THE EFFECTS OF STUDENT SOCIAL CLASS ON LEARNING IN COMPUTER-MEDIATED VERSUS FACE-TO-FACE SETTINGS

by

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Abstract

Contemporary higher education makes use of computers and the Internet more than ever before and the extent to which education is delivered via these media is only likely to increase in the future. While computer-mediated communication and education have been studied extensively, relatively little research has examined the potential impact of cultural background (e.g. social class) on students’ experiences of different learning media. To address this gap, the current research uses a multi-sample (6 samples; n = 473), quasi-experimental approach to interrogate the relationship between student social class background and learning environment on various educational and individual outcomes. Examining a trichotomous (lower, middle, upper) conceptualization of social class across three distinct learning environments (face-to-face, computer-mediated, and fully-online) I find evidence of effects of student social class, learning environment and their interaction. In general, middle class students vary the least across conditions; lower class students tend to score lower on outcomes overall but with some notable exceptions for shared experience in face-to-face settings and comfort in online settings; and upper class students tend to experience a laboratory-based computer-mediated learning environment most positively. Implications for studying computer-mediated learning and social class are discussed, along with implications for real-world online education.
Introduction

Education is sometimes referred to as “the great equalizer,” implying that gaps in achievement, status, and other domains can be closed through a quality education (Duncan, 2012). Indeed, American culture has widely embraced the value of education at all levels and attempts to ensure that all of its citizens have access to it. But there remains a persistent academic achievement gap in the United States, both in terms of academic performance and persistence in higher education (Espenshade & Radford, 2009; Ross et al., 2012). Students from disadvantaged groups perform worse than other students and are less likely to complete college (Dickert-Conlin & Rubenstein, 2007; Ross et al., 2012; Stephens, Fryberg, Markus, Johnson, & Covarrubias, 2012; Stephens, Markus, & Phillips, 2014). A lot of research has gone into explaining this gap and trying to address it among various cultural groups, including socioeconomic groups. Some explanations for the achievement gap among lower class individuals include worse preparation for college (Crozier & Reay, 2011) and cultural mismatch with college environment (Stephens, et al., 2012). This research illustrates how cultural differences associated with social class background can have an important impact on educational experiences. One area to which this lesson has not been applied so extensively is online and computer-mediated education.

The advent of computers and the Internet has added another layer to the already complex and difficult problem of educational achievement gaps. New technology has dramatically affected pedagogical possibilities and substantially expanded the potential accessibility of educational opportunities (Allen & Seaman, 2015). Consequently, educational institutions increasingly see online, computer-mediated (CM) learning as an important component of their future educational offerings (Allen & Seaman, 2015; Mazoue, 2012). This trend towards online
education is usually seen as a good thing because of its efficiency and accessibility. But despite its advantages, online, CM education presents some unique challenges to closing the achievement gap. Among the challenges involved in providing online, CