realizing students had some kind of ongoing personal issue prompted the instructors to try and learn more. Such as interviewee 02 who described how they trained their TAs to try and spot personal issues based on how students assignments:

> But we really try to do our best with the TA teams trained to look at different assignments and be like “maybe this student might have something going on in their personal life” things like that are "oh, like we noticed that the student was doing quite well and then something happened."

But, the process of learning about students’ personal issues in order to provide them with support is tricky. Like interviewee 09 noted ambivalently, “do I go into their personal lives and want to learn all about why it might be at risk? If they give me information, I listen.” Interviewee 09 expressed concern about violating a student's privacy or comfort by prying into their personal life. In general, since things in a students personal life happen outside of class they may not seem like the purview of the instructor. As interviewee 16 put it, “when I see these things happening, it almost never has anything to do with the class itself. It has to do with stuff outside of the class.” The topic of personal issues was usually brought up in conjunction with other aspects of students' lives similarly beyond the scope of class, like family crises or personal health. I describe these topics below in descending order of their prevalence across the interviews.

The most commonly mentioned personal issue was family crisis. The interviewees described a variety of ways that a family may be in crises, including family members’ deportation (interviewee 14), accidents (interviewee 04), and deaths (interviewee 08). Both interviewee 04 and 08 noted that such events are rare, but both had seen students dealing with serious family accidents or crimes that lead to losing a loved one. In interviewee 04’s case, the student had “lost two members of their family in a violent incident.” Similarly, interviewee 08 described the experience one of their students supporting other family members after the death of a loved one:

> I had this one student one year. He was extremely stressed out. [...] I think his father had passed away at some point. But two years before he was taking my class, his brother had gone down to Mexico to go visit family, and he'd never gotten there. And they found out later that he had been murdered. And so this was just like two years before. Even just telling you, it almost brings me to tears because he was trying so hard. He was the oldest and he had a sister who was also at UC Davis and he was trying to support her, but his mom was having a really hard time. [...] I think that they lived a couple hours away so he couldn't be there all the time. And when he did go, you know, it was a long trip, you know, for him. And so he said he and his sister were doing okay. But you could tell that he wasn't doing okay, because he was getting behind on assignments.

In both of these instances the professors sought to support the students by involving student support officers, recommending counselors, and modifying assignments. In both cases, they reported that the students "pushed through" but not without struggling. It was the struggle and need for outside support that made these students at risk for these professors.

Supporting families and dealing with family crises were seen as temporary upsets to otherwise successful students. Interviewee 15 distinguished between students that were not performing well and students going through a crisis, defining only the latter as an at risk student:

> Just generally academically not performing as well in the class isn't a kind of risk to me. [...] But you know, someone who's just really dealing with something horrible at home and maybe having to be away a lot and stuff versus not performing well [is at risk]. [...] I mean sometimes at risk means people who are really going through a lot right at that moment, there may be some health crisis or a family issue.

This perspective highlights the often brief but influential impact of family crises on student grades.

Around six interviewees highlighted physical health (4) and safety (2). These two aspects of wellbeing are distinct but closely related. Risk in terms of physical safety was described by interviewee 06 as sexual assault:

> There are the students that, who, there is no record of the risk and who will come see me and I know that they want to talk about perhaps sexual assault, but I know that, you know, I offer though, I offer the whole I'm a mandated reporter, but here's who you can speak with and I hate that because they've come to me because they feel comfortable and here I am going "ahh, whatever you tell me I have to report." So that's very difficult. And so I do notice the decline in how that student engages in the class. And so I know that there's something wrong. And I'll check in and say, "Hey, did you go to counseling, have you, you know," so there's that type of thing.

In this anecdote interviewee 06 highlighted how physical safety may not be visible to instructors, unless the student chooses to disclose the event. Often events like this or health do not become apparent until a student struggles academically, as interviewee 06 added: “a student who, because of a personal issue or health issue, didn't do well in a previous quarter or a semester and is now on academic probation, that's at risk. So there are the students that we can identify on paper.”

Generally the descriptions of personal, fixed risk status that I categorized together here are discrete events. Typically when the instructors were describing student health, they were referencing isolated events. But, illness may also be repeating or chronic. Interviewee 08 considered it difficult to know how to help students when there was repeating health issues:

> I had about five students that were getting sick really regularly. And then just like things happen to them one after the other, you know, and it was really hard to kind of, you know, figure out how to help them because it just seemed like there was always something going on with them. But usually it's only like one or two. And if I'm lucky, none.

Even though the instructors did not describe illness in terms of chronic issues, by defining being at risk in terms of physical and mental well being—"I think it can mean anything from like a person who is at risk in terms of their physical and mental well being" (interviewee 12)—the instructors are mentioning considering fixed and ongoing causes of difficulty for students.

Beyond chronic illness, academic preparation is the only individual and fixed risk type that does not relate to a discrete and traumatic occurrence in students' lives. In some ways, academic preparation is both an individual and an institutional issue. But since the interviewees discussed academic preparation mostly at the individual level I categorized it this way. There is, however, an argument I agree with that recognizes that academically unprepared students were likely failed by institutions in some way. I prefer this perspective because it yields more generative points of change (to the institution) rather than framing students as deficient and in need of remediation. Interviewee 07 acknowledged this perspective, noting that unprepared students had likely been disadvantaged in some way:

> So it tells me that the students coming from these backgrounds somehow didn't have proper education. And they are probably disadvantaged in a way. And so these students are at-risk students, so we have to just probably help them more than other students to get to the level of other students and go beyond. So they don't really probably they didn't, yes, again, didn't get the proper education.

Adding to the perspective that student preparation is a systemic issue is interviewee 06's observation that the number of unprepared students had increased over their career. They said, "there is an increase in the number of students who are ill prepared to be here [...] That's a whole different at risk; no one talks about that."

While I categorized academic preparation as a fixed characteristic—for the reason that once students arrive at university their past academic career is already set—interviewee 04 described ways that they tried to support students that were not academically prepared:

> And I would tell people, you know, your writing is not good enough, you need to go to the Writing Center. You need to do these things to get it better. You need to do these other things [too].

Their approach illustrates another way of looking at academic preparation, which is that students can, in fact, do things to compensate for not being academically prepared. Another perspective counter to the way I categorized academic preparation was offered by interviewee 01 who did not describe not being academically prepared as a form of risk. Interviewee 01 said, "I think they're more at risk of just dropping out of school for reasons beyond their control, not because they can't do it academically." This perspective both frames academic success as something under students' control and also emphasizes external factors like the forms of risk described earlier in this section over academic preparation.

Many of these "fixed" aspects of being at risk were mentioned in conjunction to the changeable aspects of being at risk. The instructors often attributed not doing coursework or not attending to things beyond students control like physical health or family crisis. From this vantage point these things not under student control influence success in school by reducing a students ability to do things that they choose to. So by separating the descriptive codes in this way I did not mean to imply that changeable and fixed aspects of being at risk are completely separate. Rather, across the interviewees multiple types of risk were typically described in conjunction. As interviewee six put it "an at risk student was someone who was having some kind of crisis. And that could be personal, it could be financial, it could be academic. So we're talking anywhere from something that happened in the home."

The second set of codes I sorted into the fixed category include those related to demographic categories, including being an international, first generation, low-income, transfer, minority, or female student. The participants in this study often included multiple of these demographic characteristics in their discussion of what made students at risk. Interviewee 07, for

instance, described at-risk students where "there is a very significant correlation between first gen, low incomes students, underrepresented minority groups and when we look at their grades." Interviewee 07 was indicating that students in such groups may have worse performance compared to peers. This perspective is reinforced by institutional statistics that track these groups specifically and report subgroup performance related to these demographics. Several of the participants described consulting the institutional statistics in their description of being at risk. Interviewee 07, for instance described a gap in performance between students in such subgroups and other students:

> When I look at the data, we know this facts, but it was very shocking to see that gap for the female students, not only just those females versus male, first-gen versus non first-gen, low-income versus non low-income, it's, it's there, it's always there, no matter what time of the year you teach summer or fall or winter, we have that just the gap.

Similarly, interviewee 03 described getting on campus statistics that led them to report that, "I could look up right now [for a specific course they named] and tell you what the percentage of first gen students, percentage of transfer students, percentage of repeaters, that sort of thing."

Usually the instructors' discussed these demographic categories together rather than highlighting a specific group (I discuss when there was a specific focus below). Given that there was an overall focus on some groups of students being more at risk or more likely to not succeed. As interviewee 07 said, "those at risk [are] the students [where] there's a very significant correlation between first gen, low incomes students, underrepresented minority groups, when we look at their grades." I wanted to probe the rationales the professors gave for why this relationship may exist. How do they explain why students in certain subgroups are more at risk? I identified two main explanations: institutional design and prior preparation.

Institutional design encompasses things about the university that may impact some students worse than others. Several professors described how students belonging to these

demographic groups may be intimidated, lack a sense of belonging, or feel anxious and overwhelmed because of something about the university. For Interviewee 10, the reputation of the institution may be particularly intimidating for students in these groups:

> If you are low income, if you are first generation, if you are a minority student, you see something prestigious as something that's trying to keep you out, or that is intimidating, or out of reach for reasons that are unfair or aggravating. [...] In the local context of UC Davis, an R1 institution, what we have is first of all, a rather intimidating What? Reputation, right? It's UC Davis, it's R1. When we think about students who are first generation, who are low income, who are minority students. The idea of prestige can be read by them as something that is intimidating, right?

In this case, interviewee 10 worried that students in these demographic groups would be at risk not because of their ability, but because of how they perceived themselves to fit within the institution. Interviewee 10 also noted that such students may actually be not at risk at a different, less prestigious institution, noting that with "an exacerbated sense of the difference between the prestige of the institution and the worth of the individual, that divide is greater. If you have a student at risk at Sac State [a less elite school], they're like, ''yeah, I'm at Sac State, I belong here.'" The sense of belonging is easier to get at a less prestigious institution. Whether or not prestige negatively impacts students or whether students actually feel worse at more elite institutions, this instructor is highlighting how the reputation and expectations of the university may adversely and disproportionately impact some students.

Two other professors highlighted students feeling anxious or overwhelmed due to institutional structure. Interviewee 03 highlighted how the speed of the quarter made some students feel overwhelmed and that given a longer term these students may not be at risk due to being stressed out:

> I feel like the students that are more at risk in terms of things like, first gen students are a little more overwhelmed by the size of the class. And the sort of speed at which the 10 week quarter happens and the speed at which even, you know, passing period is only 10 minutes, you gotta like, get out and get in, right? Like, all of that just happens really fast.

Alternatively, interviewee 05 noted that students have been becoming more grade conscious over time, leaning to anxiety: "one of the things I noticed right away was this kind of like, spike in the level of just general anxiety and grade consciousness is, is a big deal and very success oriented." Interviewee 05 was contrasting this performance anxiety broadly with other institutions they had worked at, noting that something was different at this particular institution compared to where they had previously worked.

The impact of institutional structure on student performance and well-being appeared to be especially critical for minority-demographic and international students. Interviewee 05 highlighted that "students who are from demographics or backgrounds that aren't particularly well served by the institution" may be more at risk and have a reduced sense of belonging, as "they don't feel supported in their work here." But in addition to considering ethnic and racial demographics, being an international student was of special concern to interviewee 05:

> I also feel like, you know, in the context, my own courses, I think international students have it really hard in particular. You know, it's a weird situation because the institution wants international students, but their experience in our courses can be sort of traumatic. [...] In writing courses in particular, I think it can be hard for them because they have ideas about what you know, native students can do or are capable of and feel vulnerable in that way.

Interviewee 05 teaches in the university writing program and so teaches many of the students in introductory writing courses. But, what they saw as putting international students at particular risk was not a lack of language ability or prior preparation, instead it was the students' comparisons of themselves to the perceived expectation of native, English-speaking students. Interviewee 05 also

noted that the institution is actively recruiting such institutional students, but adds that the writing courses are not structured to adequately support and provide a sense of accomplishment and belonging for international students. At least, the term "traumatic" strongly suggests a negative experience.

Interviewee 10, also a writing instructor, highlighted the experiences of international students in the writing program, noting that due to mechanical difficulties with writing international students may be conflated with at risk students:

> Because of language differences, the vast majority of [international] students necessarily had to come through the writing program. And I think at some point, a lot of people within our program, and maybe, this may be true university wide, I don't know, started to confuse Chinese international students with minority students, because they're multi-lingual. Right? And because, you know, writing is such a challenge for them in ways that writing is a challenge for other at-risk students who tend to populate our developmental writing courses, right? There's grammar and spelling and mechanics, both those student populations are dealing with those things. And so at some point, I think we've sort of conflated multilingualism, with maybe with the sense that students are at risk or minority.

This distinction seems important to the interventional approach. It is unsurprising that an international student may benefit from a developmental writing course. But, as interviewee 10 pointed out, just because they are in a developmental course does not mean they are automatically an at risk student.

The demographic risk area was being a transfer student. Unlike some of the other risk areas, in which the interviewees explicitly rejected a narrative that students belonging to various demographic groups (e.g., female, minority, or low income students) were less prepared than other students, the interviewees specifically described their transfer students as at risk because of prior experience. For example, interviewee 08 noted that, "one student who was a transfer from [a local

community college] was in an upper division class, but I think she wasn't ready for that upper division class." This professor, continuing, noted that they still did not know why the student was struggling, adding, "I'm not quite sure what was going on with her because she didn't stay in the class very long. [...] I think she stayed about three or four weeks and then she dropped out. And it was more, you could tell that she couldn't focus on what we were talking about." It sounds like the students ability to focus was also a part of their difficulty in the course. But the interviewee primarily highlighted being a transfer student, rather than the lack of focus, as what made the student at risk. Interviewee 04 also highlighted that their department had noted that transfer students struggled and as an instructional team they were trying to develop interventions to better support such students: "we're having a lot of people transfer in as juniors with low [grades] so the overall Junior thing goes down as opposed to up. We're trying to figure out how to prevent students from getting to the point that they might face being kicked out of the university." In this case, the underlying problem seems to be academic preparation (described as low grades), but the marker for students falling into this group was being a transfer in their junior year.

4.3 The Tri-Part Model of Engagement

4.3.1 Applied to Engagement

A classic model of engagement is the tripart model which conceptualizes engagement as comprising behavioral, cognitive, and emotional components. I analyzed the interviewees definitions of engagement to see how the instructors' perspectives mapped on to the tripart model. I assigned each of the participant-driven codes to either the behavioral, cognitive, or emotional domain. The cognitive domain includes paying attention, thinking about course content, and making connections. The emotional domain includes developing interest. The behavioral domain includes completing work, participating, questioning, and interacting with peers. Table 4.7 summarizes the outcome of this analysis. The cognitive and behavioral domains were mentioned

frequently, by 16 and 17 of the interviewees, respectively. The emotional domain received less emphasis, with 9 of the interviewees discussing developing interest.

Table 4.7 — The Tri-Part Model of Engagement in my Data

	codes	interviewees	segments
cognitive	3	16	44
emotional	1	9	16
behavioral	4	17	54

The emphasis on cognitive and behavioral aspects of engagement indicates an academic focus on student success. The interviewees emphasized aspects of engagement that would promote academic success, like doing work and thinking about course content. These areas of emphasis are also more observable. Professors are able to directly observe students completing work, participating, questioning, interacting with peers, and paying attention. The instructors described fewer aspects of engagement that they could not directly observe—only thinking about course content, making connections, and developing interest. This may explain why the emotional domain was discussed half as much as the other two domains. Emotional aspects of engagement are more apt to be unobservable. Further, the way that developing interest was discussed was often as a motivational factor that would promote academic success.

Figure 4.2 below shows how each of the engagement themes I developed from the participants definitions of engagement map onto the tripart model of engagement. The unit of analysis for this figure is participants' definitions of engagement. I assigned each of the eight themes that I developed by analyzing the participants' definitions to either the emotional, behavioral, or cognitive dimension. A line between two themes indicates that those two themes co-occurred in a participant's definition of engagement. That is why these lines are non-directional, lines indicate a co-occurrence. The weight of the line indicates how many participants had that

particular co-occurrence of themes. So line thickness can be read as the frequency of theme co-occurred across participants' definitions of engagement.

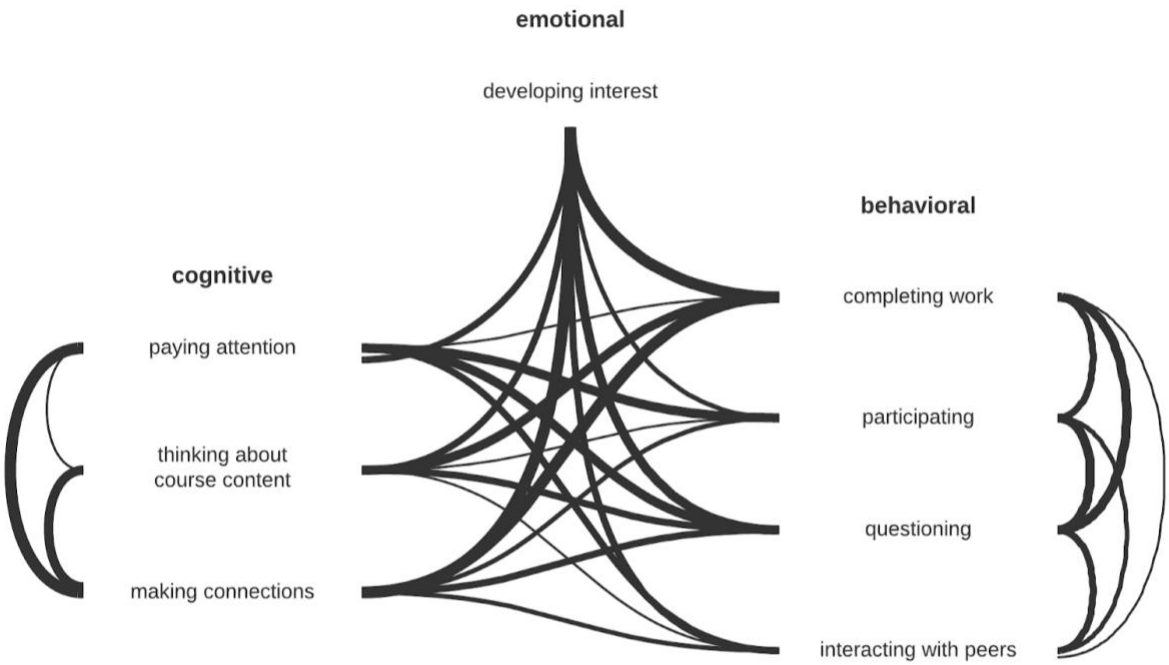


Figure 4.2 — Mapping Engagement Themes in the Tri-Part Engagement Model

The themes that appeared together most often in instructors' definitions was making connections with completing work, paying attention, and developing interest respectively. The three resulting pairs showed up six times each. I interpret these co-occurrences as making connections being strongly connected to students paying attention in class, completing coursework outside of class, and ultimately developing an interest in the course. This progression could also be described as a professor's ideal form of engagement; that is, a student doing what is expected in class, meeting course requirements, and ultimately transferring learning beyond the course. In these associations making connections was also strongly connected to an aspect of cognitive, emotional, and behavioral engagement.

The only other pair of concepts that occurred six times was developing interest and completing work. One interpretation of this is that professors assign work with the hope that it will promote interest in the topics. I also think of this connection as a strong link between a desired

outcome of engagement and a means of reaching this goal. Student activities such as completing work and participating, paying attention, and thinking about course content are means to an end. For instance, course work is usually assigned to help practice, demonstrate learning, or some other objective. For instance, assignments can also support students developing a deeper understanding of course content. But, in contrast, students developing enduring interest in course topics was described by interviewees as a goal of their instruction. This explanation also describes the three connections between making connections discussed above. Making connections, like developing interest, was discussed as a desired outcome for students.

Lastly, the least common connections were between aspects of engagement that would happen in class and out of class. While there were no non-connections, the table below shows the five least frequent connections, each of which co-occurred in only two interviews. Since I mapped co-occurrences of ideas, the five least common connections are dyads of themes. To make sense of these dyads, I introduce the division between in class and out of class. In the table below, the first column identifies a dyad pair that would occur in class; the second column is the corresponding theme which occurs out of class. As the table illustrates, all of the infrequent co-occurrences of engagement themes in participants definitions included an in class and an out of class theme. Suggesting that participants focused respectively on more in-class and out-of-class definitions of engagement and tended to not include both forms of engagement in their understanding.

To understand the connection between engagement in- and out-of-class, I categorize paying attention, interacting with peers and participating in class activities in Table 4.8. The interviewees described these topics as things that happened during their class and that they could observe. Alternatively, I categorized completing work and thinking about course content as primarily out-of-class activities. Of course, both of these could happen in class as well, but they were mostly described as doing assignments out of class and thinking about course content in terms of reading or while doing assignments. This lack of strong connection between in- and out- of class may

indicate that professors think of student engagement separately in these contexts rather than as a monolithic characteristic.

Table 4.8 — Comparing Engagement In- and Out-of-Class

in class	**out of class**
paying attention	completing work
interacting with peers	completing work
paying attention	*thinking about course content*
interacting with peers	*thinking about course content*
participating	*thinking about course content*

4.3.2 Applied to Risk Status

Like I did with the engagement descriptive codes, I also analyzed the risk descriptive codes in terms of how they aligned with the tripart model of engagement. The dimensions of this model were created to describe student engagement. But, since being at risk is often described as low or no engagement, I chose to apply the model to the interviewees' definitions of student risk status. By doing so, this analysis aims to consider similarities and differences between how the participants think about engagement and risk in the behavioral, emotional, and cognitive domains.

The table below shows that the majority of interviewees described a behavioral (15 of 21) and emotional (14 of 21) aspects of being at risk while only 5 of the 21 interviewees discussed cognitive aspects of being at risk. This emphasis on behavioral and emotional aspects over cognitive ones is quite different from what I observed in the analysis of engagement. With engagement, most of the was on behavioral and cognitive dimensions (see Table 4.9). For both engagement and being at risk student behavior is a frequently discussed attribute. But for engagement cognitive domains were more salient than emotional. But this pattern was reversed for risk status, the emotional domain was more salient than the cognitive in the interviewees definitions.

Table 4.9 — Prevalence of the Tri-Part Engagement Model Across Participants

	interviewee																					total segments	number of interviewees
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
behavioral	■	■	■	■	■	■			■			■		■	■	■	■		■	■		46	15
emotional	■		■	■	■	■		■		■	■	■	■	■		■	■			■		31	14
cognitive		■									■					■	■			■		6	5

For this analysis I sorted the descriptive risk codes into the three behavioral, emotional, and cognitive domains. In this section I selectively emphasize codes that were not discussed at length in the preceding analysis of the definitions of risk status. While behavioral aspects are most numerous, (see Figure 4.3) I already described these codes in depth in the preceding sections, as such most of my focus in the subsequent sections will be on the cognitive and emotional aspects of being at risk.

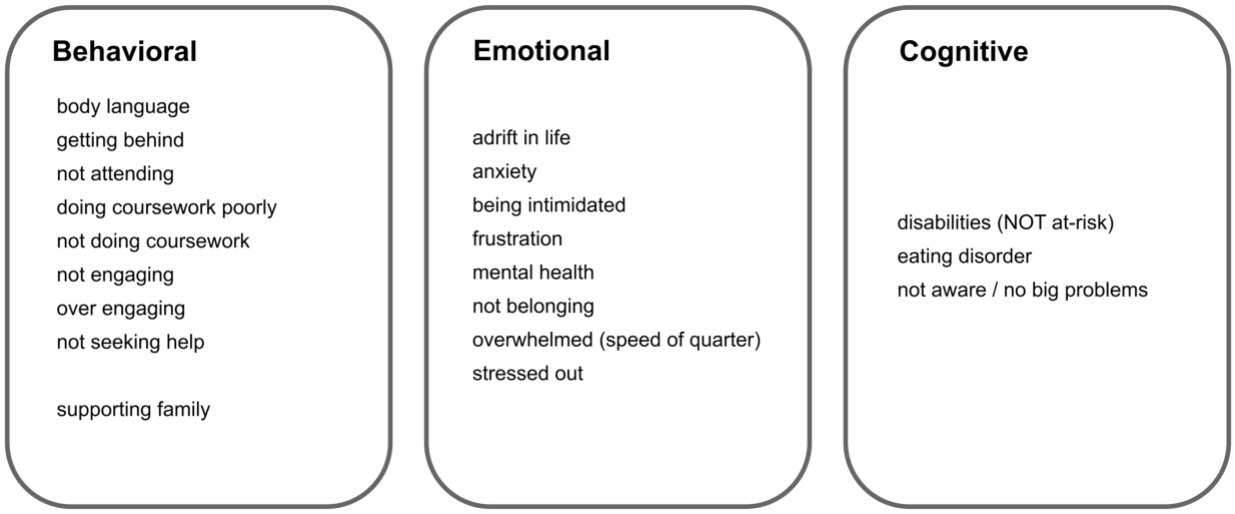


Figure 4.3 — Applying the Tri-Part Model to Risk Factors

In particular, because of how the emotional and cognitive dimensions of being at risk were emphasized so differently between the participants' engagement and risk definitions. In particular, because of how the emotional and cognitive dimensions of being at risk were emphasized so differently between the participants' engagement and risk definitions. In particular, because of how the emotional and cognitive dimensions of being at risk were emphasized so differently between

the participants' engagement and risk definitions. In some cases, distinguishing between emotional and cognitive dimensions is difficult, an example is an eating disorder. For example, I categorized eating disorders as cognitive while I categorized mental health as emotional. This illustrates one of the limitations of the tripart engagement perspective, as eating disorders and mental health entail emotional, cognitive, and behavioral aspects. In this case, eating disorders were categorized as cognitive because they involve perceptual distortions; I made this decision based on the way the interviewee described their concerns. However in another context, a strong case could be made for categorizing eating disorders as behavioral (e.g., restricting food) or emotional. Similarly, mental health as a whole could also be categorized as cognitive. Further, eating disorders are a subset of mental health. However, the participants mostly described mental health as an affective problem that impeded students' learning, so I saw mental health best fitting alongside participants' discussions of student anxiety, feelings of not belonging, and being stressed out in the emotional dimension.

Behavioral risk factors. The descriptive codes I sorted into the behavioral dimension were primarily things that students could control, such as doing coursework, getting behind, not attending or not seeking help (see Figure 4.3). I discussed these codes in the previous section on changeable versus fixed aspects of engagement. Supporting one's family is the only behavioral aspect outside of students' control. Of course, students do have some choice over whether they engage with and support family members. But families need support because things of traumatic events or illness are unpredictable. I believe behavioral aspects play a large role in instructors' understandings of both engagement and being at risk because they are the most observable. For example, when defining how they cannot tell if a student is at risk, interviewee 02 said, "when you're teaching in a face-to-face setting, you can look at and read the body language of the students more so to see, okay, do we have active listening going on?" For them, students that were not

actively listening were likely to be doing poorly in the course. It strikes me that this quote could also describe engagement, as active listening was also discussed as a form of engagement.

I want to discuss how engagement relates to the behavioral aspects of students being at risk. I already identified the descriptive codes of not engaging and over engaging in the section on changeable aspects of being at risk (see Table 4.9) but I did not discuss them in depth. I also sorted these codes into this behavioral category. But what did the interviewees include in this behavioral form of engagement? And, how does it relate to a student being at risk?

For interviewee 08, if a student was over engaging it was a sign of being at risk. Interviewee 08 described a student in their writing course that would "kind of dominate the conversation, but not necessarily in a way that is productive." This particular student disrupted the class by trying "to be the one to answer all the questions." In this case, this professor saw the students behavior as a need to control their environment:

> I see her behavior more as needing to kind of control her circumstance more than "I know it all," right. It's not that kind of "I know it all" so I'm just gonna tell you, it was more of you know, let me be the leader, let me be in control of what's going on more because the stuff that's happened this last week has shown me that things can get out of control in her life a little too easily.

While the professor accounted for this type of behavior as something that they would identify as making a student at risk, noting "for me the at risk ones are usually the ones that are, if they are engaged, they're a little over engaged." But this is not strictly behavioral, as Interviewee 08 thought the student's over-engaging behavior was likely due to anxiety, suggesting that the student "seems like a high anxiety kind of person, like she's really struggling with high anxiety and so she'll talk a lot." Interviewee 08 was the only instructor to find too much engagement as an indicator of a student being at risk. In part, because engaging too much, on its face, is not bad unless it is driven by another negative experience, like anxiety.

The other three instructors discussing engagement as an indicator of student risk status all described students under engaging as a sign of distress. Interviewee 09 put it most directly, describing being at risk as "a student [that] is not engaging." They did add other aspects beyond not engaging to their definition of what makes a student at risk, such as "[not] coming to class, or if they're in class, they're not engaging with their classmates, they're not participating in full group discussions." But interviewee 09 further emphasized not engaging as a sign of being at risk, describing one student that was not engaging even though they were receiving accommodations and support due to difficult external circumstances: "despite accommodations for that particular student, [they were] still not engaged, [and] when they do engage it is not engaging to the level I would expect to see."

The other two professors that mentioned engaging in relation to being at risk linked engagement to other concepts. Interviewee 04, for instance, noted that students could not concentrate enough to engage fully, observing that recently they in the past two years more students had been doing poorly in their class because of this phenomena:

> I also have [more] failures; which I never had before. I think that is a concentration issue. I mean, I also think, you know, you get new students to learn in new ways and you have to change at some point, but that's taking me longer than I would say, concentration as in people not being able to concentrate at certain levels or not being able to engage.

Interviewee 05, on the other hand, emphasized that reluctance prevented their students from engaging fully, which put them at risk of not succeeding in the course:

> I do a significant amount of small group work having people have discussions in small groups for sharing with each other. And sometimes I feel like there's a certain amount of reluctance not just on international students, but, you know, for a variety of reasons like that kind of engagement, that kind of work, I think can be intimidating for some people.

In these two examples, the professors are respectively linking engagement (something behavioral) to cognitive and emotional facets. Concentration is cognitive and being intimidated is emotional. This helps to illustrate that, like with engagement, when thinking about students being at risk, behavioral aspects are typically connected to other cognitive or emotional aspects of the students' experience.

Emotional risk factors. Unlike with engagement, where emotional aspects were not commonly discussed, the emotional aspects of being at risk were discussed by many interviewees (see Table 4.10). Some emotional aspects were discussed consistently across several interviewees, including mental health and anxiety. The other descriptive emotional codes I developed were each discussed by fewer participants, these include a sense of belonging and being intimidated, adrift in life, or overwhelmed. Collectively, these codes indicate a students response to something external to themselves, with a sense of belonging, intimidation, and overwhelm the students were described as responding to their learning institution. Since each of these describe a different response, I highlight each one even though only two or three participants talked about each one. Finally, I mention frustration and stress, both of which were major components of only one participant's understanding of students being at risk.

Table 4.10 —Emotional Risk Factors

code	interviewees	example segments	interviewee
mental health	5	But for me I think I think when I think about risk I think more about people's kind of mental health and well being.	interviewee 12
anxiety	5	I think the ones that struggle the most, it's depression and anxiety, you know. And that's, you know, and without diagnosing people, but certainly ones that have had diagnoses, I think that's the biggest issue.	interviewee 20
sense of belonging	3	Then there is an increase in the number of students who are ill prepared to be here, feel like they're not comfortable here. And that's a whole different [type of] at risk. So no one talks about that.	interviewee 06
intimidation	2	In the local context of UC Davis, an R1 institution, what we have is first of all, a rather intimidating What? Reputation, right? It's UC Davis, it's R1. When we think about students who are first generation, who are low income, who are minority students. The idea of prestige can be read by them as something that is intimidating, right?	interviewee 10
adrift in life	2	To me [the] at risk are the students that are, I think, mentally struggling just with life in general, you know: What am I going to do? Why am I not succeeding here? [...] So, those are most at risk.[...] Students [like] that don't continue on for whatever reason.	interviewee 13
overwhelm	2	Now, if you mean at risk because they're overwhelmed by the quarter system. Well, then, I've asked that the quarter system be changed that has always been voted down for as long as I've been here	interviewee 17
frustration	1	So, for me, [an at risk student is] somebody who gets very behind on the assignments, who when they're in the classroom, they seem frustrated, as opposed to being engaged	interviewee 08
stress	1	I had this one student one year, he was extremely stressed out because he was in a single parent family.	interviewee 08

The widest spread emotional aspects of students being at risk was mental health and anxiety. I explored if there were any patterns among which professors discussed these emotional aspects of risk status. All of the writing program professors discussed one of these topics (interviewees 04 and 16 talked about mental health; interviewee 05 discussed anxiety; and interviewee 08 discussed both). Beyond that set of faculty members there was not a widespread pattern. The other professors discussing mental health and anxiety were from humanities

(interviewees 04 and interviewee 14), health science (interviewee 20) or social science (interviewee 11). None of the natural science professors discussed these topics, but as my sample was not well balanced this does not provide much support for a broader pattern in that respect.

Broadly mental health was a concern for both students academic success but also for their personal well being. Interviewee 04 described their students being in multiple ways due to mental health issues, noting that "those kind of things that put them at risk in multiple ways, whether it's [academic] risk, [or] things like suicide or other kinds of mental breakdowns." Similarly, interviewee 16 noted that, "there's so many ways you can be at risk. You could be at risk in terms of mental health, physical health, [or] physical safety." The issue of mental health was positioned as something that both puts students at academic risk, but may extend beyond their performance in school to be an issue for their well-being as a whole. Interviewee 12 described this distinction, suggesting that, "I think [what] a lot of people think of at-risk students as students who are at risk of not graduating or not completing the class successfully. [...] I think [being at risk] can mean anything from like a person who is at risk in terms of their physical and mental well being." This view of mental health as a risk for students beyond the academic identifies an area of being at risk that may be beyond faculty intervention.

The instructors also discussed what they could do to help students struggling with mental health. In this, they noted that it was a difficult issue for them since they can't directly help students they think need help. Instead, the instructors described connecting students to on campus resources and hoping they received support. Interviewee 08 described an experience with a struggling student in which they advised the student to seek counseling:

> I said, you need to talk to a counselor. So please tell me you'll do that. Because you really need somebody to talk to about this and you can talk to me, but I'm not a counselor, you know, and I will help you with your schoolwork and you know, anything related to our class,

but you really need an outside person to, you know, just talk through this stuff, so that you can deal with the stress of it.

Similarly, interviewee 16 described their own experience as a student, where they "I needed the support from my professors [so] that I can have time to go to counseling." Such counseling was described both in terms of professional counseling and on campus resources. Interviewee 04, for instance worked in department that had non-teaching staff that were tasked with supporting students, in their interviewee 04 described if they would "encounter those kinds of students" that they would "try to monitor people in our majors who would be at risk of not doing well, which is a different kind of risk." Like interviewee 04, the professors discussed connecting people with on campus supports.

Connecting students with on campus resources was important for the instructors, especially if the students had not already made such a connection. In these undiagnosed or unaccommodated cases, the professors saw the students as particularly at risk. For instance, interviewee 20 emphasized the undiagnosed students as being at risk, musing, "I think it might be maybe someone who's undiagnosed or some who's going through psychological problems; that's students that struggle the most." The role of connecting students to support is particularly salient for such unidentified students. As interviewee 16 noted when describing their personal experience with mental health in college and how that influences how they advise students, "if I hadn't gotten the support and accommodations I needed to get treatment and still be a student, I might have had to drop out of college for a while and I might have gotten sicker." Indicating that if students do not receive support from professors to initially seek help, they may get sicker or suffer academically.

Among mental health topics, anxiety was specifically mentioned the most. As with mental health overall, anxiety could be unidentified. As interviewee 08 noted:

Sometimes I find that [my students] have anxiety, but they haven't gotten an accommodation letter. So I tell them, you know, I talk them through that, and say "you

know, you could get an accommodation, which would allow me to give you a little extra time on these things." So I have done that. I usually try to work with them when I know that there's some heavy duty stuff.

While anxiety was sometimes described as a mental health issue, something that students experienced generally, like how interviewee 08 described one of their students as "high anxiety kind of person," anxiety was more often a response to something. Interviewee 11 did not identify what was causing their students to have "super high levels of anxiety and depression" but identified an upward trend. Interviewee 05 suggested that increasing grade consciousness was increasing anxiety among their students, noting, "one of the things I noticed right away was [a] spike in the level of just general anxiety and grade consciousness." This perspective suggests that mental health could be augmented by the design of the students' environment and culture. This is a concept that was expanded in the interviewees described below. Like interviewees 11 and 05 positioning anxiety as a response to something or changing over time, six professors discussed other emotional aspects of being at risk that were in response to something external.

Interviewees 05 and 10 discussed a sense of belonging and feeling intimidated together. For them, negative emotional states, such as experiencing imposter syndrome, were caused by the institution. From a student's perspective, these professors suggested that students may be "feeling like somehow they got in by fluke, like they don't belong" (interviewee 05) or "[feeling like the university is] trying to keep you out, or that it is intimidating, or out of reach for reasons that are unfair or aggravating" (interviewee 10). The interviewees attributed such student feelings to things like "difference between the prestige of the institution and the worth of the individual" (interviewee 10) or intimidating "group work" (interviewee 05). But not necessarily for all students, these responses were identified specifically for first generation, transfer, low income, or minority students. In these interviewees discussion of emotion, some of the fixed, demographic attributes being at risk are identified as issues not because of group memberships but differential experiences

within the institution. Something that is actually changeable and productive for instructors if they are accommodating students individually or with group-level needs in mind.

Like feeling a sense of belonging or intimidation, feeling overwhelmed, stressed, or frustrated were also described as a response to something about the institution, specifically the 10-week term length. As interviewee 17 described: "Now, if you mean at risk because they're overwhelmed by the quarter system? Well, then, I've asked that the quarter system be changed, which has always been voted down for as long as I've been here." For interviewee 03, the overwhelmed response to the quarter was particularly salient for first generation students which they suggested might be "a little more overwhelmed by the size of the class and the sort of speed at which the 10 week quarter." Interviewee 03 did not elaborate why first generation students, compared to say international or transfer students, might particularly struggle with the size of classes or 10-week term. Only interviewee 08 discussed their students experiencing frustration or stress; but, like being overwhelmed it was described as a response to something about the university:

> I had one student who was a transfer from [the community college]. She was in an upper division class, but I think she wasn't ready for that upper division class. [...] She always seemed to be a little frustrated with how to do what we were doing.

Interviewee 08 identified a transfer student as experiencing frustration that their other students were not experiencing. Because the course was more challenging and run differently than the students prior experience prepared them for.

Cognitive risk factors. As mentioned previously, cognitive aspects were not a major factor in the interviewees' definitions of being at risk—unlike the interviewees' definitions of engagement. I coded having a learning disability, eating disorder, and lack of awareness of cognitive aspects of being at risk. Cognitive disabilities are interesting because they were often described as something

that was challenging for students but not something that put a student at risk. Interviewee 20 illustrates this perspective, noting that:

> I'm more lenient with my students that I know have documented disabilities just because for them, you know, from just an equity standpoint, they're, they're not in this, they don't have the same resources necessarily, that someone else has. And so none of them are at risk.

Similarly, interviewee 17 described having students with registered disabilities and how they were accommodated:

> We do ask in the student information for if there are disabilities that require the disability center, and there is a subset of students who sometimes sit at front or we have, require translation of the materials to formats it they can access, or hearing, or if they have different forms of trauma or autism, that they may have to leave the classroom. So if you mean those, I mean, those things are accommodated.

But like interviewee 20, interviewee 17 also explicitly noted that given the right accommodations their students with cognitive disabilities were not their at risk students:

> It's just that if [students] have the technologies, or the availability, you would be fine. And I'm telling you, some of the students that do require recording or translation, or have autism or PTSD, and all those things, they excel, so I don't see them at risk. I really don't.

The interviewee's perspective on cognitive disability was that as long as institutional supports are available, these students are not at risk. This perspective mirrors what professors said about the fixed, institutional aspects of being at risk; factors like the term length may negatively impact some students and some professors advocate for change. Accommodations like recording and translations are available for students with cognitive and learning disabilities, and because of this no risk is created for these students. The implication is, of course, that if the institution was structured in a way to remove these supports, students with cognitive or intellectual disability may become at risk.

Two interviewees highlighted eating disorders as a way that students may be at risk. I struggled with how to classify eating disorders because they manifest in behavioral and emotional areas as well. Ultimately, because in disordered eating conditions cognitive distortions led to behaviors that endanger a person's physical wellbeing, I chose to categorize eating disorders as cognitive facets that place students at risk. Unlike cognitive and learning disabilities, which may directly impact a student's learning capacity, eating disorders impact a student's well being more generally. Both of the professors identified this distance from impact on learning, when they discussed how they may not be able to help students directly, despite seeing them as being at risk in this way. On this topic, interviewee 02, who is a professor in health sciences, noted, "I'm also not a psychologist or a psychiatrist or anything like that. But I can give the students the resources for where to go and let them know that I can be at least a connector, right? There's something."

Personal experience was also important for both of the instructors that discussed disordered eating. For interviewee 02, healthy eating was an area of research (though not disorders specifically). For interviewee 16 there was a more personal connection:

> I mean, like part of this is like informed by my, like my own experience as a student, because when I was in college I had an eating disorder and was getting outpatient treatment for it, but I needed like support from my professors that I can have time to go to like the counseling I was going to and stuff like that. [...] You know, so kind of thinking about that, like as a teacher, I'm like, I was at risk. You know, I might have you know, if I hadn't gotten the support and accommodations I needed to get treatment and still be a student. I might have had to drop out of college for a while, I might have gotten sicker.

Motivated by their own experience, interviewee 16 was likely more attuned to this form of risk among their students. I asked if they had ever supported a student, and they had, but agreed it was rather rare. To me this suggests that different teachers are differentially suited to recognizing

particular kinds of risk. Some instructors will recognize aspects of being at risk better than others and given their own experiences may be better able to support students as well.

The last code I sorted into the cognitive field was being unaware or not having any major problems. On the surface, not having problems seems unlikely to put a student at risk. Indeed, only one faculty member discussed this, but it was a major theme in their discussion of what places a student at risk. Interviewee 11, a social science professor, contrasted students that are aware they are struggling—"I would say a lot of people are at risk and they know it"—to those that are unaware they are at risk, people who "are at risk [but] they kind of are powering through. [For them] there's no real big problem in their life that, I would say, puts them at risk." Given that these students do not have major stressors or issues in their life, what would put them at risk? Interviewee 11 noted in their experiences that for such students, "their brain is not really engaged and they're not really aware of their world and they're just going along with the flow" and this lack of awareness puts them "at risk right now in the world we live in right now." From this vantage point even things like stable income and being successful may put students at risk; interviewee 11 added "if they're kind of wealthy and doing okay, for now, I'd still say they're kind of at risk. [Because] this is a world that's really dynamic." So, for this professor, cognitive awareness and paying attention to the world and one's place in it is important to avoid becoming at risk.

4.3.3 Findings Summary for RQ1 — Part 2

I will now summarize how instructors defined students being at risk, also illustrated in Table 4.11. Unlike with engagement, the majority of the participants did not use the term at risk in relation to their teaching. This avoidance of the term at risk could be for several reasons, including because the term was unfamiliar (4 participants) too generic (6 participants), or might stigmatize students (4 participants). Despite the fact that many participants did not use the term "at risk", I asked participants what the concept of being at risk meant to them and most provided a definition. I identified 39 descriptive codes that highlighted the diversity of ways that instructors understood

their students to be at risk. In particular, I focused on the ways that professors understood risk to be a changeable (8 codes) or fixed (10 codes) student status. Describing students as being at risk in terms of unchangeable attributes or situations was more common than in terms of changeable actions, as the Table below shows.

Table 4.11—Types of Risk Factors in Participants' Risk Definitions

	interviewee																					number of interviewees
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
changeable		■	■	■	■	■		■	■						■	■			■	■		11
fixed	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■		■	■		18

The changeable ways that instructors described students being at risk—that is, things students could improve given support—were primarily related to classroom behaviors and included not doing coursework, doing coursework poorly, getting behind, not attending class, not seeking help, and not engaging in the course. These ways for students to be at risk can be seen as the inverse of engagement in terms of the stereotypical forms of course participation. In contrast with these changeable aspects of risk were the unchangeable—or fixed—aspects of being at risk. Notably, instructors more frequently defined risk status in terms of factors beyond students control. A total of 18 instructors talked about either person-specific (15) and demographic (8) ways that a person could be at risk beyond their control. Figure 4.4 shows the person-specific and demographic fixed ways instructors described their students being at risk. The person-specific, fixed ways instructors described students being at risk included prior academic preparation as well as the interrelated family crises, health, safety, and general personal issues. The demographic fixed ways that students were described as at risk included most of the institutionally-tracked at-risk metrics, including first generation, low-income, minority, under-represnted gender, international, and transfer student status.

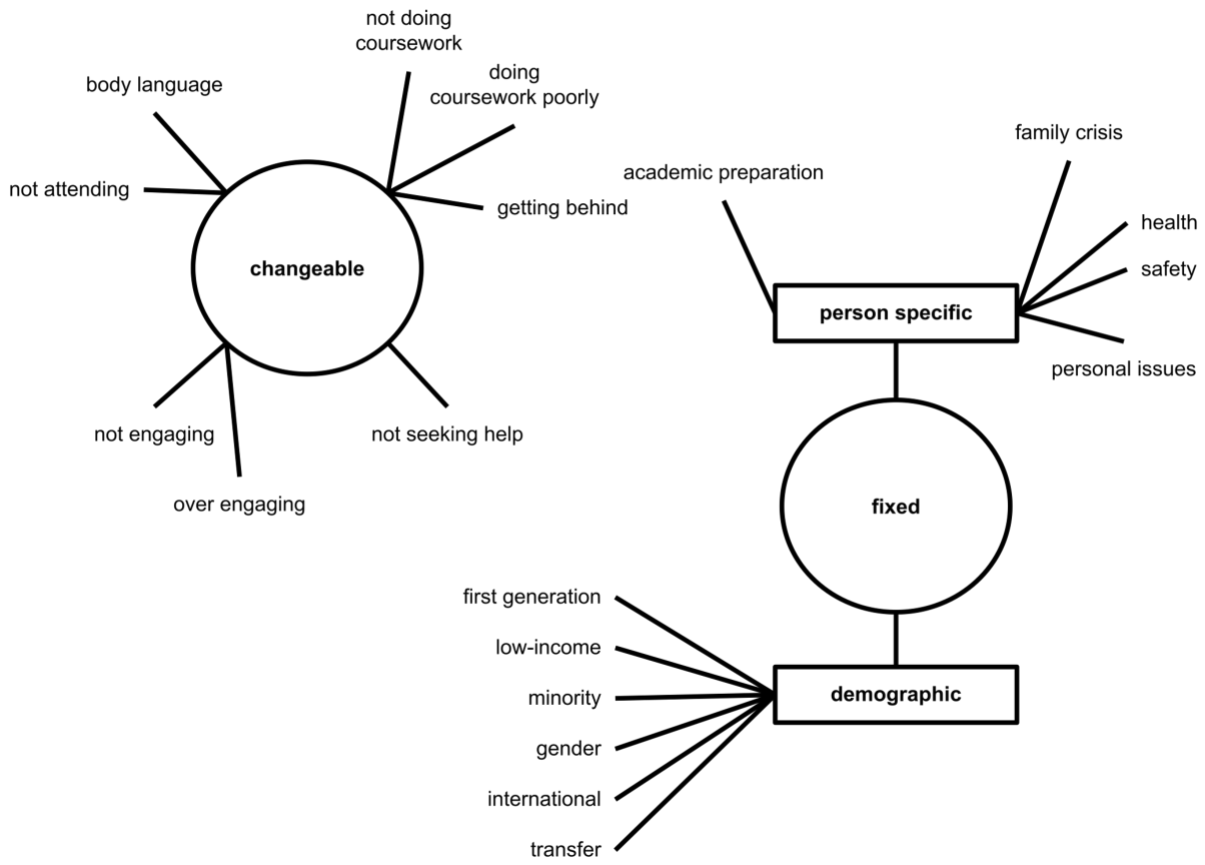


Figure 4.4 — Underlying Concepts Relating the Risk Factors

In addition to the fixed and changeable ways of being at risk, I also organized ways of being at risk in terms of behavioral, emotional, and cognitive modes of being at risk. The changeable ways of being at risk, seen in the figure above, are all behavioral. The only other form of behavioral risk status not captured in the figure above, was supporting family, which is generally not directly changeable through academic support. In contrast, the other ways that students were at risk and could potentially change were actions students were not doing in relation to their schoolwork. The other emotional and cognitive ways students were at risk were in part changeable and yet also fixed. For instance, emotional ways of being at risk included feeling adrift in life, anxious, intimidated, frustrated, overwhelmed, stressed out, or like one did not belong (instructors also described general mental health). In general, these forms of being at risk were described as emotional responses to institutional design or a student's prior academic preparation. For instance,

students may feel overwhelmed in response to the speed of the quarter or may feel frustrated if they did not have the skills to succeed in a course. These types of being at risk are chanfable at the institutional or systemic levels, but are fixed for individual students. Lastly, instructors described cognitive forms in terms of eating disorders. Lastly, several instructors explicitly excluded a common cognitive aspect of risk from their definition, noting that disabilities were not something that would automatically make students at risk.

4.4 Connecting Engagement and Risk Status

The topics of students being at risk or engaged are not separate conversations. Above I give the interviewees definitions of each individually, for clarity. But the participants also described whether and how these two concepts were linked in their understanding. In general, nearly all participants all described some kind of connection between being engaged and being at risk. But expressing the nature of that relationship was more difficult. As interviewee 07 put it, "Certainly there is a strong correlation between them. I'm just not sure where it starts. [...] That's just very complicated." To summarize the relationships these instructors described, I sorted the interviewees responses based on whether engagement or risk status was primarily an influence or a response. Of the 18 participants that answered this question, seven emphasized engagement's influence on being at risk, nine emphasized being at risk's influence on engagement, and four did not make a connection (I categorized some participants as describing multiple relationship types, e.g., interviewees 01, 04, and 16).

In emphasizing the impact of engagement on risk status, several professors observed that if their students were more engaged, they would do better in their classes. By doing well in the class, the students were not at risk for academic failure. As interviewee 18 put it:

> I do think there's a relation between the student engagement and their performance or risk of poor performance in the class. Students who are engaged [who have] more engagement, no matter what their level, definitely perform better compared to if they are not engaged.

Interviewee 09 described the connection between engagement and performance, saying “I think that the student who is more engaged will likely do better and then I won't, I won't have them on my, you know, hit list.” This instructor's “hit list” was the list of students they were worried about or might follow up with, that is, their at-risk students. Both of these instructors emphasize the protective nature of engagement against being engaged.

Conversely, some of the teachers highlighted the deficit that a lack of engagement could create. Interviewee 11 put it like this, “if I see a student who I don't think is engaged, even in that superficial way, then I think of them being at risk, and there's something going on there.” For interviewee 11 simply not engaging was an identifier of being at risk. Interviewee 20 elaborated this idea differently, noting that not engaging enough with their course instructions could put the students at risk for poor class performance:

> It's very obvious when someone doesn't read the instructions, because they'll lose points because, you know, they didn't follow the map basically, and so. A lot of that has to do with not spending time in Canvas, not reading things, not downloading things, not paying attention.

Interviewee 04 echoed this perspective, but with an emphasis on the effect of missing classroom discussions:

> Also the ability to have the peace of mind or whatever it is, that allows you to engage deeply in a subject, in a classroom, in a conversation, etc. All those things being missing, you know, puts you at risk for failure in the class, but you might make me and you're at risk, and many other ways also. So I do think they're highly connected.

Also highlighting low engagement cumulative impact on performance, interviewee 19 reflected on how their grades reveal patterns too late:

> If you're looking at what the [student’s] performance is [in the grade book], that is generally too late to catch anything at risk because [you’re] looking at the scores after they're already

> done rather than proactively telling you, "this is not shaping up well for the student." So unless you've got the class setup so the student can go back in and complete assignments a second time, that's not a really great way to catch at-risk students until after the risk has already been realized.

In this interview excerpt, interviewee 19 highlights how learning about a level of engagement too late to interviewee makes somewhat moot the connection between engagement and risk status. If students cannot modify their level of engagement in a proactive way, what does knowing about their level of engagement do for promoting positive impacts or ameliorating deficits created by level of engagement?

Figure 4.5 summarizes the proceeding excerpts. High engagement may have a protective impact on risk status while low engagement may create a deficit and place a student at risk or compound existing problems. The line weights indicate the prevalence common each relationship was across the interviews.

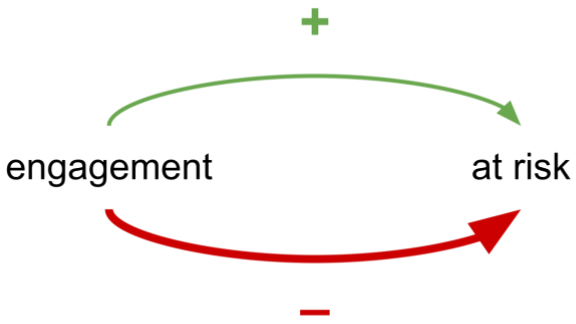


Figure 4.5 — How engagement impacts risk status

Among the professors that described the impact of being at risk on engagement, risk status always negatively reduced engagement, just to varying degrees. For some the impact was described as a nuisance or a distractor, as interviewee 03 put it: “I think the pressures of life and the overwhelmingness and difficulty of college generally can be a distractor to at-risk students and make it harder for them to engage.” Or, as interviewee 16 put it, their students were “at risk in the

sense that [they] are having external trouble that is making it hard to complete coursework." At the other end of the impact spectrum, professors made comments like interviewee 08, who described being at risk as a complete block to students engaging in their coursework:

> Because if they're at risk, they're not really able to put their attention on the classwork because their attention is distracted by whatever's going on with them. If they're having mental health issues, then their brains are not working well enough to be able to stay focused anyway. They're not getting their work done; they're not reading before they come to class—they can't be engaged.

Most of the other interviewees were between these two extremes. Figure 4.6 shows that nearly all the interviewees discussed risk as reducing engagement rather than increasing engagement (dashed lines indicate the connections discussed previously emphasizing how engagement impacts risk).

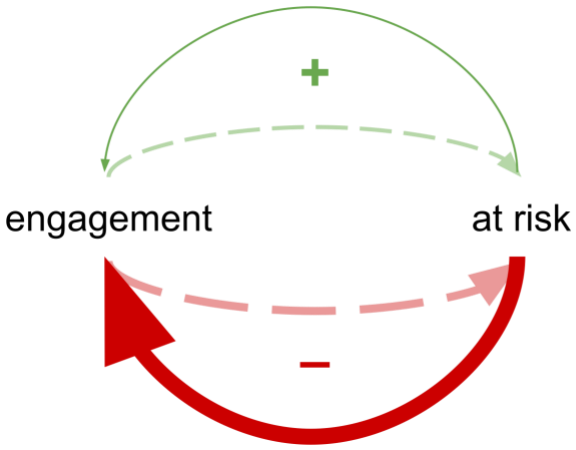


Figure 4.6 — How risk status impacts engagement

Complementing how the participants described engagement as binary dynamic, with high engagement serving a positive, protective factor and low engagement serving to place students at risk, the participants described risk as a feedback loop. Being at risk may alter or prevent engagement, and low engagement serves to place the student at greater risk. Interviewee 06, describing their at risks students—those that are "living in your car, [...] don't know where their

next meal is going to come from, have stuff happening at home, [are one] academic probation, [or] have mental health issues—noted that their struggles were compounded by being at risk, making it harder to be engaged and ultimately successful. Interviewee 06 contrasted students struggling in these ways with a student that was not at risk and was not engaged, noting that because they were not at risk there was no negative feedback loop: "Let's be honest [...] they're not interested. They're not. [But] a student that's not at risk is going to do okay." Interviewee 07 put this feedback process this way:

> I guess, I'm just trying to decide which one [risk or engagement] is more important. Being at risk. Because [the students] don't have [the] proper background so [they] cannot really engage in the class, and since you cannot engage, [they're] going even more, just the back and you're just having high risk and high risk creates an engagement problem.

This feedback loop of engagement was not only described as a negative feedback loop. Students could divert and by increasing engagement reduce their risk for failing or underperforming academically.

An example of this, interviewee 04 described how engagement may serve as an intervention to disrupt a negative at-risk feedback loop:

> One can ameliorate the other. So, if you have a student who's at risk because something catastrophic has happened in their home, if they come to office hours if they see the TA, if they come to discussions, if they are president class, they do a lot better than if they don't with the same circumstances, they're not necessarily do as well as they would without those circumstances. But it allows cushioning and allows people to help them.

This perspective of engagement as an ameliorative factor may also invite consideration if there are ways that the environment or design of instruction makes engaging more difficult for at-risk students. Interviewee 06, for instance, described how their at risk students may not know how or may feel embarrassed to ask for help:

> But you know, it's the systemic crap that's adding to the risk. That's where these things need to be addressed. [...] It's so embarrassing for them to say to me: “my laptop broke.” I've had students say my laptop broke and I don't know how to get it fixed. [Instead] they'll pretend [it’s] something else.

Interviewee 05 described how their students may experience anxiety if they were at risk, and the anxiety would make it more difficult for them to engage:

> I guess [among my at-risk students] I would expect to see some amount of anxiety or not resistance, more reluctance to perform based on that anxiety, a kind of tentativeness that can come through in someone's writing in particular.

For interviewees 06 and 05, reducing or supporting students so that their lack of knowledge, embarrassment, or anxiety did not prevent engagement would interrupt an at-risk feedback loop. Interviewee 01 alluded to this, when they noted their at-risk students “don’t do very well in class,” but that this was “because of the way I teach.” Interviewee 01 noted that their at-risk students would stop coming to class if their life was overwhelming, but because of the way the class was structured, not attending class would make it very difficult to complete the course.

In figure 4.6 there is one slim green line from risk status to engagement. This represents the minority perspective that being at risk may actually increase engagement. Interviewee 10 acknowledged the prevailing view that being at risk would lower engagement, saying “I think what I'm seeing is the opposite.” They added:

> I think that [the students] we would institutionally define as at risk can often be the students who are hyper engaged because they have been told that this is the key to the castle—hyper engagement: go to office hours, talk class, ask lots of questions, take lots of notes. And so they may be doing these things without a sense of why they're doing them. But it presents as total engagement.

They contrasted the "total engagement" that a demographically at risk student may exhibit with other students:

> Whereas, you know, sort of our traditional mainstream students may be a little less inclined to think that they need to engage, especially in writing classrooms where there's this sense of I already know how to write. [The student thinks:} "I'm a good writer. I got A's in high school, right? Who do you think you are? Right. To tell me I need to learn how to write."

For interviewee 10, they "don't see any kind of pattern," the negative feedback loop for being at risk, because at risk students may engage a lot and other students may engage a little. This perspective, however, may also fit within the negative feedback model. Perhaps engagement is good but more optional for students that are not at risk. There is an augmenting effect for engagement; engagement has beneficial effects for most students but the students already doing ok will probably be ok despite lower engagement. In contrast, at risk students may not be alright without increased engagement.

So far I have described how the participants connected engagement and being at risk. However, not all the interviewees made this connection. Interviewee 05, for instance, said, "I wouldn't automatically assume that someone who's at risk is going to be less engaged. [...] Sometimes I interpret disengagement from my class, as just you as the student have decided 'this course not me.'" In their view someone who is at risk may be engaged and someone who disengages may not be at risk, they may simply not be interested. In this vein, interviewee 14 said "you can't really draw a connection between their level of personal and intellectual engagement and the types of real world social economic problems that pull them out that keep them distracted" and interviewee 16 said:

> I also think they're not always connected. Because the student can be having, like, the worst quarter of their lives and be dealing with a serious illness or family trouble or you know, not having money or a place to live or something like that. And still be a super, you know, high

> performer in class and be really engaged and be getting good grades. So, I try not to automatically equate struggling in the class with being at risk, or low engagement.

In excerpts from interviewees 14 and 16, they observe that they do not see a consistent dynamic between engagement and risk status. This is the perspective interviewee 12 endorsed when they noted that they "try to see there are risks with every student."

5 Findings related to Research Question 2

5.1 LMS and Analytics Usage Trends

I interviewed the participants about how they used the LMS and its analytics to learn about students' engagement and risk. To put these findings into context, here I will summarize the participants' overall technical experience and attitudes, their experience with the LMS, and general usage patterns. This background reveals that the participants' backgrounds include varying experiences with and expectations about the LMS. For instance, the professors rated their overall technical competence in terms of whether they had beginner, intermediate, or advanced proficiency with technology. Most identified as either intermediate (12) or advanced (7), while only interviewee 17 identified as a beginner (and one participant did not respond to the survey).

The instructors in this study had an average of 3.5 years of experience with Canvas. Although most of them had worked with an LMS for longer than that, I specifically wanted to know how long they had worked with Canvas. The participants reported working in Canvas for between one to eight years. This latter number is the length of time that Canvas was commercially available at the time that the interviews were conducted; so this participant reported working with Canvas since it was first available. The average time working with Canvas, 3.5 years, also corresponds with when the university transitioned to Canvas from its previous LMS at the time of the interview. Overall, most of the interviews had worked with the LMS for multiple years and all of the interviewees reported using the LMS.

In addition to asking about how long and how often the participants used the LMS, I also wanted to know how they generally felt about using the LMS. This was captured by the attitudes towards LMS items, summarized in Table 5.1 and the Affect column in Table 5. The interviewees' attitudes towards Canvas ranged from negative to positive. Overall, the professors gave a slightly positive appraisal of the usefulness of the LMS, with their average response sitting at .55, between neutral and agreement with most items. The average overall attitude scores ranged from -1.2 to 1.8. In particular, the professors most strongly endorsed the questions about the LMSs ability to improve their instruction and students' learning experience. In general, the professors agreed that the LMS helped improve their instruction and made it possible for their students to study more efficiently. They also disagreed they could do most things just as well without the LMS. But, on average, the professors were neutral about whether the LMS helped them design more interesting and creative lessons. They were also neutral about whether the LMS saved them time in designing their teaching. Table 5.1 shows the average response for each question.

Table 5.1 —Attitudes Towards the LMS

instruction improved	students study more efficiently	plan more interesting lessons	lms usefulness	save time
0.7	0.6	0.3	0.75	0.4

There was also a positive correlation between length of LMS experience and positive attitude towards the LMS. I correlated the length of experience with Canvas (in years) with the aggregated attitude question response (-2 to +2) and observed a positive correlation of $p = .53$. This correlation suggests that the professors who had spent more time with the LMS more strongly endorsed the idea that the LMS was helpful.

Beyond the LMS, I also asked the participants about their use of the LMS analytics. While everyone used the LMS, only half of the participants (10) reported using the analytics. I explored whether analytic usage was limited to the instructors with more advanced self-reported technical ability. But as Table 5.2 shows, use of the analytic tools was spread evenly among those with

intermediate and advanced technical abilities. Technical ability was rated as none, beginner, intermediate or advanced ability by the participants.

Table 5.2 — Participants Background with LMS

Interviewee	LMS experience length (years)	Technical Ability	Attitude	Use LMS?	Use analytics?
01	1.25	intermediate	-1.0	yes	yes
03	3	intermediate	1.2	yes	yes
11	5	intermediate	-1.2	yes	yes
15	4.5	intermediate	-0.2	yes	yes
16	2.5	intermediate	0.6	yes	yes
19	8	intermediate	0.8	yes	yes
02	1	advanced	1.0	yes	yes
05	3.5	advanced	1.4	yes	yes
18	3	advanced	-1.0	yes	yes
20	4	advanced	-0.2	yes	yes
17	3.5	beginner	0.6	yes	no
04	3.5	intermediate	0.2	yes	no
06	3.5	intermediate	0.6	yes	no
07	5	intermediate	0.6	yes	no
09	2	intermediate	-1.4	yes	no
12	3.5	intermediate	-0.2	yes	no
13	3	intermediate	0.2	yes	no
10	4	advanced	0.2	yes	no
14	3.5	advanced	0.2	yes	no
08	2	advanced	1	yes	no
21	–	–	–	yes	no

5.2 Seeing Engagement with the LMS

I asked the instructors if the LMS helped them learn about their students' engagement. The majority of the participants reported using the LMS to learn about their students', though most of

these instructors qualified this by also acknowledging that the LMS was limited in how much it helped in various ways. Below I first summarize the perspectives of the six instructors who did not use the LMS to learn about student engagement. Then I summarize the 15 instructors' perspectives that did use the LMS to find out about their students' engagement.

5.2.1 "No": The LMS does not capture engagement

The six participants that did not use the LMS to learn about engagement tended to reference either unfamiliarity or disinterest with the LMS and its analytics as the main reason they did not use it to learn about student engagement. Interviewee 01 noted that , "I'm sure [the LMS] does way more than it used to before [...] but beyond that I haven't really. No, I don't. I don't use it [to learn about student engagement]." In a similar vein, interviewee 09 also illustrated unfamiliarity, particularly towards graphs, as they elaborated on how Canvas does not help them learn about student engagement. Pointing at a bar graph in Canvas, they said:

> I mean, these little sticks, as I say, if I were clever, if I knew what they meant, maybe maybe I would learn about student engagement. Through this bar graph. I actually didn't know what to actually do know that is called the bar graph. They're not called little sticks. [...] this is opaque to me.

Similarly to interviewee 09, interviewee 13 said:

> I'm sure [the LMS] can be used that way [to learn about engagement] but I'm not using it. It's more of a place to go and post information or lectures. [...] I think in the way that I'm using it, I'm not really seeing the engagement aspect. [...] But again, time wise, I don't have time to do that. Maybe if I knew how to do it, I'd be more apt to do it.

This latter responses capture both a lack of knowing how to use the LMS to learn about student engagement but also a lack of interest due to the extra time it would take. This lack of interest was expressed to some extent by the other participants not using the LMS to understand engagement.

For interviewee 07, their disinterest was due to prioritizing using the LMS as a way to communicate with their students. This approach was also prioritized by the other professors that were uninterested in using Canvas to learn about student engagement. Interviewee 17 noted that their TAs may use the LMS to learn about student engagement, but they did not and primarily used the LMS to "upload my materials and, in an organic fashion that meets my needs, can communicate with [my students]." Similarly, interviewee 14 said they did not use Canvas to learn about student engagement but did use it to communicate with their classes, stating "I actually don't use it that way. You know, I use Canvas mainly as a communications medium, right? I use it to let them know that the classes are canceled, or that here's a groovy new article, to take in their assignments."

For these instructors, like interviewee 17 and and 14, their emphasis on using Canvas to communicate with students rather than as a source of engagement metrics was not necessarily due to ignorance. Interviewee 07 illustrated this, when they responded that they do not use the LMS: "I don't actually use [the LMS to learn about engagement]." But continued to describe several engagement-related analytics in Canvas, as they continued, "Maybe there is something [in the LMS] that I haven't used? [Like] how many students are actually clicking those links and how many of them are really utilizing the resources?" Though interviewee 07 wasn't sure, they anticipated what kind of metrics Canvas could offer them, but overall did not feel the need to seek them out as a way to learn about student engagement.

The remaining participants used the LMS to learn about engagement, to varying degrees. Of the 15 that did use the LMS to learn about engagement, two professors strongly agreed that the LMS helped them see their students' engagement. For interviewee 15, the LMS showed them whether students were taking quizzes; they responded that they, "Definitely [I use the LMS to learn about student engagement]. I do actually look at who takes the quizzes." But they questioned whether it was useful, continuing to question, "Do I act on it?"

Table 15 compares the aspects of student engagement I identified in each interviewee's conceptual definitions of student engagement. I compare this to what each interviewee learned about student engagement from the LMS. For interviewee 15, while they strongly agreed that the LMS helped them learn about student engagement, they mainly emphasized students interacting as when they defined student engagement. But this idea did not resurface when they described how the LMS helped them learn about student engagement; instead, completing work was what the LMS helped them learn about, in the form of whether students were doing quizzes.

Interviewee 10 was another instructor that agreed strongly that the LMS helped them learn about their students' engagement. They agreed that, "Certainly, Canvas discussion boards are helping me with reading." They elaborated how reading was important to their understanding of student engagement and described how the discussion boards both helped facilitate engagement and made engagement visible:

> Pretty much all college writing is engaging with what we've read. And yet we don't really offer students a structured reading instruction, any explicit reading instruction. And so discussion boards have been my sort of first attempt to counter that. So I will give students really hard texts to read. And they read those sort of independently and on their own and then I asked them some targeted questions and they'll engage with one another. And what I find by making the instructions very clear and discussion boards, I do find that students really, they listened to me when I tell them this is you talking to your classmates. It's called a discussion board for that reason. You're helping each other understand this reading and engage with it.

For interviewee 10, when they conceptually described student engagement they highlighted completing work, questioning, and thinking about course content. Doing course reading aligns with completing work. Interviewee 10 also highlights questioning the students, which somewhat aligns with questioning; although as I scoped this theme it is more centered around students asking

questions. Lastly, I think interviewee 10 implies that the students are thinking about course content when they say that with the discussion boards "the students helping each other understand this reading and engage with it." Overall, it seems that their use of the LMS does help them learn about aspects of engagement they care about. But, in their use of the LMS, there is also a strong emphasis on peer interaction that did not appear in interviewee 10's conceptual definition of engagement.

Beyond these professors that strongly agreed that the LMS helped them see student engagement, most of the remaining 15 reported that it was limited to some degree. To give an overview of the range of responses, I first briefly summarize the responses that found the LMS barely useful and gave brief responses. As many of these responses were similar, I illustrate them all in Table 5.3. These four interviewees did not disagree that the LMS helped them learn about student engagement, but their responses were not strong endorsements. For instance, they critiqued that the LMS lacked relevant data, that it was hard to use, or that it was reactive rather than proactive.

Table 5.3 — The LMS has limited usefulness for learning about engagement

Interviewee	Segment
interviewee 02	So I don't have that kind of data.
interviewee 04	Otherwise it's a bit hard for me.
interviewee 15	Probably, yeah.
interviewee 19	Not much. Most of what Canvas shows is respond— is reactive to a task or an assignment.

5.2.2 "Sort of": Misalignments between definitions and the LMS

I grouped the 11 responses summarized below because they all mentioned the mixed or limited utility of the LMS to learn about student engagement. These interviewees did not use the terms "mixed" or "limited" themselves to describe their use of the LMS, but they gave examples that I thought indicated a mixed experience. In this section I contextualize and try to understand why the LMS had limited utility for these professors by comparing what they described learning about engagement from the system with their conceptual definitions of engagement. This analysis

examines the possible misalignments between the instructors understandings of engagement and the information available from the LMS.

One form of misalignment I identified among several interviewees was Canvas showing them something about student engagement but not the aspects of student engagement they prioritized or to the level of specificity desired. Interviewee 05 described how they used the LMS to see if their students were doing work. This use of the LMS aligns with the conceptual definition of engagement interviewee 05 described, which emphasized students doing coursework. But, discussing the LMS they described how they did not learn about what the students were doing and experiencing at a deep enough level:

> The [LMS] tools can't tell me whether somebody is having the experience of the course, they can tell me at a basic level. Did they do the thing? Right? They can and, but it's my engagement, like I have to engage with their work to know anything beyond that, right? That I don't see a way to have Canvas tell me whether they're doing the work in the way that they need to be doing.

For interviewee 05, seeing that students have done work did not get at the deeper level of "whether they're doing the work in the way that they need to be doing." Interviewee 05 noted seeing an aspect of student engagement they cared about, but not in a rich and contextual way that they wanted. Interviewee 05 addressed this tension directly noting concerns about whether the LMS captures what is most important about engagement:

> I heard this phrase. "You treasure what you measure," right? So like, I don't want to start valuing things just because it's easy to. Like the amount of time on the screen, or the number of words you wrote, [stuff] like that. Like, I don't want to start to value whatever that is as a thing.

In this excerpt, interviewee 05 acknowledges that while the LMS measures student engagement but in a limited way. As Interviewee 05 summarized it: the LMS could tell them "how long they've been [on the website] or how many words they've written" but "can't tell me whether they're learning."

Interviewees 03, found the LMS (and the third party tools connected to the LMS) somewhat useful but limited. For interviewee 03, their conceptual definition and LMS analytics partially overlapped. To compensate for gaps in the LMS, interviewee 03, described using a video analytics tool that integrates to Canvas, but added that even these were not particularly useful for them:

> So the way that Canvas and specifically the third party tool that manages the integration between the videos and Canvas, the way they record the data is outside my control and is kind of useless in a bunch of ways. So all I have is the number of videos they watched. So I can't figure out if you watched the lecture 5 or 10 times or just once. It's sort of like a yes or no. [...] I wouldn't know which lectures they were. But I wouldn't know when the student watched it. Is it like immediately after? Or is it in prep for finals week or whatever? And I wouldn't know how many times they watched it, or whether they watched the first three minutes and turned it off, or the whole lecture or minute 20 to 25, 15 times. All of that is just a yes, they watched that video.

For interviewee 03, though they were using the LMS to learn about student engagement, what it showed them did not seem meaningful given their definition of student engagement. In their conceptual description of student engagement interviewee 03 emphasized making connections, developing interest, and paying attention. Their critique of the LMS highlights its limitations in learning about these aspects of student engagement. For paying attention, interviewee 03 described how the video analytics showed them whether students watched a video but not how much of the video students watched. In this way, the analytics provided general participation information but not whether the students were paying attention to the video. As interviewee 03 observed, "I wouldn't know if they watched the first three minutes and turned it off." Also, because the video

metrics described if the students watched the video but not when, interviewee 03 pointed out they could learn something about if students were completing work in a general sense, but not if the students were following along in the flipped course and truly participating all along the term, they observed "I wouldn't know when the student watched it," if the students were participating along the course or just watching all the videos "in prep for finals week." Additionally, the video analytics did not capture whether students were making connections or developing interest. So, for interviewee 03, the LMS did not give them deep enough information in one of the dimensions of student engagement that they cared about and missed others completely.

For some instructors the misalignment was not just that the LMS showed them things they did not prioritize or in enough detail, but the LMS showed them aspects of engagement completely outside their definition of student engagement. Interviewee 19 and 12 described below described this scenario, but when asked if the LMS showed them something about student engagement, neither gave a definitive "no" response. Instead, both described the LMS capturing a form of engagement that did not overlap with their understanding. For instance, interviewee 19 said that the LMS really did not help them learn much about student engagement, "not much" they said, adding "most of what Canvas shows is reactive to a task or assignment." They emphasized that Canvas does not give them proactive metrics and mainly just shows them if a student has completed work after the deadline. That interviewee 19 found the LMS not very useful is not too surprising looking at how they conceptually thought about student engagement. Interviewee 19's conceptual definition emphasized students thinking about course content and did not include completing work. So, for them, the LMS told them "not much" about student engagement.

Similarly, interviewee 12 raised concerns that the quantified form of engagement that the LMS presented were not relevant to their writing instruction, observing:

> I don't think that numbers measure accurately in terms of a person's progress in writing. I'm, I don't see I can see progress in the writing. And I don't use numbers or data and

> analytics in that way as a writing teacher. I mean, I can see the value in them and other settings.

In their conceptual definition of student engagement, interviewee 12 emphasized making connections, developing interest, completing work, and questioning. They described finding out about these facets of engagement during their in-person time with their students and through student writing, as they described "much of what I think I measure [about] student engagement has to do with face to face discussion or questions, private conversations, emails. [So] I do skirt Canvas a lot. I try to not include it." Given interviewee 12's preference for in-person learning this makes sense. Plus what numbers canvas did show they considered inaccurate measures of real progress. Like interviewee 12's preference for in-person observation over quantification, interviewee 16 also found the in-person approach more useful. Interviewee 16 said:

> I feel like my engagement indicators come from interactions with students, [so] that I tend not to rely on Canvas so much for that. [...] So yeah, I don't know. I don't know how much Canvas adds there.

In their definition of engagement, interviewee 16 focused on a number of aspects of engagement, including, making connections, completing work, questioning, paying attention, and thinking about course content. For them, they felt like they could observe these things happening in their in-person interactions and so they did not find Canvas very useful. While both interviewees 12 and 16 said Canvas captured something about engagement, it was not any of the themes I identified in the conceptual definitions.

Interviewee 11 described a scenario where the LMS was not particularly informative, not because there was a misalignment between their understanding of engagement and what the LMS revealed but because it only confirmed what they already knew and did not really add new understanding. As they put it:

> I think there are ways that Canvas confirms my suspicion around engagement. There have been times where I'm concerned [about] or questioning a student. Or are they even coming to class? Or they're asking me a question or complaining about something and I'm not sure how engaged at a superficial level they are. And I've used Canvas, rarely, but to check up, you know, are they even getting the material? Almost as a technical thing. [...] I think there are ways that Canvas indirectly without me trying kind of shows me students that are posting questions in the discussion. It usually doesn't give me any new information. It's usually just confirming what I know.

In their conceptual definition of engagement, interviewee 11 included making connections, completing work, paying attention, and participating. Their conceptual description of engagement aligns with what they learned about student engagement from the LMS, particularly whether students were completing work or participating in the course. They describe checking on whether the student is posting questions in the discussion, to confirm whether a student is doing the basics when they approach the instructor with a question or complaint. However, this instructor felt like this check is perfunctory, confirming what they know about students—though they did not elaborate how they already knew whether a student was posting questions or attending. The LMS covered some but not all of the aspects of engagement relevant to interviewee 11.

The last source of misalignment I identified is when the LMS was additive to the professors conceptual definition of engagement. In the case of interviewee 21, they defined engagement one way and then, when discussing the LMS, broadened their definition to include another aspect of student engagement. In their conceptual understanding of engagement, interviewee 21 mentioned questioning, thinking about course content, and participating. However, learning about any of these from the LMS. Instead, for interviewee 21 the LMS was useful for understanding peer engagement. As they put it, “I think for our class right now, student engagement would be mostly between

students," which broadened interviewee 21's definition of engagement to include interacting with peers.

Interviewee 21 taught several blended and fully online courses, so for some of their classes peer interaction would take place online more than in an in-person class. Interviewee 21 described how the LMS " helps me get like, I think a flavor of their digital engagement with each other, their peer engagement. [...] Like I get a sense of who's friends, like who you know, who's working in the small group." But they added that the LMS was limited because the in-person format was more informative in this respect, as they said "but, you know, I think in terms of just social nuance, it's the face to face that I'm learning most things from." To this extent, the dimensions of engagement that interviewee 21 mentioned in their conceptual definition were not brought up at all in terms of what they learn from the LMS, but they did expand their definition of engagement and described another dimension of engagement that the LMS did help them understand.

Overall, these instructors described the LMS capturing some aspects of engagement, but not with sufficient depth or relevance. In Table 5.4 I compare these instructors' conceptual understanding of engagement (see the top, highlighted row, for each interviewee) to what they described the LMS showing them (see the bottom row for each interviewee). The numbers indicate the number of instances I identified that individual mentioning that particular concept. The table shows how for interviewees 03, 15, 19 and 21 there was no overlap between their conceptual understanding of engagement and what the LMS showed them about student engagement. For interviewees, 05, 10, and 11 there was a partial overlap. But they described limitations in the depth of what the LMS revealed. Similarly, interviewees 12 and 16 did not find the LMS informative and did not mention it revealing any of the aspects of engagement highlighted in the conceptual definitions.

Table 5.4 — Comparing Professors Understandings of Engagement to the LMS Instantiation

interviewee	making connections	completing work	questioning	developing interest	paying attention	thinking about course content	participating	interacting with peers
03	2			3	3			
05		2						
10		1	1			2		
11	2	1			3		1	
12	1	4	1	2				
15								2
16	1	2	1		1	1		
19						1		
21			1			1	1	

5.2.3 "Yes": Engagement as captured by the LMS

Despite the misalignments I described above, between the instructors' conceptual understandings and what the LMS revealed about students, many of the instructors still described learning something about student engagement from the LMS. Across these discussions about what the LMS reveals about student engagement, three major topics came up consistently, including students' online activity, assignment submissions (i.e., turning in work), and grades. In the Table 5.5, I summarize the prevalence of these three topics—online activity, work submission, and grades—by highlighting the cell in the participant's row if they discussed that topic. This table

includes only the subset of participants that described the LMS as useful for learning about student engagement. The percentages indicate how many of these 13 participants talked about that topic. Online activity was discussed the most (9 participants), then work submission (7 participants), and grades (4 participants).

Table 5.5 — How the LMS Presents Engagement

Interviewee	online activity	work submission	grades
	70%	54%	31%
interviewee_01	■	■	
interviewee_02	■	■	
interviewee_04		■	■
interviewee_05	■		
interviewee_06	■		
interviewee_07	■		
interviewee_08	■	■	■
interviewee_09			■
interviewee_11		■	■
interviewee_12		■	
interviewee_15	■		
interviewee_16	■	■	
interviewee_18	■		

Online Activity. The interviewees most often discussed LMS features that summarized students' online activity; this set of features were mentioned by 70% of the professors as a way to see their students' engagement based on the logs of students' online activity. As interviewee 01 put it, "what I look for mostly is just to make sure that they're on the site." These online activity features show both which parts of the LMS course site the students access as well as how much time students spend on various parts of the LMS course site. Interviewee 19 mentioned seeing which parts of the course sites students accessed, noting:

> Canvas will tell me how much a student has been logged into the class. Canvas will tell me what content areas or what module areas the student has been in. I can go into Canvas and see how a student has progressed through modules, if they've clicked different links.

While interviewee 18 described seeing how much time students spent, noting, "one option to show us how students are engaged, [is] seeing how much time they spend on Canvas." Across the 15 interviewees that described learning something about student engagement, 12 of the interviewees described online activity features of the LMS as a way to see student engagement.

In particular, the LMS ability to reveal students' online activity was related to the concepts of participating and completing work. Interviewee 05 described how the LMS showed online activity and emphasized its importance to engagement, saying:

> I guess it goes back to what I was saying earlier, like, is the work getting done? Right? Are you here and doing the work? Because to me, that's what's important. It's that you, you're keeping up with the work, you're doing the work.

Depending on how the course is set up, the LMS could log various student actions and this may give instructors a perspective beyond whether students were participating and completing work. For instance, doing course readings was described as important to students developing interest and thinking about course content. Some instructors may infer from the logs of students accessing modules with reading or links to assigned readings, that students are engaged in terms of interest and thinking more deeply.

But, these inferences remain somewhat blunt and noisy. Several of the instructors raised questions about the precision and accuracy of the online activity logs. As interviewee 02 put it, the LMS activity logs "tell me how much time someone is spending on that Canvas page, but also that could just be [because] someone has it open in the browser and isn't like actively on it." This question probes how the activity log metric is composed. Interviewee 02 was well informed about how the online activity metrics were calculated, so they chose not to read too much into the

metrics. Alternatively, interviewee 07, who knew less about how LMS would calculate online activity also wondered if the metric was valid: “Maybe [the LMS shows me] how long they spend on the website on Canvas? I don't know if that's a good measure of their engagement or not.” Interviewee 05 gave more in-depth consideration to this issue. They described an instance that week when they had been looking at online activity metrics about their accuracy:

> I looked at whether that student had even looked at the Canvas site. And then I found myself looking up and down the column just to see my other students, like, how long they had [been on the site]. Because [the LMS] shows you how many hours a student has been on the site. And then I got to thinking: how accurate is that, really? Like, you know, you could open it and just leave it open and walk away and make a sandwich. And you know, it doesn't mean that you're actually reading what's on the page. It doesn't mean you're watching videos. It doesn't mean you're spending that time actually drafting any work. Although I don't know, I don't I don't know exactly how Canvas calculates that number. I'm suspicious of it, I guess is what I'm saying. It falls in that category of, like, I don't want to develop theories about [student engagement] like, "Oh, you've been on our Canvas site for a long time you, you must be a diligent student." Because I don't think that's true.

In this excerpt interviewee 05 is questioning both how the LMS may imprecisely capture students' online activity—“how accurate is that, really? Like, you know, you could open it and just leave it open and walk away and make a sandwich.” But at a deeper level, interviewee 05 is questioning whether online activity itself, even when correctly calculated, indicates student engagement.

This latter question raised by interviewee 05 is interesting to me, particularly as it relates to the trade-offs of surveillance. The instructors described a variety of student actions captured in the online activity logs, such as interviewee 06 saying, “I can look to see when the last time you looked at the gradebook, and how many times you looked at it, but that's like, I mean, and I can look to see how many times you've accessed something” and interviewee 16 saying “if I want to go look and

see if they're accessing readings, you know, or things like that—I can look." But despite talking about what instructors could see about students, my interviewees did not describe this ability to see their students as a form of surveillance or imposition.

Work Submission. Among these interviewees, 54% talked about how the LMS shows them students submitting work. They described this way of seeing student engagement in the LMS in terms of seeing whether assignments were turned in or missing, as well as the timeliness of the students' work. This ability of the LMS most strongly relates to engagement in terms of the concept of completing work.

Most of the interviewees discussing students submitting work described this as a rather basic LMS feature. Interviewee 04 put it, the LMS "definitely" shows the engagement in terms of "whether [students] are turning in papers or not. [...] That is the most obvious way [it shows engagement] I would say. Similarly, interviewee 11 said:

> I think that [at a] kind of basic level [the LMS] just shows me they're turning in their essays. I can kind of monitor that and when they're turning in stuff and it's recorded. Yeah, I think also as the professor, I can kind of get a feel for the whole class around things like that in an instant.

As interviewee 11 described, work submission gave an overview of the class and their engagement. Interviewee 02 also used this approach to see engagement at the class level, noting "I can see how many assignments students have been doing in both the classes." In this way, interviewees 11 and 02 are themselves aggregating patterns of assignment submissions to get a sense for their classes level of engagement. Work submissions, viewed in the gradebook, assignment submission summaries, or speedgrader, can also be used to see individual students' work submissions. Which is how interviewee 01 described learning about one student's engagement, describing how they looked at "if they've turned in things and what time they've turned them in."

Here, interviewee 01 also touches on the timeliness of work submission. While getting behind was discussed more in terms of student risk status, participating and doing work also require doing things along the course timeline. Interviewee 16 described this, saying, "If Canvas shows me anything, [it] is showing me: Are they turning in work? Are they turning it in on time? [...] I think as far as the, like, turning work in or getting working on time, that's helpful for me [to learn about engagement]." Likewise, interviewee 12 also said the LMS showed them "timeliness in terms of their submission of assignments and the writing that they've produced." However, work submission in terms of what students have missed or have turned in late identify low engagement after it has happened. Interviewee 19 mentioned this, observing, "whether the assignments are in or not, that's also very reactive." Here interviewee 19 described the ability of the LMS to identify engagement through work submission as reactive rather than proactive and useful.

Grades. Finally, grades was a way that 31% of the interviewees described the LMS indicating student engagement. For interviewee 09, they described the LMS as showing them student engagement simply, stating, "it tells me what grades they are getting—just grades." For interviewee 06, they found that the LMS "doesn't do a great job" of helping them learn about student engagement besides checking on students' grades. These reserved responses make sense given that grades were not a featured aspect of student engagement in the conceptual definitions. While completing work was discussed as a facet of student engagement and completing work is necessary for grades, there is an indirect connection between engagement and grades.

Alternatively, interviewee 19 used grades as a comparative indicator of student engagement. As they put it, "I can see overall how students are performing and how that performance lines up with other people in the class." For interviewee 19, the level of a student's engagement was indicated in the LMS in terms of whether a student's grades were higher, lower, or on par with other students.

Finally, rather than grades an indirect or comparative indicator of student engagement, several instructors described how the process of entering or marking grades itself gave them a sense of student engagement. Interviewee 04 described how they learned about student engagement through the LMS when they were "putting down grades and [doing the] arithmetic of grades." But they added that they did not see this as particularly useful. Alternately, interviewee 11 described seeing student engagement in the LMS in the gradebook. They described the process they would follow for a given assignment, starting with, "[the students] turn in the assignment. And then you [the instructor] click on it, and you [...] can mark it up and all that and it goes right to the gradebook. That seems like a minor obvious thing, but it's actually really helpful." In this process of marking and recording grades interviewee 11 felt they got a sense of engagement, though they did not elaborate which aspects of engagement this revealed. I am inferring that they learned about the completing work aspect of engagement.

Overall, the main ways the LMS indicated student engagement was in terms of online activity, work submission, and grades. In general these facets of engagement only partially captured the aspects of engagement that were important to the instructors. Based on the instructors' experiences, the LMS could help them learn about engagement in terms of whether students were completing work, paying attention, and participating, to various degrees. But overall, the LMS' ability to show online activity, work submission, and grades limited its ability to reveal whether students were making connections, questioning, developing interest, or thinking about course content. Notably, the LMS does have tools to promote peer interaction, which was an important aspect of engagement in the professors' conceptual definitions. But only one of the interviewees highlighted this feature of the LMS to learn about or promote student engagement, and as I mentioned previously interacting with peers was not even a part of interviewee 21's definition of student engagement. In the next section I move on to consider similar questions about the LMS and student risk status.

5.3 Seeing risk status with the LMS

I asked the instructors if the LMS helped them learn about their students' risk status—whether students were at risk or not. The responses were split, nearly half found the LMS useful and the other half did not. And, like with engagement, most of the instructors also qualified that when the LMS could inform them about risk status it was limited in how much it told them about student risk status. Below, I first summarize the perspectives of the half of the instructors who did not use the LMS to learn about student engagement. I then summarize the remaining instructors' descriptions of how they used the LMS to see whether students' being at risk or not.

5.3.1 "No": The LMS is impersonal

Almost half of the participants (10) reported that the LMS was not helpful in learning about student risk status. As interviewee 06 put it, "[The LMS and its] new analytics? So far it has failed me." I summarize the responses of the nine professors that reported that the LMS was not useful for learning about which students were at risk in two groups. The first group (interviewees 09, 11, 12, 15, 18, and 21) described relying primarily on interpersonal connections to find out about which students were at risk rather than the LMS. The second group (interviewees 5, 7, 11, and 13) gave various reasons for why the LMS did not inform them about students' risk level. (Note that interviewee 6 is not included in either group because they did not elaborate on the response described above. Also, interviewee 11 fits in both groups.) I organized their responses around the concept that how a professor uses the LMS impacts the resulting risk analytics. Illustrating this theme, was interviewee 13 who, when asked if the LMS helped them learn about at-risk students, said, "I don't believe so. Not the way I'm using it, no."

The professors emphasizing that personal connections are the primary way to learn about student risk status shared the perspective that the LMS misses critical aspects that in-person interactions capture. As interviewee 21 put it, learning about students being at risk requires

"human talking to humans." Among these instructors the LMS was seen as too impersonal and inhuman. Interviewee 11 highlighted this point, noting:

> I think in general, [risk status] is not really something that I can get from an interface. Like to see that a student is at risk I kind of need to see them or have some personal contact in some way. Or some information that they're probably telling me in private or something like that.

Across these responses the instructors described various ways that personal contact could help them learn about students, including office hours, TA interactions, one-on-one conversations, and in class observations.

Interviewee 09 emphasized an interpersonal way of learning about students' risk status through their teaching assistants (TAs). In their class the TAs got to know the students well and so interviewee 09 described relying on their TAs to inform them when problems arose. This instructor also delegated a lot of the LMS management to their TAs as well. Interviewee 09 stated that the LMS did not inform them about student risk status, noting, "I don't think it plays much of a role." Interviewee 09 acknowledged that they may go in and learn about students' performance in the gradebook, saying "I have to go into the gradebook and look at low grades. But the TAs are pretty diligent, they can tell me if somebody is in trouble." They added that rather than relying on the LMS, they expected their TAs would alert them if a student was at risk. Elaborating on how the TAs informed them about their students being at risk, interviewee 09 added:

> The TAs have to be, you know, they're in the front line. So they're the ones who have to [look out for at risk students]. If there's a problem or something like that, then they're the ones who help, the student will see [them] first, but Canvas I don't think it plays much of a role.

In interviewee 09's classes, the TAs had personal insight into how students were doing.

For interviewees 12 and 18, they focused on their own experiences with students to figure out if a student was at risk. Interviewee 12 relied on their own senses to identify at risk students. For them, the LMS could not show them students' risk status "beyond what they've written and submitted or not, which might show me that some people are slipping or are losing sort of control of their schedules." In interviewee 12's writing classes they preferred to learn about their students through the observations they made in class and interactions in office hours, as they put it: "I certainly wouldn't rely on [the LMS] to help me determine if a person was at risk. I have to rely on my senses. You know, Canvas doesn't capture sensory stuff." For interviewee 12, the LMS lacks affective, sensory dimensions that are necessary for identifying if a student is at risk. Similarly, interviewee 18 prioritized office hours as a way to tell if students were struggling:

> I don't think Canvas itself helped me to tell which students are at risk. [It shows] the grades of their exam or the engagement during the class. But, I mean, whether they join office hours and those help me to tell.

For both these professors, though they were aware that Canvas showed them grades or what was turned in, they preferred to rely on their own senses based on interactions with students.

Similarly, interviewee 15 also prioritized personal connections to find out if students were struggling. Interviewee 15 highlighted their ability to judge if someone was at risk from conversations. For them, the LMS was not useful but conversations were important:

> [Whether a student is at risk] is sometimes you learn by talking directly with students who trust you enough or are in a bad enough place that they have to come and tell you things. But that's just more one on one.

The conversation format, interviewee 15 noted, is one on one and does not give instructors access to many students at once. To see across students, interviewee 15 added that they might look at assignments:

> You can judge [risk status], you know, by what's going on there with their assignments. [...] If people are doing really poorly that helps you see if people at least are at risk in terms of performing for the class. That definition of at risk.

But, despite noting that poor work performance is a form of being at risk, interviewee 15 added that Canvas did not help them learn about students being at risk, even though the LMS collects students' work.

The next group of instructors gave various reasons that the LMS did not help them learn about students' risk status. I have clustered these responses based on the idea that how the LMS is used influences whether it is useful for learning about risk status. As interviewee 11 said, "I think Canvas does a better job of telling me and confirming who is engaged [rather than identifying] the truly at risk ones. [With that] it doesn't do as well. At least the way I'm using it." For interviewee 05 the LMS did not help them look at work in the way they wanted and for interviewee 07 using the LMS to set up courses took a long time and did not leave time for considering additional analytics.

Interviewee 05 also discussed how they could tell if students were at risk based on their work quality. Overall, interviewee 05 did not think they could use the LMS to learn about if their students were at risk, stating, "Honestly, I don't think so, no—except to the extent to which I view the students' work through Canvas, right?" For interviewee 05, looking at student work was important, but not something the LMS excelled at. Interviewee 05 elaborated that there is an efficiency to using the LMS to see all the students at once: "compared to a to without an LMS, I think the amount of work I can see and get through fairly efficiently, it's more like a fire hose of information as opposed to a trickle." But this efficiency came with a trade-off that grading in the LMS "flattens" and depersonalizes the students: : "Canvas flattens and students out. Like, all their work kind of looks similar, right? Whereas handwritten stuff like you could be making all sorts of subconscious judgments." Ultimately, interviewee 05 felt with the LMS they were working more efficiently but learning less about the students as a result, adding:

> The work [grading] gets shaped by the tool rather than me doing doing it the way I would kind of prefer to do it, which would be to like to highlight something and say like, here, here, you're doing this right, which is what I do when students turn in, you know, files or just text. As far as I don't I honestly don't know, I don't think there are ways that Canvas is making me see at-risk-ness or not.

Interviewee 05 observed that when they interacted with their student work in ways they preferred they were closer to the students' work. This closeness gave them a better sense of whether their students were at risk that for interviewee 05 they did not get using the more efficient grading tools in the LMS.

Interviewee 07 stated "no" when asked if the LMS shows them anything about which students are at risk. They elaborated that the LMS didn't help them in particular because they did not have time to do "analysis" in addition to instructional activities:

> Not really. Again, these are time commitments. While we're teaching—and we're not only teaching, of course, we have to do research and service and other things—my role as an assistant professor of teaching is to help students learn and do well in these classes. So I'm doing my best to provide the material. So I spent a lot of time thinking of ways to present the material [and preparing these resources. I just really put lots of time in creating my Canvas course. The Canvas took a lot of time. And putting in just those modules and putting those pre-lecture and post-lecture assignments, pre preparing worksheets, and with their questions, explanations, and we have just the additional all the assignments I create for them to practice for midterms. There are many things that we have to put together. In addition to this, really, there's not much time to do analysis.

But interviewee 07 was not disinterested in exploring analytics related to student risk status. They continued to discuss in detail how the LMS was not easy to use and how it could more usefully inform them about students. Interviewee 07 said the LMS should "make it easier for the faculty" by

sending “weekly reports or monthly reports” or “an email reminder with a link, you click the link, you see this just an article, you see that just the analysis and probably the program you'll tell ‘okay, these students are at risk.’" Overall, interviewee 07 described being at capacity with the instructional aspects of their course, they wished the LMS provided them easier ways to learn about their students, beyond the current analytic offerings which they described as just “just averaging things [...] that's an easy thing that I can determine myself.”

5.3.2 “Sort of”: Risk concepts the LMS does not capture

In contrast to the professors that did not find the LMS helpful in learning about their students’ risk status, the others gave responses ranging from a qualified “sort of” to an emphatic “yes.” Interviewee 19 illustrates the former, noting that the LMS helps them learn abou risk status “if I look hard enough.” To understand the qualified responses like this one in more detail I analyzed the instructors’ use of the LMS to identify misalignments between conceptual understandings and what the LMS showed—like I did with the concept of engagement. However, compared to engagement, in the context of risk status the interviewees did not seem as aware or worried about conceptual and LMS misalignment. In part, I think this is due to the fact the interviewees discussed so many ways that students could be at risk. Given the variety of ways students may be at risk, if the LMS only identified some of these ways, that information may still be useful for instructors. Further, some of the ways that the professors conceptually defined students being at risk—such as institutional, health, or safety ways—were considered beyond the scope of a learning management system. So, it is possible that there were no expectations for the LMS to capture whether students were at risk in these ways. Interviewee 04 touched on this idea, saying:

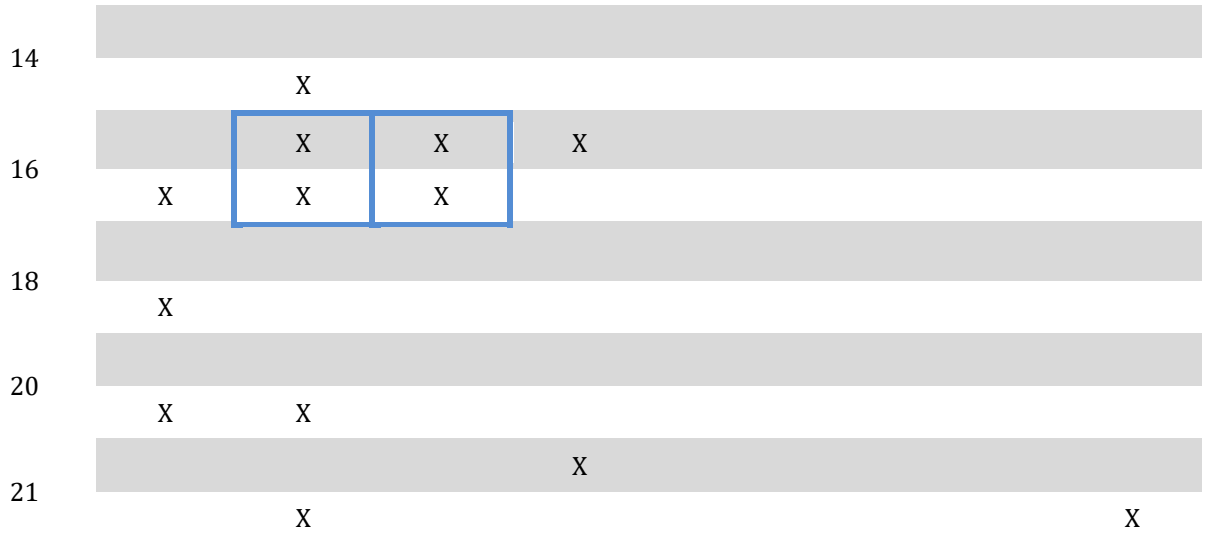
> So I think [the LMS] does [show risk status} in the sense of just [...] one form of risk. It indicates that someone might be having a problem in that class. It doesn't really tell you about other kinds of problems, or overall if they're doing because you can't look at any other classes at the university, [or] general kind of at risk.

So, what forms of risk does the LMS capture?

Table 5.6 below identifies the conceptual facets of being at risk that instructors described learning about with the LMS, including doing coursework poorly (5), not doing coursework (8), not attending (2), not seeking help (2), not engaging (4), academic preparation (1), feeling intimidated (1), and feeling overwhelmed (1). These concepts are also a subset of the ideas that were a part of the professors' conceptual definitions. Table 5.6 compares, at the individual level, which concepts were mentioned in conceptual definitions compared to which concepts were made visible through the LMS. Here I am only focusing on the subset of concepts that participants discussed in relation to the LMS. I focused on this subset to analyse overlap or misalignment between participants conceptual definitions and LMS experience.

Table 5.6 — Comparing Professors Understandings of Risk Factors to the LMS Instantiation

interviewee	doing coursework poorly	not doing coursework	not attending	not seeking help	not engaging	academic preparation	feeling intimidated	feeling overwhelmed
01		X				X		
		X		X				
02				X				
	X							
03								X
				X				
04	X		X	X		X		
		X						
06				X		X		
		X			X			
08		X						
	X				X			
10								X
					X	X	X	
11								
		X	X		X			



As Table 5.6 shows, there was almost no alignment between the concepts used to define risk status and what the LMS showed participants. Columns correspond to codes; pairs of grey and white rows correspond to participants. For each participant the top, grey rows show concepts that participants described in their conceptual definitions while the bottom, white rows show concepts the interviewees described learning about from the LMS. As Table 5.6 shows (boxed-in in blue), only interviewees 01 and 16 learned about concepts referenced in their conceptual definition. Despite this ostensible misalignment, the interviewees summarized in Table 5.6 agreed that the LMS showed them something meaningful about whether their students were at risk or not. Overall, there seemed to be less concern about this misalignment than with engagement. So, the misalignment between concept and LMS did not appear salient among these interviewees.

The LMS showed coursework-related aspects of risk including doing coursework poorly, not doing coursework, and academic preparation. Interviewee 16 gave an example that that explained how the LMS helped them observe risk status based on students work:

> I feel like in the classes where I see their work more often, it's way easier for me to, like understand, like, who might be at risk of not passing or doing as well in the course as they want to a lot faster than in like the 101 class where it's like, we had our project proposal, and now they're turning in their next project next week. And I'm like, that's week 6, you

know, like there's this kind of big gap in time, you know, problems could have been brewing or you know, issues could have been developing in that time. I don't know about it yet because I haven't seen their work. Um, so that's one reason I tried to do the weekly check ins like, what are three things you've learned, what's a question you have. Because then I can gauge that a little more accurately.

In interviewee 16's course they looked at student work quality to get a sense of if the students were on track versus if there were "problems brewing." This use of the LMS fit interviewee 16's definition of risk status which included not doing coursework and not attending. Doing coursework poorly and not doing coursework are discussed in more detail in the subsequent sections on word submission and grades.

Interviewee 21, described how the LMS could show them students missing work and help identify students feeling overwhelmed. In the example below, they started with the LMS and looked at work, but then consulted other sources (e.g., talking to the students) to understand that their students were feeling overwhelmed:

I think [the LMS] does offer a really useful snapshot of what students are doing and aren't. And maybe things that students are having a tough time with, whether it's time management, you know, sometimes that's an issue when everything is stacked together. Or if they're, I mean, some students I've found out last week, you know, some people are just overwhelmed right now. And so that we were able to get a little more information and talk with a student, you know, and figure out like, hey, like, last quarter, you were super, you know, like, on top of it, like, Are you okay, now? And so he was, you know, really open after somebody asked him, like, you know, I'm feeling like, there's just a lot happening right now.

In interviewee 21's definition of risk they spoke mostly about students not seeking help. But still found the LMS useful when it helped them identify at risk status based on not doing coursework, which ultimately identified a student feeling overwhelmed. I think this fits with their perspective on

not seeking help because the LMS, in essence, identified as a student not seeking help that ended up getting support because the instructor saw missing work in the LMS.

For comparison to these topics that occurred both in the conceptual definitions and discussion of how the LMS revealed risk status, the other conceptual topics that interviewees used in their definitions of being at risk but did not describe learning about in the LMS are summarized if Table 5.7. Primarily, personal issues related to health and safety (e.g., family crisis, anxiety, mental health) and student demographics occured in the interviewees' descriptions of ways that students may be at risk but were not ways that the LMS identified at risk students to these professors. For several instructors, these concepts that could not be seen in the LMS were still important to consider when interpreting risk as revealed in the LMS. For example, interviewee 08 described tempering their interpretation of risk-status in the LMS in the context of students prior academic preparation, disability, or home life:

> I try not to make assumptions [about being at risk] until I've talked to them. Because there could be so many things. You know, it could be things at home, it could be, it could be a disability that they haven't even identified. It could be, it could be that they weren't ready for this class. You know, it could be that they jumped into this class that maybe they were mis-evaluated when they first came to UC Davis and they were put in a higher level class and they were really what they're ready for.

As Table 5.7 shows, there are a variety of ways that the LMS does not show risk status and thus limit instructors interpretation of the risk indicators that are identified in the LMS.

Table 5.7 — Risk Factors the LMS does not Capture

Changeable	Fixed (personal)	Fixed (demographics)	Emotional
body language	personal issues	international	mental health
getting behind	family crisis	first generation	anxiety
over engaging	health and safety	low-income	sense of belonging
		transfer	adrift in life
		minority	frustration
		gender	stress

5.3.3 "Yes": Risk Status as captured by the LMS

At the other end of the spectrum from "sort of" were several responses that gave unqualified support to the idea that the LMS helped them learn about student risk status. For example, interviewee 16 said, "Oh, absolutely. I would say definitely that is helpful. I'd say that is one area where the Canvas has been incredibly helpful for me. It's just [great] having that kind of data available." Among the ways that the LMS helped instructors learn about students' risk status were online activity, work submission, and grades. These are the same themes I identified in my analysis of how the LMS helped instructors learn about engagement. For risk status, however, the relative importance of each method was different. Additionally, the theme of emailing and reaching out to students was uniquely salient for risk status. I describe the perspectives of the instructors around these four areas—work submission, grades, and emails—to describe how the LMS helped these professors learn about their students' risk status. I first discuss the three areas that overlap with engagement before describing the theme of emailing students.

In Table 5.8, I summarize which participants (in the rows) talked about each theme (in the columns). If a cell (a row and column intersection) is highlighted, that indicates that that particular interviewee discussed that theme. The email column is grey because these are responses to observing a student being at risk using LMS. The other columns are ways of seeing risk status in the

LMS The table below shows the prevalence and co-occurrence of these topics among the subset of interviewees that described ways of learning about risk through the LMS. Among these 12 participants, emails were discussed (7 participants) and work submission (7 participants) were discussed the most, then grades (5 participants), and then online activity (2 participants). The percentages describe these prevalences as the proportion of this subset that talked about each theme.

Table 5.8 — How the LMS Presents Risk Status

interviewee	online activity	work submission	grades	email
	17%	**58%**	**42%**	**58%**
interviewee_01	■	■		■
interviewee_02			■	
interviewee_03			■	■
interviewee_04		■		■
interviewee_06	■	■		
interviewee_08			■	
interviewee_11		■		
interviewee_14		■		■
interviewee_16		■		■
interviewee_18			■	
interviewee_20		■	■	■
interviewee_21				■

Online Activity. Online activity was the most prevalent theme I identified related to seeing engagement with the LMS, with 70% of the instructors discussing it. In contrast, for seeing risk, the ability to see online activity was only important for two out of 12 interviewees, with 17% discussing it. Interviewee 01 briefly mentioned that the LMS only showed them if "they're not logging in." Interviewee 06 elaborated further in a qualified response about LMS' utility to learn about students' risk status, noting that they did not see much:

> Unfortunately [not] with Canvas, alone, so if I don't, in the online class, it's really kind of awful. The only thing I can see as a student hasn't touched anything or has had very little engagement. I have found that it's actually incorrect.

For them, particularly in online classes, since the LMS did not show much they did not know much about student risk status. They described how the LMS showed if a student "touched anything" in the online system as one of the only things they could see. But even this was not reliable in their experience. They added:

> I've reached out to students where [the LMS] says they've had zero interaction. And they're like, "What are you talking about? I just did this, this, and this, and this." I'm like, "Oh, well, you did." So it makes me look stupid because it's incorrect. So even that's not, I can't rely on that either. So I no longer do.

Based on this experience, interviewee 06 stopped using the online activity metrics as a way to identify at risk students and started looking at work submission: "I engage in these stupid little low stakes quizzing, because that's the only way I know if they're interacting in in the with material. So that's what I rely on." Beyond this, none of the other instructors described using online activity to learn about risk status.

Work Submission. Work submission was discussed by 58% of the instructors that used the LMS to learn about students' risk status. This is similar to the 54% of instructors who discussed work submission in the context of learning about students' engagement. In the context of seeing if students were at risk, considering work submissions mainly took the form of checking for absent work. Interviewee 14 put it like this, "the only thing that Canvas can tell me about whether someone is at risk is if I look and see "oooh, this one has several assignments missing, what's up with that?" Echoing this perspective, interviewee 01 said, "all it can really show me [about risk status] is that they're not doing the minimum work: they're not logging in; they're not turning on the assignments." Seeing if students were missing work entirely was a strong indicator for these

instructors of whether students were at risk or not. Interviewee 11 described an extreme form they might identify from the LMS, when their students had essentially dropped out of the class, describing students that were "not turning in work, skipping essays" and ultimately having "essentially dropped the class, but they're still on Canvas. [...] they're the ones really at risk."

Part of the discussion of using work submission, particularly missing work, to identify at-risk students emphasized that this was a particularly quick and easy way for the instructors to see whether students were struggling or not. Interviewee 16 said, "it's really easy for me to just check really quickly, you know, who still hasn't turned something and it [is] like flipping through a stack of papers, you know, and trying to figure out like, is something missing?" For them, the LMS provided a way to virtually flip through students' submitted work to see if anything was missing. For interviewee 04, seeing missing assignments was the most apparent way to see if students were struggling:

> And you would see [risk status] from missing assignments, mainly. Or dropping assignments, or something like that. Which you might see anyway if there was no [work submitted in] Canvas. I think missing assignments are particularly obvious because there's a blank and everything else is numbers and that I often go back and say okay who has these blanks and why?

Interviewee 04 is referring to looking in the grade book to see missing assignments. Visually, when an assignment is blank it stands out to them easily and prompts them to consider why a student may have multiple "blanks."

However, not all instructors fully endorsed the idea that missing work or blanks in the grade book indicated which students were engaged. As interviewee 11 observed, "there are students who might just be not turning in work or not engaging with [the class], that doesn't mean that they're necessarily at risk. Maybe they are, maybe they're not". But for the most part, the interviewees described missing work as a strong signal that students were struggling.

Grades. Grades were discussed by 42% of the instructors that used the LMS to learn about students' risk status. This is close to the 31% of instructors who described grades as in the context of learning about students' engagement. Professors said things like, "passing grades are still the traditional way to tell [if someone is at risk]. You rely on the traditional way to tell whether students are engaged or not, or at-risk or not." As professor 18 put, grades are a traditional way to tell if someone is both engaged or at risk. Instructors described looking at the grade book as well as individual quiz or assignment grades. There was some overlap between work submissions and grades. Interviewee 20, for instance, described both in conjunction when they described how they used the LMS to see risk in quizzes:

> I look at the highest grades, most students got full credit. But one student who's a poor performer did not even submit one. And so, so kind of tracking, you know, halfway through the quarter, and you know, what's going on, because you're losing a significant amount of points. So that person is at risk of my class.

Interviewee 20 illustrates the connection between work submission and grades; they first identified a student based on not submitting work, but then identified that student as at risk based on their grades ("losing a significant amount of points").

Some of the instructors described using grades in the context that the LMS did not tell them much about being at risk, and described grades as the only, limited thing that they could learn about students' risk status. Interviewee 03 said they learned about risk in the LMS "only in terms of grades" and interviewee 20 said "just based on grades or not completing assignments." Others described grades not as the only way to see risk status but as the easiest. Interviewee 02, for instance, said "I think the gradebook [is] the most straightforward way to identify students that could have something going on. Looking at the grades for a certain assignment and seeing who performed below X amount of percent [is how I see who is at risk]." For interviewee 02, comparing students in the gradebook was the easiest way to see risk.

Some instructors also described seeing low grades as an initial indicator that they would follow up and explore in more depth. Interviewee 02 said that they would start by "seeing who performs below a certain amount on the exam" as an initial indicator of risk, then they would follow this by exploring specific aspects of performance by "going into the actual quiz on Canvas because it was built to Canvas and see the questions." Similarly, interviewee 08 described using the quizzes as a starting point, saying they looked at "how well they do on quizzes, because I keep quizzes pretty simple and if they're not doing well on quizzes, then there's a problem." But given performance on quizzes they would also consider a student's "work quality and the discussions" to add depth of understanding in addition to grades.

5.3.4 Emailing Students: A response to identifying at-risk students

Emailing and responding to students based on their risk status was a major topic discussed by the interviewees in the context of how the LMS helped them learn about at-risk students—58% of the interviewees touched on this theme. Emails were not a way that professors used the LMS to learn which students were at risk, rather emailing was the response to finding out who was at risk using the LMS. Essentially, the instructors in these interviews described emailing students as a primary way they would react to seeing which students were at risk in the LMS. In this section I describe emailing as well as the other responses that instructors would take once they identified at risk students.

Instructors described seeing missing work or low grades as prompts that might lead them to send an email to students that they perceived to be struggling. Interviewee 21 summarized this process, saying:

> If I'm scrolling through and somebody has nothing and hasn't turned in anything, that will prompt an email from me. Just, you know: "hi, how are you? Let's, you know, I'm just noticing this and this, and this is missing, like, Can I help you?" So I think Canvas can give you a quick snapshot of what people are not doing.

Interviewee 21 described scrolling through the gradebook, noticing students were missing work (work submission), and this prompted an email response. Interviewee 16, alternately, described sending emails based on attendance:

> The attendance thing I was talking with you about earlier, like, it's really easy for me to see, like, how many students have been in touch with me about needing to miss how many students have just missed, you know, if a student's late all the time, you know, that just gives me, you know, a way to, like, start a conversation with them.

When interviewee 16 would see students missing class a lot they would reach out and begin a conversation.

I was interested if these emails and conversations were working for these instructors. When I probed this, they described varying degrees of success. For some, it was successful. Interviewee 01 described making connections with students that wanted help but had been too embarrassed to ask, saying “If they're fully disconnected, then I'll email them and see how they are.” Interviewee 01 continued, describing a particular student when this worked:

> I reached out to him and when he finally would talk to me about it, he was like, “Oh, I was just too embarrassed to turn it in.” Right? And I'm like, you know, I think, and I've done this with a couple students who, if I reach out to them, they'll say, "Oh, I'm so glad you reached out because I meant to write to you but I was too embarrassed."

In this instance, emailing the student worked to help the student to ultimately succeed in the course. But interviewee 04 described another possible outcome.

> I'll contact the student. First of all message them through Canvas, to very little results. If they're in class I ask them to come to or I send them an email. Yeah, so I definitely, in seeing multiple blanks, especially by the time of the midterm, you're like, everyone should have all these things.

In interviewee 04's case, seeing uncompleted assignments in the gradebook at critical course times prompted sending emails, but they responded that they did not get much of a response.

The instructors' consistent description of seeing low grades or missing assignments prompting an obligation to reach out to students interested me. It places responsibility on the instructors to do something based on noticing indicators of at risk. This sense of obligation was not a consistent theme in relation to engagement either, this seems to be specific to risk status. Of course, not all instructors took this responsibility on themselves. On exception was interviewee 03, that described how they wanted students to take on the responsibility to recognize if they were at risk and to reach out for support:

> The students kind of need to self-identify whether or not they think they're at risk, right? Like, if you want to talk about your grade, I believe that I'm approachable. And I get some good student feedback on my evals about my, you know, feeling like they're comfortable with me and stuff. And so, I try to be explicit about, like, if there's stuff you want to talk about, like, shoot me an email, and we'll set a time, you know, but I want them to do that, like, I'm not gonna reach out to you and tell you, I think you're struggling. You know, like, if you don't think you're struggling, all right, like, right. And that's partly because like I said, I can't take a personal hand holding approach with every student who's failing the class, because it's a large number.

Interviewee 03 was the only professor I talked to that had shifted the responsibility to respond to being at risk or struggling to the students. The other professors all had some sense that reaching out to students was their responsibility.

For example, exploring what instructors' responsibility is if they see students are struggling, interviewee 14 described students reaching out to them at the end of the term and asking about extra credit. Their response to such students gives an insight into how they feel about their responsibility:

> And then I say to them, there's nothing you can do. Because if there were something to be done, we should have done it in week four [not week 10]. Right? And so unless I'm actively monitoring that situation, which I do and sometimes I don't—I don't, because again, there's a lot of people here— [I'll miss which students are at risk] But I don't see that Canvas actually tells me anything.

For interviewee 14, they felt that the LMS did not give them information about which students were at risk. So, they weren't able to intervene and "actively monitor" which students were at risk and needed help until it was too late. Interviewee 20 also considered obligation by wondering if other instructors responded in the same way, asking: "I will sit down with them and say, 'Hey, you know, this student is at risk of, you know.' And do other instructors do that? I don't know." Altogether, the ability of the LMS to indicate risk primarily through work submissions and grades created a sense among many instructors that they needed to do something.

5.4 Findings Summary for RQ2: What can the LMS help us learn about students?

My second research question asked how instructors used the LMS system to learn about student engagement and risk status. The instructors varied in how useful the LMS was for them to learn about the engagement and risk status of their students. Table 5.9 summarizes the overall response of each participant and whether they found the LMS useful, of limited use, or not at all useful to in learning about their students' engagement or risk status. A general trend among most of the interviewees was that they had a mixed experience with the LMS, where it could show them some things, they cared about but was also missing aspects of the concept that they cared about. Below I describe what aspects of engagement and risk status the instructors found out about using the LMS. I then discuss the ways that it was limited or missing important concepts.

Table 5.9 — Usefulness of the LMS to see Engagement and Risk Status

	Did use LMS	Sort of used LMS	Did not use LMS
Engagement	2	13	6
Risk Status	4	8	9

Overall, the instructors that used the LMS to learn about their students described learning about the same type of things in relation to engagement and risk status. Related to learning about either concept, the LMS was described as being good for learning about students' online activity, work submission, and grades. Though, the instructors described interpreting these metrics differently depending on if they were trying to see student engagement or risk status, respectively. Figure 5.1 shows the three main ways the LMS was used by the instructor to learn about students in grey. In the engagement column are the engagement codes and how they are associated with these LMS indicators—the dashed line indicates an indirect relationship not explicitly discussed by the participants. Similarly, in the at-risk column are the codes related to each LMS metric. Hopefully this visual shows the respective facets of engagement and risk status related to online activity, work submissions, and grades.

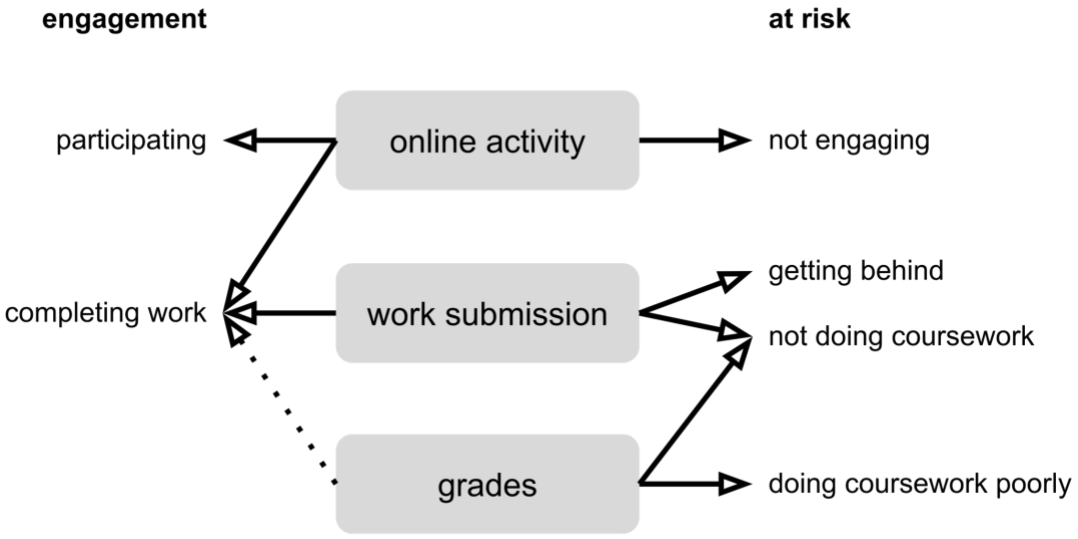


Figure 5.1 — What the LMS reveals about engagement and risk status

In total, nine instructors described learning about their students participating or completing work—participating and completing work were two of the facets of engagement in the professors' conceptual definitions of engagement—through the LMS' online activity metrics for their students. These were the most common ways instructors reported using the LMS to learn about student engagement. In contrast, the online activity metrics were not commonly used to learn about student risk status, only two instructors used online activity metrics to learn about their students' risk status. For risk status, online activity was interpreted as indicating whether students were engaging or not; note that, not engaging was described as a risk factor.

Work submissions were another way that instructors learned about whether students were completing work; seven instructors described learning about student engagement in this way. Similarly, seven instructors found work submission metrics useful for understanding if their students were at risk, particularly in terms of if the students were not doing coursework or getting behind.

Finally, grades were discussed as a way to learn about engagement by four instructors and about risk status by five instructors. In terms of risk status, grades were an indicator that informed teachers about whether students were doing coursework poorly. In their definitions of risk status, most instructors talked about students doing coursework poorly in an individual context. But in terms of using grades to determine which students were doing coursework poorly, and thus would be at risk, several instructors compared a student's performance to other students. So, given the way the grades allowed for quick comparison between students, grades added a comparative perspective to considering whether students were at risk. Grades were also used to see if students were at risk because they were getting behind. Overall, grades were described as a rather straightforward metric of risk. As the figure shows by the dashed line, the instructors describing how they used grades to learn about student engagement did not explicitly link grades to one of the

the conceptual domains of engagement I developed based on the interviewees definitions of engagement. As such, I linked their descriptions implicitly to the concept of completing work.

As Figure 5.1 and preceding discussion suggest, the LMS was only useful for learning about limited aspects of engagement and risk status. Large parts of the interviewees' conceptual understandings of these concepts were beyond the scope of the LMS. Or, in the case of online activity records, the instructors did not see the relevance or conceptual link to aspects of engagement or risk that they cared about. Several instructors called out this misalignment for both engagement and risk status explicitly, while others expressed a general sense of confusion or dissatisfaction with the LMS as a way to learn about engagement or risk status. In general, this sense of misalignment between conceptual understanding and LMS ability was stronger with engagement than risk status, despite fewer of the conceptual dimensions of risk being captured by the LMS metrics. I suggest that this is because the instructor did not expect the LMS to capture fixed, demographic, personal, or institutional ways that students are at risk. As such, the LMS could be perceived as succeeding at identifying student risk status in terms of academic risk such as not doing coursework or doing coursework poorly.

Finally, regarding engagement and the LMS, multiple professors acknowledged that LMS metrics are not sure-fire ways to tell if a student is truly engaged. At a conceptual level, they acknowledged that engagement comprises a lot of varied activities and can mean different things to different people and in different contexts. As such, when in defining engagement, these instructors acknowledged that the same behavior they interpreted as engagement could also not mean engagement. This skepticism was carried over to the LMS, with instructors acknowledging that metrics may not actually mean what they are interpreting them to mean. There was also skepticism towards both engagement and risk metrics in terms of accuracy and trustworthiness.

6 Discussion

In this chapter I contextualize my findings in relation to several ongoing scholarly conversations. In the Contributions to Scholarly Discourse and Practical Applications section, I return to the gaps and open questions that I identified in my literature review and offer answers from this study. In particular, I discuss how I found that instructors' conceptualizations of engagement and risk status differed significantly from the LMS' instantiation of these concepts and based on this finding suggest specific questions that LMS designers and selection groups should consider. I also contextualize this study in relation to the contextual themes that I outlined in the introduction, including constructivist pedagogy, accountability, and datafication. Then, in the Limitations and Future Work section, I discuss the limitations of this work and offer suggestions for how I could address these limitations in future work.

6.1 Contributions to Scholarly Discourse & Practical Applications

Starting with my literature review, I have argued that LMS are designed tools and as such they have implicit perspectives about student learning designed into them. Given this, then the LMS design process has implications for how the resulting LMS will impact teaching and learning. However, based on my survey of prior LMS research, I found that this perspective about the importance of implicit conceptualizations has rarely been considered in LMS design or adoption. With this gap in the scholarly discourse in mind, I undertook this study to understand how instructors made sense of the concepts of engagement and risk with and without the LMS.

Through this dissertation study, I found that the way professors described student engagement and risk status differed a lot from how these concepts were instantiated within the LMS. Overall, professors understood engagement and risk status in rich and nuanced ways, but very little of those understandings were informed by the LMS. Instead, the LMS primarily informed the instructors about students' online activity, work submissions, and grades. Based on these findings, below I make several suggestions for practical work as well as future research. To organize these

suggestions, I revisit and extend the LMS adoption model that I introduced in the literature review. I use the LMS adoption model that I created as an organizing framework for a series of questions which I argue should be asked in the LMS adoption process. I argue that, by asking these questions, LMS designers and implementers could better align LMS and teachers' conceptualizations. Figure 6.1 shows the three phases of LMS adoption, including LMS selection, use, and outcomes of use. Shown in blue in Figure 6.1, are questions I suggest that LMS designers or selection committees consider.

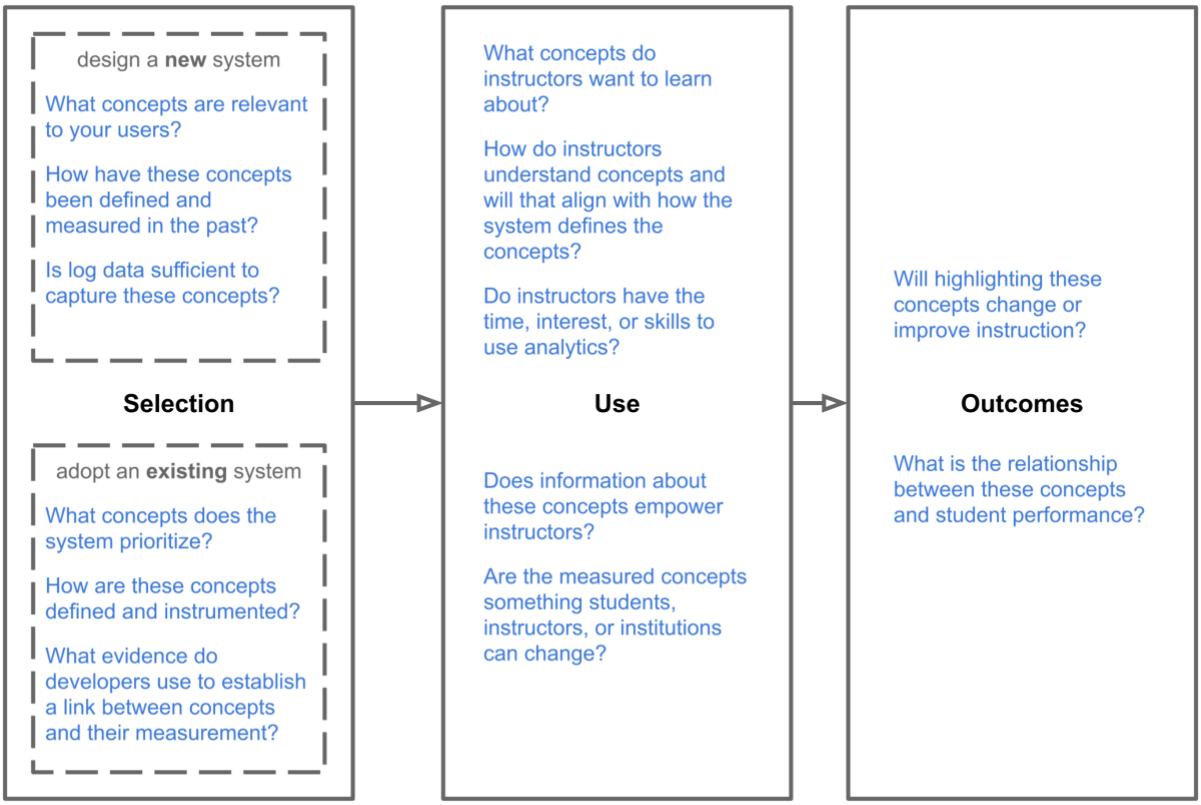


Figure 6.1 —Questions for Better LMS Adoption

These questions stem from my reflections throughout this study, particularly the current limitations in what LMS reveals about students and misalignments between professors' understandings and the LMS. Additionally, these questions are also informed by measurement theory. I am adapting questions that are common in scholarly discourse around measurement and

assessment and applying these perspectives to studying learning management systems—for such measurement perspectives, see AERA et al. (2014) or Mislevy et al. (2003). In particular, the questions I propose are indicated based on validity and construct definition theory (e.g., Kane, 2012). For instance, the *Standards for Educational and Psychological Testing* describe validation as follows, "validation involves careful attention to possible distortions in meaning arising from inadequate representation of the construct and also to aspects" (AERA et al., 2014, p. 13). In this study I identified several such distortions between how professors understood the constructs of engagement and risk and the ways that engagement and risk were captured in the LMS. I also found that overall, the professors reported did not find the LMS useful for learning about their students beyond the surface level. That is, the LMS offered a "inadequate representation" of the constructs of engagement and risk status. I offer this specific example to illustrate how, by posing the questions in Figure 6.1, I am adapting measurement theory to the context of LMS development and adoption. I hope that by asking these questions in a new context, my study can deepen thinking about implicit concepts in LMS design.

6.1.1 LMS Selection

The first stage in the LMS adoption framework is selection. Selection involves either creating a new system or picking an existing system. In relation to LMS selection, I wish to raise two areas of inquiry related to, respectively, designing and choosing. Related to designing new systems, I outline three questions that developers can consider, shown in Figure 6.1. I also outline three complementary questions related to adopting an existing system, also shown in Figure 6.1. I discuss these questions below and offer initial answers to some of these questions based on my study.

One of the first questions I suggest asks that developers should explore what aspects of concepts are important to the end user: "What concepts are relevant to the user?" This recommendation flips a technical systems lead design process, so that instead of starting with log data and asking what metrics can be developed, designers start by considering what concepts and

specifically what dimensions of those concepts are useful to the users. This sets a more challenging design goal, as not every concept is easily captured by log data. For developers I further pose two questions around how concepts are defined and instrumented in relation to technology systems: "How have these concepts been defined and measured in the past?" and "Is log data sufficient to capture these concepts?" Asking these questions invites considerations of how concepts are defined and whether available system data captures these concepts in a meaningful way are missing in the present LMS landscape. I attempted to answer the first question in my literature review by describing existing scholarly conceptualizations around these concepts.

Considering the second question about log data, my study suggests that the log data is not offering a sufficiently rich perspective of student engagement and risk status. That is, the gap between professors' understanding and what they could learn from the LMS can be partially explained by the fact that the LMS log data does not capture dimensions relevant to professors. I discuss this in more detail subsequently. Perhaps illustrating this gap, as I found in my study, the conceptualizations by the LMS and by faculty can differ significantly. Additionally, as I reported in Chapter 5, many of the professors described the LMS as not useful or only somewhat useful for learning about their students. If designers want their system to be useful then they need to consider how it will be used and whether the information in presents align with users' understanding. At present, my study suggests this hasn't happened in relation to student engagement and risk status. That is one reason why I hope this study suggests areas for continued development that introduces validity questions like the ones I pose in Figure 6.1 into the design process of LMS and educational technology more broadly (see also Fincham et al., 2019).

A majority of people working with LMS are not LMS designers but are instead making decisions about adopting an LMS. For such LMS adopters, I reframed the three design questions outlined above in the context of LMS adoption. I suggest that LMS selection committees should consider how a system conceptualizes instructionally relevant concepts, how such concepts are

instrumented by that system, and what evidence the LMS designers provide to establish a link between concepts and their measurement. As I found in my literature review, to date, this type of research is largely absent. One notable, historical exception is Dougimas and Talor (2003)'s study on Moodle's development. My study extends the latters' work and focus on constructivism to a currently prominent, commercially developed platform. Especially since the latter study was done in 2003 the landscape of LMS usage has consolidated so that presently 89% of LMSs in use comprise four commercial platforms—Canvas, D2L, Moodle, and Blackboard (Hall, 2021). Research on how these platforms are developed and how such systems conceptualize or measure concepts is sparse. As such, the questions I propose in Figure 6.1 should be addressed in future studies to address a current research gap.

In the previous paragraphs, I have argued for the relevance of the selection-related questions that I proposed in terms of what gaps they address in the research and practice. Next, in the subsequent paragraphs, I demonstrate an attempt at answering several of these selection-related questions based on the findings from my study. It is worth noting that, though I interviewed professors about how they used the LMS, I am discussing both the LMS selection and use questions because they are closely related. For simplicity, I am discussing only the selection questions in this section and l will address the use questions in the subsequent section.

In the introduction, I discussed how the demand for more constructivist instruction and the corresponding perceived increase in class size and instructional burden have led to adopting LMS as a solution to address these concerns. Indeed, over the past three decades, constructivism has come to be a primary influence in instructional practices in higher education (Lueddeke, 1999, O'Connor, 2020). By considering how constructivist thinking was reflected in the interviewees' understandings of engagement and risk status I take up some of the questions related to LMS Selection outlined in Figure 6.1. In response to the question I posed for LMS designers, "What concepts are relevant to your users," I suggest that constructivism is a driving perspective. In

response to the question "How have these concepts been defined and measured in the past," I summarized existing models of engagement in the introduction. And here, in this section, I respond to the questions "What concepts does the system prioritize?"; "How are these concepts defined and instrumented"; and "Is log data sufficient to capture these concepts." In doing so, I also consider whether the ways instructors used the LMS to learn about their students did, in fact, make teaching at scale easier and ease instructional workloads.

Fox (2001) describes several tenets of constructivism that I have summarized in terms of roles, epistemology, and related instructional practices in Table 6.1. These attributes of constructivism were reflected in my interviewees' understanding of engagement. In terms of the roles students enact in learning, constructivism describes students as taking an active role in directing their learning and working with peers and instructors cooperatively. The theme of interacting with peers as a facet of engagement reflects a constructivist understanding of how students should interact in learning. This theme also relates to the constructivist perspectives on how knowledge is constructed, invented, and socially distributed. These perspectives on knowledge are aligned with the deeper thinking theme I identified as a way to unite the topics of thinking about course content, questioning, making connections, and developing interest. Together these approaches to learning position students as actively cultivating their learning and building knowledge. In the table below, I align the ways the instructors defined engagement with attributes of constructivist instruction. (These are not one-to-one relationships, as engagement themes may relate to more than one constructivist ideal.) Overall, as the Table shows, there was quite a cohesive alignment between how professors understood engagement, at least in terms of how the professors' conceptualized engagement in terms of deeper thinking, and constructivist theory.

Table 6.1 — Constructivism as it Relates to Engagement and Risk Factors

Constructivism	Engagement themes	Risk themes
Roles		
teachers as facilitators		emailing students
students take initiative	asking questions interacting with peers	not seeking help
co-operative and multi-perspective	interacting with peers participating	
Epistemology		
learning is an active process	thinking about course content making connections	not engaging
knowledge is constructed, invented	thinking about course content making connections	
knowledge is distributed and socially constructed	interacting with peers	not seeking help
Learning Design		
authentic activities and contexts	developing interest	
learning requires open-ended problems	questioning	

As the table above shows, the codes I related to deeper thinking in Chapter 4 align with a constructivist perspective. But in addition to the core idea of deeper thinking, I also found that the idea of stereotypical course participation was prevalent among the professors' understandings of engagement. And while the concepts related to deeper thinking are closely related to constructivist theory, stereotypical course participation, including completing work, interacting with peers, paying attention, and participating is not closely aligned to constructivism. However, stereotypical course participation is aligned with how the LMS positions student engagement. In Figure 6.2, I show how several of these aspects of stereotypical course participation can be seen in the LMS. So, in response to the question, "What concepts does the system prioritize?", the LMS prioritizes the

core concept of stereotypical course participation which the participants described in terms of completing work, participating, and paying attention. And given this, the LMS is not well aligned with a constructivist perspective of student engagement. Rather these themes prioritized by the LMS reflect an instructive perspective that positions teachers as leaders and knowledge disseminators.

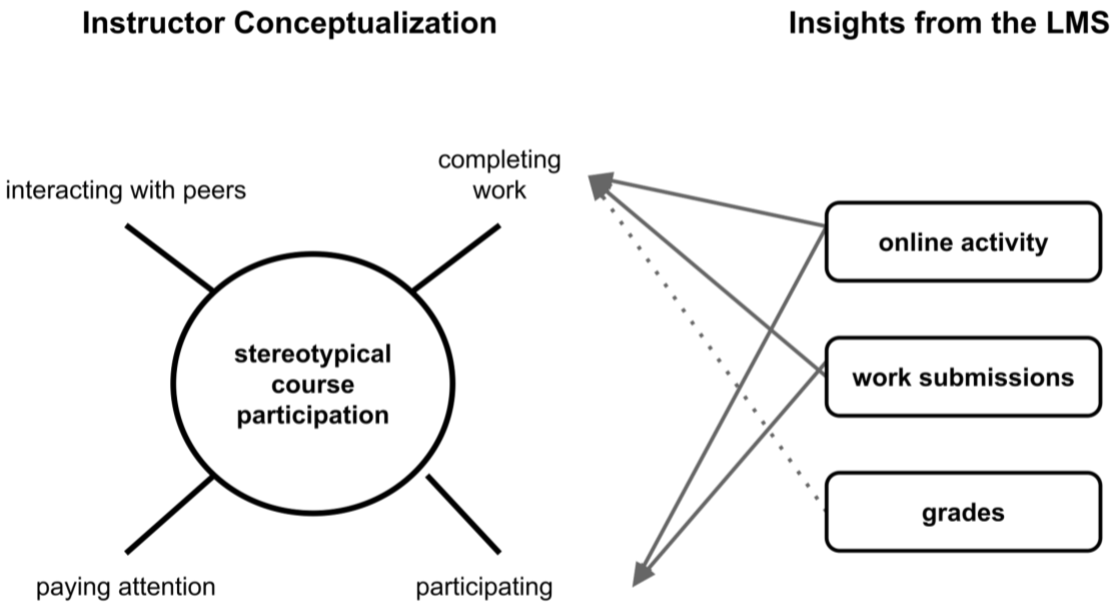


Figure 6.2 — How LMS Reveal Stereotypical Course Participation

Of course, across my participants there was not a division between those holding instructivist versus constructivist philosophies towards engagement. Rather, most instructors reflected aspects of both philosophies in their definitions of engagement. Put in terms of the themes I identified, professors often thought about engagement in terms of both deeper thinking and stereotypical course participation. Instead, the bigger distinction can be seen between the professors' understandings of engagement and risk status. As Table 6.1 shows, the professors' understandings of risk overlapped with the constructivist perspective in fewer ways. When instructors described risk status as not not engaging or not seeking help, they touched on the ideas that students must be active participants in learning but also construct learning cooperatively with

others. This may be, in part, because engagement is a concept that is closely aligned with active learning and constructivist instructional practices. Risk status, in contrast, is not. In fact, the theme of emails and reaching out to students in response to identifying at risk students is interesting from a constructivist perspective. Most instructors positioned themselves as a director of learning, needing to find students and intervene and solve problems students were facing. Only one instructor actively rejected this perspective, instead adopting a position more in-line with the constructivist concept of teachers as facilitators. In their class they described helping students learn to take responsibility and develop awareness of when they needed to ask for help rather than the instructor chasing students. In this sense, it seems that constructivist responses to at-risk students' conflict with instructors' general approach to be supportive and helpful to their students. Or perhaps such instructors' aim is to help their students develop executive functioning, which is not a target of constructivism which prioritizes building understanding.

So, does the LMS fulfill the expectation that it can promote constructivist learning, while also lessening demands on instructors? Through the LMS' online activity, work submission, and grade metrics, instructors did learn about their students' engagement and risk status to some extent. But those metrics mostly revealed aspects of engagement and risk status that are not particularly important in terms of constructivism, such as completing work, getting behind, or doing coursework poorly. Further, in terms of instructors' time, interviewees described setting up the LMS as a time-consuming activity. And multiple professors reported not using the LMS to learn about student engagement or risk status because it took too long or was complicated. Given this, in response to the question I posed, "What concepts does the system prioritize?" I argue that the instructors' experience with the Canvas LMS suggests that the system does not prioritize an understanding of student engagement or risk status from a constructivist perspective. Rather, the LMS prioritizes learning about online activity, work submission, and grade metrics. In response to the question I posed, "How are these concepts defined and instrumented?" I suggest that, in

essence, the LMS fails to get at a rich understanding of student engagement. At its worst, the LMS presented a frustrating and time-consuming challenge.

If the way concepts are defined and instrumented in the LMS is superficial, why is this? The answer to the question, "Is log data sufficient to capture these concepts?" offers one suggestion. Rich learning metrics are challenging because learning takes place in students' minds or through interactions. Learning is not directly observable. This poses a measurement challenge, as it is difficult to capture aspects of learning that are not directly observable. I saw an example of this being instantiated with LMS and the professors' experiences of it in this study. The LMS relies on log data to capture learning based mostly on clicks and online interactions. This log data is easy to use to provide metrics about student grades and online activity, but more difficult to connect to students' internal learning processes. This insufficiency of the LMS log data to give a rich measure of student learning, I think, explains why most of the instructors reported relying more on their own observations of students, which they thought were more attuned to student thinking and interactions. As observers of their students, the instructors were inhabiting the facilitator role. In light of this, to be more closely aligned with constructivist instructional practices, the LMS either needs to capture more than log data or address the challenge of making a connection between log data and learning. While some scholars have begun this effort, the OnTrack project from Pardo and colleagues (2018) stands out, I argue that LMS developers must design metrics of student engagement and risk status by beginning with a concept (e.g., students developing interest or not seeking help) and identifying its importance to instructional practice, and then determine if it could be captured and presented to faculty in the LMS. The questions I pose in relation to LMS selection are a good place to start.

6.1.2 LMS Use

Historically, research on LMS use has focused on what features are used most and why (e.g., Ifenthaler, 2008), not whether features align with professors' learning theories. In contrast to

features-focused research, which can become out of date quickly as LMS features are added or removed by corporate developers, this study illustrates another way to study LMS that can offer longer-lived insights, by studying how LMS features inform instructors about instructionally relevant concepts. To this end, as Figure 6.2 shows, I suggest future work asks use-related questions about what concepts instructors want to learn about and how learning about those concepts will impact instruction. In this section, I illustrate answering and reflecting on several of these use-related questions.

In Figure 6.1, I posed the use-related question: "What concepts do instructors want to know about?" My findings suggest that at present the LMS is not informing teachers about everything that they want to know about student engagement and risk status. As I described in Chapter 5, the majority of participants said that the LMS either "sort of" or "did not" help them learn about these concepts. Particularly important is the misalignment I observed between how the professors understood these concepts and the ways the LMS instantiated these concepts. In terms of engagement, professors wanted to know about student actions related to deeper understanding as well as typical course participation. But the LMS only told instructors about the latter. In relation to risk status, the professors described a wide variety of risk factors, but only found the LMS useful for learning about risk as it related to online activity, work submissions, or grades. These misalignments suggest that not only is the LMS not informing about construct dimensions that they want to know about, but it is potentially redefining or reshaping definitions of these concepts by highlighting and emphasizing some dimensions rather than others. For example, in my findings, I delineated between fixed and changeable aspects of risk in instructors' understanding for student risk. The LMS highlights risk dimensions related to students struggling with coursework but not risk factors that could be improved by institutional changes. As I developed the themes around risk status, I found myself asking: what is the impact of providing feedback on risk factors (or engagement) if they are beyond instructor control?

Is there a benefit, beyond accountability, of such metrics? I introduced the topic of accountability in the introduction, suggesting that LMS are well aligned with accountability. Accountability promotes efficiency, effectiveness, and performance and tracks progress in these areas through assessment (Kai, 2009). Such administrative accountability, not to mention political accountability, relies on quantitative data and metrics to ensure quality of instruction or whatever other outcomes are being prioritized. In light of accountability as a systemic trend, I use-related questions "Does information about these concepts empower instructors?" and "Are the measured concepts something students, instructors, or institutions can change?"

Broadly speaking, the LMS is a potential tool of accountability towards both students and instructors. It is advertised as streamlining instruction and fits nicely with the accountability goals of efficiency and effectiveness. It also provides data about how people are working and allows quantitatively assessing performance. A LMS can be used as a tool for performance tracking of students, by capturing what they do and when. In this way, students' online activity logs are a source of accountability metrics. But the LMS can also be used to inspect what instructors do. As LMS are currently instrumented, they tell instructors about what instructors do as well, in terms of how their courses are structured, when they are interacting with students, and log their patterns of behavior in the system. Some of the instructors in my study were unaware of these aspects of using the LMS—how would they respond to the features of their instructional tool doubling as a source of accountability? Other instructors were aware that the LMS tracked their students. Several instructors described telling their students about how the system would tell instructors about student behavior, highlighting ethical concerns about what students do and do not know about what their use of the LMS may tell their instructors. I did not talk to the instructors about their perceptions of the LMS tracking them, in terms of accountability, but the theme of responding to students based on risk metrics had a sense of obligation that, to me, suggests that the instructors were somewhat worried about failing to respond to a problem.

The misalignment between what instructors wanted to know about their students and what the LMS was showing them suggests that, in terms of institutional accountability, there could also be similar misalignments between what the LMS can capture and summarize about students and what improves learning. It is also likely that the goals of constructivist instruction are not closely aligned with accountability; as Firestone (2009) put it, "accountability culture defines teaching as routine work with a well-defined knowledge base." In a constructivist perspective, teaching is anything but routine transmission of a well-defined knowledge base. So, it may be impossible for LMS metrics to be both in support quality instruction as well as accountability metrics. Currently, the emphasis on documenting what students do and when indicates that the metrics available to instructors learning about their students' engagement and risk status are more in-service of accountability than informing instructors about things that can help them modify their teaching and ultimately their students' learning. So, from my consideration of accountability as it relates to LMS, I suggest that the answer to the questions I raised about whether the LMS empowers instructors is related to whether the concepts that the LMS tells instructors about are things that they can control. (This applies to students as well, are they receiving feedback about how they learn that are actionable.)

Accountability is intertwined with datafication. Datafication is the societal trend to transform social actions into online quantitative data, data which are then used for the real-time tracking, commerce, and predictive analytics (Mayer et al., 2013). In education, specifically, digital technologies like LMSs have made such datafication possible. The LMS' dashboards and measures of students' online activity and grades are an instantiation of datafication. However, as I mentioned in the introduction, datafication, as a perspective, prioritizes understanding the world through quantitative metrics; as van Dijck (2013) described datafication, it is "rooted in problematic ontological and epistemological claims." As I am arguing that tools such as LMS are designed with implicit perspectives, I want to highlight how the participants in this study responded to the

datafied perspective of students instantiated by the LMS. I discussed the LMS' quantitative metrics with my participants as if they were quantitative ways of understanding the students. Some participants strongly reject this approach, as did the few instructors who did not understand or find relevance at all in such metrics—they're just "little sticks," said one instructor of the LMS dashboards' graphs. But, for most, this way of viewing students did not deeply resonate with them; these instructors described a nuanced tension in which they somewhat appreciated the metrics but felt they were limited, missing something, or inaccurate.

The tension instructors identified was also one where the LMS metrics and instructors' observations were in competition. For me, this touches on datafications epistemological claims about data and raises the question of what we should trust and value in the process of learning about students. In terms of trust, metrics need to be accurate and created automatically in a way that does not introduce errors. But several of the instructors described having the opposite experience. For instance, regarding video-watching metrics, one instructor wanted to see if their students were watching assigned videos. They also wanted to see which areas of the videos students rewatched or paused, as a way of understanding where students were interested or struggling. However, this instructor found that while the video-watch statistics told them whether a video had been watched, it did so in a too blunt way. A student could watch only a minute of a video and still be identified as having watched the video. Further, the video-watching metrics did not reveal what parts of the video the students watched most, repeatedly, or not at all. This experience led the instructor to ignore the video metrics entirely. In this instance the professor had taken the time to become well-versed in the technical details related to the video metrics, but what if they hadn't?

This example relates to the use-related question I posed "Do instructors have the time, interest, or skills to use the given analytics?" In the anecdote I described above, I wonder whether a different instructor would have interpreted the metrics assuming they were accurate and made an

incorrect assumption or interpretation about their students' participation or interest? On the surface this question is asking about the practical features of analytics as they relate to instructors. But more critically, in this question (and many of the other questions posed in Figure 6.1) I am suggesting that LMS and analytics developers and users probe the assumptions inherent in datafication.

LMS analytic metrics also need to inform instructors about what they value. But, as one instructor put it, "we value what we measure." So does the LMS measure aspects of engagement and risk that instructors care about? Or is it an exercise in datafication for its own sake? After talking with the instructors in this study, it seems that the latter is closer to their experience with LMS metrics. Regarding learning about students' engagement and risk status, the LMS particularly prioritizes metrics related to students turning in work on time and interacting with the online platform. These metrics quantify engagement and risk status in ways that were of some value to instructors. But there were also numerous misalignments between how these instructors described engagement and risk and highlighted what they cared about and what the LMS could show them. The various ways that the professors conceptual understandings and the LMS metrics were misaligned suggests that the LMS has not yet succeeded in quantifying student engagement or risk status. Given this, it makes sense that most of the instructors prioritized their own interactions with students over using the LMS.

Since the perspective of datification prioritizes quantitative meaning-making over personal sense-making, datafication deprioritizes personal approaches such as those the instructors in my study used to learn about their students compared to quantitative metrics, from a datafied perspective. But none of the participants adopted or took up this perspective. In contrast, several even gave examples of when they had faced a conflict between the LMS and a personal experience and found the LMS metrics to be wrong. For example, one instructor approached a student about their lack of online activity accessing resources and looking at readings. The student countered that

the LMS was wrong and ultimately provided sufficient support so that their instructor agreed that the LMS was wrong. But what if the instructor had been more inclined to look at LMS metrics from a datafied perspective? Would they have been inclined to discount the student because the metrics were more objective and accurate? Whether or not this datafied future is desirable, it seems that the LMS metrics are not yet robust enough to trust over personal experiences.

In this study, I found that the LMS revealed little about students that the instructors did not already know. This was true for instructors of both large and small classes. The LMS did succeed in providing information about students at scale, primarily through the grade book. A summary of the class that would be difficult for instructors to have based on personal interactions alone. But such overall summaries of students in terms of grades are a new development in education, it is more a digital instantiation of a tool that instructors previously used in analogue. As such, the LMS may position itself as a tool for datafication, turning learning processes into data and metrics, but in reality, the LMS may be better described as offering digital versions of traditional instructional tools like gradebooks, discussion forums, and assignment submissions.

In the design of LMS, what is most important to measure and tell instructors about? My study suggests that the answer differs depending on whether the goal is datafication or not. In the datafied perspective metrics are focused on individuals and their behavior. But returning to the perspective of constructivism, learning takes place in a distributed system not isolated within an individual (O'Conner, 2020). Given this, the very individualized metrics the LMS provides lack the broad contextual perspective that learning takes place in, according to constructivism. To design LMS that are more learner and learner focused, I suggest asking questions like the ones I posed in Figure 6.1 about how and why we use LMS.

6.2 Limitations and Future Work

Qualitative research can be responsive to unexpected developments and constraints. As such, interviews were a flexible way to learn more about each interviewee in terms of their unique

teaching practices, class types, and ways of thinking. But this flexibility also meant that I encountered relevant and interesting topics that I could not practically develop. Below I explain some of these data-driven topics and how they could be subjects for future work. I also explore some of the limitations of my research design that became clear as study progressed and changed, and I discuss ways to address these limitations in future work.

First, exploring additional tools beyond the LMS was a topic the interviewees raised that interested me but were outside the scope of this study. I'd like to explore more about what tools beyond the LMS that instructors used to learn about students. When I asked the instructors how they learned about engagement and risk status, they consistently mentioned a handful of software and online tools, such as Piazza. As these were not a part of my focus on LMS and their metrics, I did not fully analyze these responses. But, if as my study suggests, there are limitations to how much the LMS can reveal to instructors about student engagement and risk status, it would be helpful to understand what tools instructors are using to learn about their students' engagement or risk status.

Another theme in my interview data that was outside the scope of this study was the role gender plays in shaping instructors' response to at risk students. As I discussed in the findings chapters, instructors frequently discussed feeling obligated to email students that they deemed at risk based on metrics in the LMS. But, among some of the instructors I spoke to that were women, there was a distinct care-taking responsibility. These professors talked about caretaking, approachability, and the need to actively reach out to students. In contrast, none of the male instructors I spoke with had the same intense feeling of responsibility to actively reach out and care for their students. It would be helpful to explore if this trend is consistently different between women and men. Prior research has strongly linked gender and care-taking responsibility in professional environments (Lester, 2008, Winslow, 2010), so observing such a link in this context would not surprise me. But fully answering this question would require speaking to more women

and men. My sample in particular, did not include a large number of male participants. Also, I would want to ask participants directly how they felt their gender role identities intersected their professional roles.

In addition to following up on these topics that emerged throughout my study, there are some areas of research that were discarded as the research progressed. As I originally conceived this study, I was particularly interested in LMS dashboards and analytics. As is clear in the findings, on average, the instructors in my sample did not use these features very deeply. Not using the dashboards to learn about student engagement and risk status is, in itself, a valuable finding that is an answer to my research questions. However, in future work it would still be interesting to explore interpretations of these dashboards and metrics explicitly, particularly through think aloud or conceptual modeling research. I would like to find out what interpretations instructors make of these tools. And if instructors are not using these tools in their practice, that is also a related phenomenon to understand as well.

In future work, I would also expand my analysis from looking at instructors meaning making to the design of the LMS themselves. Because I was conducting interview studies, it made sense in this study to focus on how instructors used the LMS to understand their students. In this study, I inferred what the LMS could show about student engagement and risk status based on what professors reported using it to learn. While this reveals what instructors are learning in practice, it leaves out what may be possible to learn, say, if the LMS was used differently. In future work it would be interesting to analyze the LMS in a socio-technical framework to more systematically see how it captures and presents student engagement or risk status. This type of analysis would be, in part, a return to the feature inventories common in early LMS research. It would still be an extension given its focus on underlying concepts rather than features and tools.

Lastly, due to the scope of my dissertation work, I focused only on the LMS available in my local context—Canvas. Canvas is a relevant LMS to study because presently it is a market leader and

impacts teaching and learning at a large portion of US-based universities. However, there is something gained by comparing multiple systems to understand how they are different. Future work extending this study should consider the major LMS systems in the US: Canvas and Blackboard. A more internationally inclusive study could also include D2L and Moodle. Together these four systems comprise 89% of the North-American LMS market (Hill, 2021) and so understanding their impact is important. Additionally, a cross-platform analysis is also valuable because it is less common in research about LMS, as such work tends to focus on single systems in isolation.

In sum, my study answered the research questions at hand but also raised questions for further study. Including, what tools beyond LMS are actually useful to instructors learning about student engagement and risk status? And, how does gender impact the way instructors respond to at-risk students? In addition to these questions for further study, my study was unable to answer several questions I initially proposed answering because of logistic constraints. First, I would like to understand how LMS define and present the concepts of engagement and risk status, not only how instructors interpret the LMS' presentation of these concepts. Second, I would like to extend the current work to include consideration of how instructors using other LMS platforms learn about engagement and risk status.

7 Conclusion

In this study, I interviewed 21 university professors about their understanding and definitions of student engagement and risk status. For both concepts, I found that their understandings were multidimensional and sometimes contradictory. For engagement I found that instructors prioritized both deeper thinking (students thinking about course content, questioning, developing interest, and making connections) as well as stereotypical course participation (students completing work, interacting with peers, paying attention, and participating). The instructors' emphasis on deeper thinking aligns with theories of engagement that prioritize

cognitive engagement as well as a constructivist pedagogy. Regarding risk status, described both changeable and fixed ways that students could be at risk. This unchangeable, fixed risk factors included both personal issues as well as institutional factors that could jeopardize student success. The instructors' understandings aligned with scholarly critiques of risk status that question whether it is a pejorative concept that pre-identifies students for failure. These findings revealed that the participants in this study had rich understandings of these concepts; but engagement was used more often than risk, which few of the participants reported using in their thinking about their students.

The semi-structured interviews also focused on how instructors used the LMS to learn about their students' engagement and risk. For the instructors in this study, the LMS was much more helpful in learning about behavioral engagement, the stereotypical course participation. It was not as informative about the deeper thinking aspects of engagement. Multiple instructors described frustration in response to this misalignment between their understanding of engagement and what the LMS could show them. Surprisingly, there was less frustration about what the LMS could show about students' risk status, even though the LMS showed less about student risk status. I suggest this is because risk was a less salient concept for the instructors in general. In response to learning about students struggling in the course through the LMS in terms of poor grades or missing assignments, instructors described a sense of obligation to reach out to students through messages or emails. They were less certain if this approach helped their at-risk students.

Together, these findings suggest that the LMS have been designed in a way that makes them better tools for accountability and datafication rather than in service of deeper understanding of students in a constructivist sense. The misalignments between what instructors would like to know about their students and the ways that LMS summarize and quantify students indicate a need to consider what instructors actually want to know about students in the design of LMS. Of course, these findings are relative to the LMS these instructors used, Canvas. These findings can be

extended through future work that looks at how instructors use other LMS platforms. Ultimately, my findings also call into question whether the LMS' approach to quantifying students is useful to instructors, in general. As most of the professors in this study primarily learned about their students by observing them in class and through personal conversations.

8 References

Aguilar, S., Lonn, S., & Teasley, S. D. (2014, March). Perceptions and use of an early warning system during a higher education transition program. In *Proceedings of the fourth international conference on learning analytics and knowledge* (pp. 113-117). ACM.

Al-Ajlan, A. S. (2012). A comparative study between e-learning features. In Methodologies, tools and new developments for e-learning. In E. Pontes, A. Silva, A. Guelfi, & S. T. Kofuji, *Methodologies, tools and new developments for e-learning* (pp. 191-214). InTech.

Alexander, F. K. (2000). The changing face of accountability: Monitoring and assessing institutional performance in higher education. *The Journal of Higher Education, 71*(4), 411-431.

Ali, L., Hatala, M., Gašević, D., & Jovanović, J. (2012). A qualitative evaluation of evolution of a learning analytics tool. *Computers and Education*, *58*(1), 470–489. https://doi.org/10.1016/j.compedu.2011.08.030

Allen, M. J. & Yen, W. M. (1979). *Introduction to measurement theory*. Long Grove, IL: Waveland Press.

Alowibdi, J. S., Daud, A., Aslam, M. A., Basheri, M., Aljohani, N. R., & Abbasi, R. A. (2018). An integrated framework for course adapted student learning analytics dashboard. *Computers in Human Behavior*, 92, 679–690. https://doi.org/10.1016/j.chb.2018.03.035

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (2014). *Standards for educational and psychological testing*. Washington, DC: American Educational Research Association.

American Psychological Association (2012). *APA Style Guide to Electronic Resources* (6th ed.). Washington, DC: American Psychological Association.

Analytics. (2018, May 25). Retrieved from Moodle website: https://docs.moodle.org/35/en/Analytics

Analytics for learn (2018). Retrieved from Blackboard website: https://help.blackboard.com/Learn/Instructor/Performance/Analytics_for_Learn

Arnold, K. E., & Pistilli, M. D. (2012). Course Signals at Purdue: Using Learning Analytics to Increase Student Success. *International Conference on Learning Analytics and Knowledge*, (May), 267–270. https://doi.org/10.1145/2330601.2330666

Asiri, M. J. S. (2012). Factors influencing the use of learning management system in Saudi Arabian Higher Education: A theoretical framework. *Higher Education Studies*, *2*(2), 125-137.

Awad, M., Salameh, K., & Leiss, E. L. (2019, April). Evaluating learning management system usage at a small university. In *Proceedings of the 2019 3rd International Conference on Information System and Data Mining* (pp. 98-102). Retrieved from: https://dl.acm.org/doi/pdf/10.1145/3325917.3325929

Bain, K. (2011). What the best college teachers do. USA: Harvard University Press.

Baltaru, R. D. & Soysal, Y. N. (2018). Administrators in higher education: organizational expansion in a transforming institution. *Higher Education*, *76*(2), 213-229.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York, NY: WH Freeman.

Bergmann, B. R. (1991). Bloated administration, blighted campuses. *Academe, 77*(6), 12-16.

Bisaso, R. (2009). Information technology for educational management at a Ugandan Public University. *IFIP International Federation for Information Processing*, *292*, 83–94. https://doi.org/10.1007/978-0-387-93847-9_8

Blackboard instructor: A powerful app designed specifically for instructors. (2018). Retrieved from Blackboard website: http://pages.blackboard.com/mobile-learning/blackboard-instructor.aspx

Blackboard learn: LMS feature showcase. (2018). Retrieved from Blackboard website: https://www.blackboard.com/learning-management-system/blackboard-learn-features.html

Blackboard predict. (2018). Retrieved from Blackboard website: https://www.blackboard.com/education-analytics/blackboard-predict.html

Blakely, T., Hales, S., Kieft, C., Wilson, N., & Woodward, A. (2005). The global distribution of risk factors by poverty level. *Bulletin of the World Health Organization*, *83*, 118-126.

Böhm, A. (2004). Theoretical coding: text analysis in grounded theory. In U. Flick, E. von Kardorff, & I. Steinke, *A companion to qualitative research* (pp. 270-275).

Bremer, D., & Bryant, R. (2005). A Comparison of two learning management Systems: Moodle vs Blackboard. *Proceedings of the 18th Annual Conference of the National Advisory Committee on Computing Qualifications*, 135–140.

Brightspace core. (2018). Retrieved from D2L website: https://www.d2l.com/higher-education/products/core/

Brightspace for higher education. (2018). Retrieved from D2L website: https://www.d2l.com/higher-education/products/

Brown, A. (1981). How the administration grows: A longitudinal study of growth in administration at four universities. Research in Higher Education, 14(4), 335-352.

Bryce, C. I., Goble, P., Swanson, J., Fabes, R. A., Hanish, L. D., & Martin, C. L. (2018). Kindergarten school engagement: Linking early temperament and academic achievement at the transition to school. *Early education and development, 29*(5), 780-796.

Buabeng-Andoh, C. (2012). Factors Influencing Teachers' Adoption and Integration of Information and Communication Technology into Teaching: A Review of the Literature. *International Journal of Education and Development using Information and Communication Technology*, *8*(1), 136-155.

Buckingham Shum, S. B., & Hammond, N. (1994). Argumentation-based design rationale: What use at what cost? *International Journal of Human - Computer Studies*, *40*(4), 603–652. https://doi.org/10.1006/ijhc.1994.1029

Canadian Education Statistics Council (2001). Children and youth at risk: Pan-Canadian Education Research Agenda symposium report. Retrieved from http://publications.gc.ca/Collection/Statcan/81-589-X/81-589-XIE.html

Canvas Doc Team. (2018, August 25). What are analytics? Retrieved from Canvas website: https://community.canvaslms.com/docs/DOC-10742-67952724559

Card, M., MacKinlay, J. D., & Shneiderman, B. (1999). Readings in information visualization: Using vision to think. San Diego, CA: Academic Press.

Cavus, N., & Zabadi, T. (2014). A Comparison of Open Source Learning Management Systems. *Procedia - Social and Behavioral Sciences, 143*, 521–526. https://doi.org/10.1016/j.sbspro.2014.07.430

Chaubey, A., & Bhattacharya, B. (2015). Learning management system in Higher education. *International Journal of Science Technology & Engineering, 2*(3).

Christenson, S. L., Reschly, A. L. & Wylie, C. (Eds.). *Handbook of research on student engagement*. New York, NY: Springer.

Chung, C.-H., Pasquini, L. A., & Koh, C. E. (2013). Web-based learning management system considerations for higher education. *Learning and Performance Quarterly, 1*(4), 24-37.

Conde, M. Á., García-Peñalvo, F. J., Rodríguez-Conde, M. J., Alier, M., Casany, M. J., & Piguillem, J. (2014). An evolving Learning Management System for new educational environments using 2.0 tools. *Interactive Learning Environments, 22*(2), 188–204. https://doi.org/10.1080/10494820.2012.745433

Corbin, J. & Strauss, A. (2014). *Basics of qualitative research*. Sage.

Course Structure: Constructivism. (2016, November, 2). Retrieved from Blackboard website: https://help.blackboard.com/sites/default/files/bb_assets_embed/19000/Course_Structure_-_Constructivism.pdf

D'Mello, S., Dieterle, E., & Duckworth, A. (2017). Advanced, Analytic, Automated (AAA) Measurement of Engagement During Learning. *Educational Psychologist*, *52*(2), 104–123. https://doi.org/10.1080/00461520.2017.1281747

de Vries, S. L., Hoeve, M., Assink, M., Stams, G. J. J., & Asscher, J. J. (2015). Practitioner review: effective ingredients of prevention programs for youth at risk of persistent juvenile delinquency–recommendations for clinical practice. *Journal of Child Psychology and Psychiatry*, *56*(2), 108-121. doi:10.1111/jcpp.12320

Dahlstrom, E., Brooks, D. C., & Bichsel, J. (2014). The Current Ecosystem of Learning Management Systems in Higher Education: Student, Faculty, and IT Perspectives. *EDUCAUSE Center for Analysis and Research*, (August), 27. https://doi.org/10.13140/RG.2.1.3751.6005

David, A., & Ben, F. (2007). The use of learning management systems in the United States. *TechTrends*, *51*(2), 40.

Davis, J. D. (2018, December 20). Why use a LMS? Why use Canvas k12? [Blog post]. Retrieved from https://community.canvaslms.com/groups/k12/blog/2018/12/20/why-use-a-lms-why-use-canvas-k12

Diversity, Equity & Inclusion: Strategic Vision Data Appendix. Retrieved from UC Davis website: https://diversity.ucdavis.edu/data

Dougiamas, M., & Taylor, P. (2003). Moodle: Using learning communities to create an open source course management system. In *EdMedia+ Innovate Learning* (pp. 171-178). Association for the Advancement of Computing in Education (AACE).

Duval, E. (2011). Attention please!: Learning analytics for visualization and recommendation. *LAK*, *11*, 9-17.

Edutechnica. (2017, September 17). *5th annual LMS data update*. Retrieved from https://edutechnica.com/2017/09/17/5th-annual-lms-data-update/

Edutechnica. (2018a, March 4). *LMS data — spring 2018 updates.* Retrieved from https://edutechnica.com/2018/03/04/lms-data-spring-2018-updates/

Edutechnica. (2018b, December, 8). *Fall 2018 global LMS Market share update*. Retrieved from: https://edutechnica.com/2018/12/08/global-lms-market-share-update/

Elliot, A. J. (2005). A conceptual history of the achievement goal construct. In A. J. Elliot & C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 52-72). New York, NY: Guilford Publications.

Ellis, R. K. (Ed.). (2009). A field guide to learning management systems. *Learning Circuits.*

Erturk, A., & Onacan, M. B. K. (2017). Usability evaluation of learning management system in a higher education institution: A scale development study. *Journal of Global Strategic Management*, *1*(11), 55–65. https://doi.org/10.20460/jgsm.2017.246

Fathema, N., Shannon, D., & Ross, M. (2015). Expanding the Technology Acceptance Model (TAM) to examine faculty use of learning management systems (LMSs) in higher education institutions. *Journal of Online Learning & Teaching*, *11*(2).

Features. (2018, August 14). Retrieved from Moodle website: https://docs.moodle.org/35/en/Features

Feldstein, M. (2018, July 8). Canvas surpasses Blackboard Learn in US market share. Retrieved from e-Literate website https://mfeldstein.com/canvas-surpasses-blackboard-learn-in-us-market-share/

Few, S. (2006). Information dashboard design: The effective visual communication of data. O'Reilly.

Fincham, E., Whitelock-Wainwright, A., Kovanović, V., Joksimović, S., van Staalduinen, J. P., & Gašević, D. (2019, March). Counting clicks is not enough: Validating a theorized model of engagement in learning analytics. In *Proceedings of the 9th International Conference on Learning Analytics & Knowledge* (pp. 501-510). ACM.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research, 59*(2), pp.117-142.

Finn, J. D. & Rock, D. A. (1997). Academic success among students at risk for school failure. *Journal of Applied Psychology*, *82*(2), 221–234. https://doi.org/10.1037/0021-9010.82.2.221

Flores, L. (2014). Digital dashboards. *How to Measure Digital Marketing*, *2003*(19). https://doi.org/10.1057/9781137340696.0016

Foster, J. E. (1998, May). Absolute versus relative poverty. *The American Economic Review, 88*(2), 335-341.

Fredricks, J. A. & McColskey, W. (2012). The measure of student engagement: A comparative analysis of various methods and student self-report instruments. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 763–782). New York, NY: Springer

Fujiwara, N., Imahori, S., Matsui, T., & Miyashiro, R. (2007). Constructive algorithms for the constant distance traveling tournament problem. *Practice and Theory of Automated Timetabling VI*, *28*(2), 135–146. https://doi.org/10.1007/978-3-540-77345-0_9

Garcia-Penalvo, F. J., Conde, M. a Á., Alier, M., Casany, M. J. M. J., García-Peñalvo, F. J., Conde, M. a Á., … Casany, M. J. M. J. (2011). Opening learning management systems to personal learning environments. *Journal of Universal Computer Science*, *17*(9), 1222–1240.

Gardner, D. P., Larsen, Y. W., Baker, W., Campbell, A., & Crosby, E. A. (1983). A nation at risk: The imperative for educational reform. United States Department of Education.

Gašević, D., Jovanović, J., Pardo, A., & Dawson, S. (2017). Detecting learning strategies with analytics: Links with self-reported measures and academic performance. *Journal of Learning Analytics*, *4*(2), 113-128.

Gautreau, C. (2016). Motivational factors affecting the integration of a learning management system by faculty. *The Journal of Educators Online*, *8*(1), 1–25. https://doi.org/10.9743/jeo.2011.1.2

Gibbons, S. (2005). Course-Management Systems. *Library Technology Reports, 41*(3), 7-11.

Gladwin, C. H. (1989). Ethnographic decision tree modeling (Vol. 19). Newbury Park, CA: Sage.

Govindasamy Thavamalar. (2002). Successful Implementation of e-Learning Pedagogical Considerations. *Internet and Higher Education*, *4*, 287–299.

Greene, B. A. (2015). Measuring Cognitive Engagement With Self-Report Scales: Reflections From Over 20 Years of Research. *Educational Psychologist*, *50*(1), 14–30. https://doi.org/10.1080/00461520.2014.989230

Griffiths, M. E., & Graham, C. R. (2009). Patterns of User Activity in the Different Features of the Blackboard CMS across All Courses for an Academic Year at Brigham Young University JOLT - Journal of Online Learning and Teaching. *Learning*, *5*(2), 1–8.

Hagood, D. (2016, April). The education dissertation: A historical exploration. Paper presented at the annual AERA conference, Washington, DC.

Harris, L. (2011). Secondary teachers' conceptions of student engagement: Engagement in learning or in schooling? *Teaching and Teacher Education, 27*(2), 376-386.

Harwood, T. G., & Garry, T. (2004). An Overview of Content Analysis. *The Marketing Review*, *3*(4), 479–498. https://doi.org/10.1362/146934703771910080

Haynes, S. N., Richard, D., & Kubany, E. S. (1995). Content validity in psychological assessment: a functional approach to concepts and methods. *Psychological assessment, 7*(3), 238.

Heisserer, D. L., & Parette, P. (2002). Advising at-risk students in college and university settings. *College Student Journal*, *36*(1), 69–80.

Henrie, C. R., Halverson, L. R., & Graham, C. R. (2015). Measuring student engagement in technology-mediated learning: A review. *Computers and Education*, *90*, 36–53. https://doi.org/10.1016/j.compedu.2015.09.005

Hill, P. (2017, October 31). *State of higher ed LMS market for US and Canada: Fall 2017 edition.* Retrieved from e-Literate website: https://mfeldstein.com/state-higher-ed-lms-market-us-canada-fall-2017-edition/

Hill, P. (2021, July 27). *State of higher ed LMS market for US and Canada: mid-Year 2021 Edition*. PhilonEdTech. https://philonedtech.com/state-of-higher-ed-lms-market-for-us-and-canada-mid-year-2021-edition/

Holton, J. A. (2007). The coding process and its challenges. In A. Bryant andK. Charmaz, K. (Eds.), *The Sage handbook of grounded theory*. Sage.

Huff, A. S. (2009). Designing research for publication. Los Angeles, CA: SAGE.

Huguet, M.-P. (2018). Designing online and blended courses for students with a learning difference. Presentation at InstructureCarn 2018. Retrieved from: https://community.canvaslms.com/videos/3850-designing-online-and-blended-courses-for-students-with-a-learning-difference

Huisman, J. & Currie, J. (2004). Accountability in higher education: Bridge over troubled water? *Higher Education, 48*(4), 529-551.

Hoic-Bozic N. ; Mornar, V. ; B. I. (2009). A blended learning approach to course design and implementation. *IEEE Education Society*, *52*(1), 19–30.

Horn, L. J. (1997). *Confronting the Odds: Students At Risk and the Pipeline to Higher Education*. (October). Retrieved from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=98094

Hu, Y. H., Lo, C. L., & Shih, S. P. (2014). Developing early warning systems to predict students' online learning performance. *Computers in Human Behavior*, *36*, 469–478. https://doi.org/10.1016/j.chb.2014.04.002

Ifenthaler, D. (2008). Implementation of web-enhanced features for successful teaching and learning. The utility of technological progressions of Learning Management Systems. *Annual Proceedings of Selected Research and Development Papers Presented at the National*

Convention of the Association for Educational Communications and Technology (31st, Orlando, FL, 2008). Volume 1, *1*, 134–146.

Increasing student success with learning analytics. (2018). Retrieved from Blackboard website: https://www.blackboard.com/education-analytics/index.html

Irlbeck, S., & Mowat, J. (2007). Learning content management system (LCMS). In K. Harman & A. Koohang (Eds.), *Learning Objects: Standards, metadata, repositories, and LCMS* (pp. 157–184). Santa Rosa, California: Informing Science Press.

Joksimović, S., Poquet, O., Kovanović, V., Dowell, N., Mills, C., Gašević, D., ... & Brooks, C. (2018). How do we model learning at scale? A systematic review of research on MOOCs. Review of Educational Research, 88(1), 43-86. doi:10.3102/0034654317740335

Jordan, W. J., McPartland, J. M., & Lara, J. (1999). Rethinking the causes of high school dropout. *The Prevention Researcher, 6*, 1–4.

Kane, M. (2012). All validity is construct validity. Or is it?. *Measurement: Interdisciplinary Research & Perspective, 10*(1-2), 66-70.

Kitchin, R. (2014). Big Data, new epistemologies and paradigm shifts. *Big Data & Society, 1*(1), doi:10.1177/2053951714528481

Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. *Journal of School Health, 74*(7), 262-273.

Kljun, M., Vicic, J., Kavsek, B., & Kavcic, A. (2007, June). Evaluating comparisons and evaluations of learning management systems. In *29th International Conference on Information Technology Interfaces* (pp. 363-368). IEEE.

Knight, S., & Buckingham Shum, S. (2017). Theory and learning and analytics. In C. Lang, G. Siemens, A. Wise, & D. Gašević, *Handbook of learning analytics* (1st ed.), pp. 17-22. doi:10.18608/hla17

Knight, A., Shakeshaft, A., Havard, A., Maple, M., Foley, C., & Shakeshaft, B. (2017). The quality and effectiveness of interventions that target multiple risk factors among young people: a systematic review. *Australian and New Zealand journal of public health*, *41*(1), 54-60.

Koball, H., Dion, R., Gothro, A., Bardos, M., Dworsky, A., Lansing, J., ... & Manning, A. E. (2011). Synthesis of research and resources to support at-risk youth (No. 8353b63284d94941bcb778e1c4027419). Mathematica Policy Research.

Ladson-Billings, G. (2007). Pushing past the achievement gap: An essay on the language of deficit. *The Journal of Negro Education*, *76*(3), 316-323.

Larivière, V., Zuccala, A., & Archambault, É. (2008). The declining scientific impact of theses: Implications for electronic thesis and dissertation repositories and graduate studies. *Scientometrics*, *74*(1), 109–121. https://doi.org/10.1007/s11192-008-0106-3

Laura, G., Bogdan, O., Aurelia, C., & Serban, M. (2018). University learning management system based on Office 365. *2018 17th International Conference on Information Technology Based Higher Education and Training, ITHET 2018*, 1–6. https://doi.org/10.1109/ITHET.2018.8424799

Leaper, C. (2011). More Similarities than Differences in contemporary Theories of social development?. A plea for theory bridging. *Advances in Child Development and Behavior*, *40*, 337–378. https://doi.org/10.1016/B978-0-12-386491-8.00009-8

Lederman, D. (2005, October 13). Blackboard, WebCT to merge. *Inside Higher Ed*. Retrieved from https://www.insidehighered.com/news/2005/10/13/blackboard-webct-merge

Lederman, D. (2018, November, 7). Online education ascends. *Inside Higher Ed.* Retrieved from https://www.insidehighered.com/digital-learning/article/2018/11/07/new-data-online-enrollments-grow-and-share-overall-enrollment

Lester, J. (2008). Performing gender in the workplace: Gender socialization, power, and identity among women faculty members. *Community College Review, 35*(4), 277-305.

Lu, J., Yu, C. S., & Liu, C. (2003). Learning style, learning patterns, and learning performance in a WebCT-based MIS course. *Information & Management*, 40(6), 497-507.

Liu, M., Yang, Y., Woo, H. L., Wang, Q., & Quek, C. L. (2011). Using the Facebook group as a learning management system: An exploratory study. *British Journal of Educational Technology*, *43*(3), 428–438. https://doi.org/10.1111/j.1467-8535.2011.01195.x

Lonn, S., & Teasley, S. D. (2009). Saving time or innovating practice: Investigating perceptions and uses of Learning Management Systems. *Computers and Education*, *53*(3), 686–694. https://doi.org/10.1016/j.compedu.2009.04.008

Macfadyen, L. P. & Dawson, S. (2010). Mining LMS data to develop an "early warning system" for educators: A proof of concept. *Computers & Education, 54*(2), 588-599.

Machado, M., & Tao, E. (2007). Blackboard vs. Moodle: Comparing user experience of learning management systems. *Proceedings - Frontiers in Education Conference, FIE*, (December 2006), 7–12. https://doi.org/10.1109/FIE.2007.4417910

Malikowski, S. R. (2008). Factors relted to breadth of use in course management systems. *Internet and Higher Education*, *11*(2), 81–86. https://doi.org/10.1016/j.iheduc.2008.03.003

Martin, A. J. (2008). Enhancing student motivation and engagement: The effects of a multidimensional intervention. *Contemporary Educational Psychology*, *33*(2), 239–269. https://doi.org/10.1016/j.cedpsych.2006.11.003

Martin, A. J., Ginns, P., & Papworth, B. (2017). Motivation and engagement: Same or different? Does it matter? *Learning and Individual Differences*, *55*, 150–162. https://doi.org/10.1016/j.lindif.2017.03.013

Machado, M., & Tao, E. (2007, October). Blackboard vs. Moodle: Comparing user experience of learning management systems. In *2007 37th annual frontiers in education conference-global engineering: Knowledge without borders, opportunities without passports* (pp. S4J-7). IEEE.

Marquart, C. L., Swiecki, Z., Collier, W., Eagan, B., Woodward, R., & Shaffer, D. W. (2019, February 7). rENA: Epistemic Network Analysis [R package documentation software manual]. https://cran.r-project.org/web/packages/rENA/rENA.pdf

Mayer-Schoenberger, V. and K. Cukier. 2013. *Big Data. A Revolution that will transform how we live, work, and think.* London: John Murray Publishers.

Mazza, R., & Dimitrova, V. (2004, May). Visualising student tracking data to support instructors in web-based distance education. In *Proceedings of the 13th international World Wide Web conference on Alternate track papers & posters* (pp. 154-161). ACM.

McCoach D. B., Gable, R. K., & Madura, J. P. (2013). *Instrument development in the affective domain: School and corporate applications* (3rd Ed.). New York, NY: Springer.

McFarland, J., Hussar, B., Wang, X., Zhang, J., Wang, K., Rathbun, A., ... & Mann, F. B. (2018). The Condition of Education 2018. NCES 2018-144. *National Center for Education Statistics.*

McGill, T. J., & Klobas, J. E. (2009). A task-technology fit view of learning management system impact. *Computers and Education*, *52*(2), 496–508. https://doi.org/10.1016/j.compedu.2008.10.002

McKenzie, L. (2018, July 10). Canvas catches, and maybe passes, blackboard. *Inside Higher Ed.* Retrieved from https://www.insidehighered.com/digital-learning/article/2018/07/10/canvas-catches-and-maybe-passes-blackboard-top-learning

McKenzie, K., & Schweitzer, R. (2001). Who succeeds at university? Factors predicting academic performance in first year Australian university students. *Higher Education Research & Development, 20*(1), 21-33.

McMillan, J. H., & Reed, D. F. (1994). At-risk students and resiliency: Factors contributing to academic success. *The Clearing House, 67*(3), 137-140.

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.

Mierzwik, B., Hanchett, C., Finch, D., Hasbun, J., Abrahams, K., Torkian, K., & Sorg, T. (2016). Methods for web content analysis and context [unpublished paper]. Retrieved from: https://github.com/Cap7pdx/phoenix-node/blob/master/Methods%20for%20Web%20Content%20Analysis%20and%20Context%20Detection.pdf

Mislevy, R., Steinberg, L., & Almond, R. (2003). On the structure of educational assessments. *Measurement: Interdisciplinary Research and Perspectives, 1*, 3–62.

Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). E-Learning, online learning, and distance learning environments: Are they the same? *Internet and Higher Education*, *14*(2), 129–135. https://doi.org/10.1016/j.iheduc.2010.10.001

Nathan, M. J. & Sawyer, R. K. (2014). Foundations of the learning sciences. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 21-43). New York, NY: Cambridge University Press.

National Center for Educational Statistics. (2016). Table 317.40: Number of degree-granting postsecondary institutions and enrollment in these institutions, by enrollment size, control, and classification of institution: Fall 2016. In *Digest of Educational Statistics* (2016 ed.). Retrieved from: https://nces.ed.gov/programs/digest/d17/tables/dt17_317.40.asp

Natriello, G. (2014). At-risk students. In D. Levinson, P. Cookson, & A. Sadovnik (Eds.), *Education and sociology: An Encyclopedia* (pp. 49–54). New York, NY: Routledge.

Ngai, G., Chan, S. C. F., Cheung, J. C. Y., & Lau, W. W. Y. (2010). Deploying a wearable computing platform for computing education. *IEEE Transactions on Learning Technologies*, *3*(1), 45–55. https://doi.org/10.1109/TLT.2009.49

Onwuegbuzie, A. J. (2016). A call for conducting multivariate mixed analyses. *Journal of Educational Issues, 2*(2), 1-30.

Outcomes reporting. (2018). Retrieved from Blackboard website https://help.blackboard.com/Learn/Administrator/SaaS/Tools_Management/Outcomes_Assessment/Outcomes_Reporting

Pardo, A., Bartimote, K., Shum, S. B., Dawson, S., Gao, J., Gašević, D., ... & Vigentini, L. (2018). OnTask: Delivering data-informed, personalized learning support actions. *Journal of Learning Analytics, 5*(3), 235-249.

Park, Y., & Jo, I. H. (2015). Development of the learning analytics dashboard to support students' learning performance. *Journal of Universal Computer Science*, *21*(1), 110.

Pellegrino, J. W. (2014). A learning sciences perspective on the design and use of assessment in education. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 233-252). New York, NY: Cambridge University Press.

Performance plus. (2018). Retrieved from D2L website: https://www.d2l.com/higher-education/products/performance

Placier, M. L. (1993). The semantics of state policy making: The case of "at risk." *Educational Evaluation and Policy Analysis, 14*(4), pp. 380-395.

Podgorelec, V., & Kuhar, S. (2011). Taking advantage of education data: Advanced data analysis and reporting in virtual learning environments. *Electronics and Electrical Engineering*, *8*(8), 111–116.

Prinsloo, P., & Slade, S. (2014). Student data privacy and institutional accountability in an age of surveillance. In *Using data to improve higher education* (pp. 195-214). Brill Sense.

Renninger, K. A., Ren, Y., & Kern, H. M. (2018). Motivation, engagement, and interest. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann, *International Handbook of the Learning Sciences*, (pp. 116–126). New York, NY: Routledge.

Reschly, A. & Christenson, S. L. (2006b). Promoting school completion. In G. Bear & K. Minke (Eds.), *Children's needs III: Understanding and addressing the developmental needs of children*. Bethesda, MD: National Association of School Psychologists.

Reschly, A. L. & Christenson, S. L. (2012). Jingle, jangle, and conceptual haziness: Evolution and future directions of the engagement construct. In S. L. Christenson, A. L. Reschly, & C. Wylie (Eds.), *Handbook of research on student engagement* (pp. 3–20). New York, NY: Springer.

Reschly, A. L., Pohl, A. J., & Christenson, S. (Eds.). (2020). *Student engagement: Effective academic, behavioral, cognitive, and affective interventions at school.* Springer.

Richardson, V. (2007). At-Risk student intervention implementation guide: A comprehensive resource for identifying programs to help decrease South Carolina's school dropout

problem. Columbia, SC: The Education and Economic Development Coordinating Council At-Risk Student Committee.

Robertson, S. (2004). Understanding inverse document frequency: On theoretical arguments for IDF. *Journal of Documentation, 60*(5), 503-520. https://doi.org/10.1108/00220410410560582

Roll, I., Macfadyen, L. P., & Sandilands, D. (2015, March). Evaluating the relationship between course structure, learner activity, and perceived value of online courses. In *Proceedings of the Second (2015) ACM Conference on Learning@ Scale* (pp. 385-388). ACM.

Rosenthal, B. S. (1998). Non-school correlates of dropout: An integrative review of the literature. *Children and Youth Services Review, 20*, 413–433.

Rupp, A. A., Bagley, E., Shaffer, D. W., Hatfield, D., Svarovsky, G. N., Nash, P., … Mislevy, R. (2009). Epistemic Network Analysis: A Prototype for 21st-Century Assessment of Learning. *International Journal of Learning and Media*, *1*(2), 33–53. https://doi.org/10.1162/ijlm.2009.0013

Russell, M. L., Escobar, M., Russell, J. A., Robertson, B. K., & Thomas, M. (2018). Promoting pathways to STEM careers for traditionally underrepresented graduate students. *Negro Educational Review, 69*(1-4), 5-143.

Ryan, F. (2013). Motivation and Engagement. *Cognitive Therapy for Addiction*, 75–98. https://doi.org/10.1002/9781118316474.ch6

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Sampson, D. G., & Karampiperis, P. (2006). Towards Next Generation Activity-based Learning Systems. *International Journal on E-Learning*, *5*(1), 129–149.

Sansosti, F. J. (2010). Teaching Social Skills To Children With Autism Spectrum Disorders. *Psychology in Schools*, *45*(5). https://doi.org/10.1002/pits

Schoonenboom, J. (2014). Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Computers & Education*, *71*, 247-256. https://doi.org/10.1016/j.compedu.2013.09.016

Schwendimann, B. A., Boroujeni, M. S., Holzer, A., Gillet, D., & Dillenbourg, P. (2015). Understanding learning at a glance : An overview of learning dashboard studies Categories and Subject Descriptors. *Proceedings of the Sixth International Conference on Learning Analytics & Knowledge*, 532–533.

Selwyn, N. (1997). Students' attitudes toward computers: Validation of a computer attitude scale for 16–19 education. *Computers & Education*, *28*(1), 35-41.

Sezer, B., & Yilmaz, R. (2019). Learning management system acceptance scale (LMSAS): A validity and reliability study. *Australasian Journal of Educational Technology*, *35*(3).

Shaffer, D. W. (2017). Quantitative ethnography. Madison, WI: Cathcart Press.

Shaffer, D. W., Hatfield, D., Svarovsky, G. N., Nash, P., Nulty, A., Bagley, E., ... & Mislevy, R. (2009). Epistemic Network Analysis: A Prototype for 21st-Century Assessment of Learning. *International Journal of Learning and Media*, 1(2). doi:10.1162/ijlm.2009.0013

Shaffer, D. W., Collier, W., & Ruis, A. R. (2016). A tutorial on epistemic network analysis: Analyzing the structure of connections in cognitive, social, and interaction data. *Journal of Learning Analytics*, 3(3), 9-45.

Shaffer, D. W. & Ruis, A. R. (2017). Epistemic network analysis: A worked example of theory-based learning analytics. In C. Lang, G. Siemens, A. Wise, & D. Gašević (Eds.), *Handbook of learning analytics* (pp. 175-187). Society for Learning Analytics and Research. doi: 10.18608/hla17.015

Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-positive psychology: Undisclosed flexibility in data collection and analysis allows presenting anything as significant. *Psychological Science, 22*(11), 1359-1366.

Skinner, E., Furrer, C., Marchand, G., Kindermann, T., Appleton, J. J., Christenson, S. L., … Griffin, O. (2008). Epistemology, Assessment, Pedagogy: Where Learning Meets Analytics in the Middle Space. *Review of Educational Research*, *10474 LNCS*(4), 410–415. https://doi.org/10.1111/j.1365-2729.2007.00260.x

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children's behavioral and emotional participation in academic activities in the classroom. *Educational and Psychological Measurement, 69*(3), 493-525.

Spence, R. (2007). Information visualization: An introduction (3rd Ed.). London UK: Springer

Students at risk of dropping out. (2018, April 24). Retrieved from Moodle website: https://docs.moodle.org/35/en/Students_at_risk_of_dropping_out

Tenenbaum, G., Naidu, S., Jegede, O., & Austin, J. (2001). Constructivist pedagogy in conventional on-campus and distance learning practice: An exploratory investigation. *Learning and Instruction*, *11*(2), 87-111.

Tempelaar, D. T., Rienties, B., & Giesbers, B. (2015). In search for the most informative data for feedback generation: Learning analytics in a data-rich context. *Computers in Human Behavior*, *47*, 157–167. https://doi.org/10.1016/j.chb.2014.05.038

Thacker, Jarrod, Russell, Matthew, Brawley, S. (2014). *Learning Management System Comparative Usability Study*. Retrieved from http://www.jarrodt.me/docs/LMSUsabilityStudy_Report.pdf

Thomas, J. J. & Cook, K. A. (Eds.). (2005). *Illuminating the path: The research and development agenda for visual analytics*. National Visualization and Analytics Center.

Tracking progress. (2018, August 10). Retrieved from Moodle website: https://docs.moodle.org/35/en/Tracking_progress

Tello, S. F., & Motiwalla, L. (2010). Using a learning management system to facilitate learning outcomes assessment. In *Learning management system technologies and software solutions for online teaching: Tools and applications* (pp. 138-156). IGI Global.

Toth, L. S., & Montagna, L. G. (2002). Class size and achievement in higher education: A summary of current research. *College Student Journal, 36*(2), 253-261.

Ülker, D., & Yılmaz, Y. (2016). Learning Management Systems and Comparison of Open Source Learning Management Systems and Proprietary Learning Management Systems. *Journal of Systems Integration*, 18–24. https://doi.org/10.20470/jsi.v7i2.255

U.S. Department of Education. Institute of Education Sciences, National Center for Education Statistics. (2020). "Characteristics of postsecondary faculty." In *The Conditions of Education 2020*. Retrieved from: https://nces.ed.gov/programs/coe/indicator/csc

Verbert, K., Duval, E., Klerkx, J., Govaerts, S., & Santos, J. L. (2013). Learning analytics dashboard applications. *American Behavioral Scientist*, *57*(10), 1500-1509. doi:1177/0002764213479363

Vozniuk, A., Gillet, D., Holzer, A., Boroujeni, M. S., Prieto, L. P., Dillenbourg, P., … Rodriguez-Triana, M. J. (2016). Perceiving Learning at a Glance: A Systematic Literature Review of Learning

Dashboard Research. *IEEE Transactions on Learning Technologies*, *10*(1), 30–41. https://doi.org/10.1109/tlt.2016.2599522

Wainwright, K., Osterman, M., Finnerman, C., & Hill, B. (2007). *Traversing the LMS terrain*. 355–359. https://doi.org/10.1145/1294046.1294130

Wang, F. H. (2017). An exploration of online behaviour engagement and achievement in flipped classroom supported by learning management system. *Computers & Education*, *114*, 79-91.

Watson, W. & Watson, S. L. (2007). An argument for clarity: What are learning management systems, what are they not, and what should they become. *TechTrends*, *51*(2), 28–34.

Weaver, D., Spratt, C., & Nair, C. S. (2008). Academic and student use of a learning management system: Implications for quality. *Australasian Journal of Educational Technology*, *24*(1), 30–41. https://doi.org/10.14742/ajet.1228

Weiner, B. (2010). The development of an attribution-based theory of motivation: A history of ideas. *Educational Psychologist, 45*, 38-36. doi:10.1080/00461520903433596

West, D. (2012). Big Data for Education: Data Mining, Data Analytics, and Web Dashboards. Governance Studies at Brookings. *Governance Studies at Brookings*, (September), 1–10. https://doi.org/10.1109/EDUCON.2014.6826107

Whiting, G. W. (2006). From at risk to at promise: Developing scholar identities among Black males. *Journal of Secondary Gifted Education*, *17*(4), 222-229.

Wigfield, A., & Eccles, J. S. (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology*, *25*(1), 68–81. https://doi.org/10.1006/ceps.1999.1015

Williamson, B. (2017). *Big data in education: The digital future of learning, policy and practice.* London, UK: SAGE

Wilson, S., Liber, O., Johnson, M., Beauvoir, P., Sharples, P., & Milligan, C. (2007). Personal Learning Environments: Challenging the dominant design of educational systems. *Journal of E-learning and Knowledge Society*, *3*(2), 27-38.

Winslow, S. (2010). Gender inequality and time allocations among academic faculty. *Gender & Society, 24*(6), 769-793.

Wise, L., & Quealy, J. (2006). At the limits of social constructivism : Moving beyond LMS to re-integrate scholarship. *Proceedings of the 23rd Annual Ascilite Conference: Who's Learning? Whose Technology?*, 899–907.

Yang, J. (2015). *Emerging Issues in Smart Learning*. 31–40. https://doi.org/10.1007/978-3-662-44188-6

Yi, J. S., Kang, Y.-a., Stasko, J. T., & Jacko, J. A. (2008). Understanding and characterizing insights: How do people gain insights using information visualization? In *Proceedings of the 2008 Workshop on BEyond time and errors: novel evaLuation methods for Information Visualization* (BELIV). ACM.

Zhou, M., & Winne, P. H. (2012). Modeling academic achievement by self-reported versus traced goal orientation. *Learning and Instruction*, *22*(6), 413–419. https://doi.org/10.1016/j.learninstruc.2012.03.004

Zimmerman, B. J., & Schunk, D. H. (Eds.). (2001). *Self-regulated learning and academic achievement: Theoretical perspectives*. New York, NY: Routledge.

9 Appendix A: Interview Protocol

General Construct Questions

- Overall, what does student engagement means to you in your teaching? What about students being at risk?
- In general, how do you learn about your students' level of engagement or disengagement? How do you tell which of your are at risk?
    - What does student engagement / disengagement look like?
    - Can you tell which students are engaged? At risk?
- So to summarize, how do you define student engagement / risk status?
    - Do you see a connection between these two concepts?

General LMS Context

- What are the ways you use the LMS? How do you typically use the LMS?
    - How many times to you seem to login in a week? day?
    - Are you required to use the LMS?
- Do you typically use the LMS dashboard? What are the ways you use the dashboard?
    - How many times to you see the dashboard in a week? day?
    - Are you required to use the dashboard?

Engagement / Risk Status in the LMS

- In particular, what does the LMS show you about student engagement? Does it help you learn about student engagement?
    - If so, can you tell me a story about that? How did the LMS inform you of student engagement? What did you do based on that information?
    - What do you wish it could tell you? What would that change about your teaching?
- What does the LMS show you about which students are "at risk"? Does it help you learn about student risk status?
    - If so, can you tell me a story about that? How did the LMS appraise you of at risk students? What did you do based on that information?
    - What do you wish it could tell you? What would that change about your teaching?
- Based on your LMS experience, what makes a student at-risk, according to the LMS? How does this relate to your own idea of which students are at-risk and why?
- What else do you learn about your class or students by using the LMS?

Wrap-up

- Given our conversation, do you want to add anything else about using the LMS? Or, about how the LMS helps you learn about your class or students?

10 Appendix B: Survey Questions

Note. The order of these questions have been changed from the survey to present them in conceptual groups.

Instructional Experience

What undergraduate courses do you teach regularly?

- open response

Are any of these courses large, lecture-hall courses?

- none
- some
- all

What is your field?

- open response

Which title best describes your position?

- associate professor
- assistant professor
- full professor
- adjunct professor
- instructor
- postdoc
- other

Is your position designated as LPSOE or LSOE? [These titles denote a teaching-focused contract.]

- yes
- no
- unsure

What percentage of your appointment is allocated to teaching?

- <25%
- 25%
- 50%
- 75%
- 100%

LMS Experience

Do you use the campus learning management system (LMS)?

- I use Blackboard
- I use Canvas
- I do not use either Blackboard or Canvas

How long have you used this LMS? (e.g. number of months or years)

- open response

How would you rate your skills as a computer user?

- non-user
- beginner

- intermediate
- advanced

How strongly do you agree or disagree with the following statements?

- strongly disagree
- disagree
- neither disagree nor agree
- agree
- strongly agree

The campus LMS helps me improve my instruction to the students

The campus LMS makes it possible for students to study more effectively

The campus LMS allows me to design more interesting and creative lessons

Most things that the campus LMS can be used for, I could do just as well without the LMS

The campus LMS helps me save time in designing and using resources for teaching and learning

General Demographics

What is your gender?

- female
- male
- other

What is your ethnicity?

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic or Latino
- Native Hawaiian or Other Pacific Islander
- White
- other

What is your age?

- 18-34
- 35-50
- 51-69
- 70-87
- 88+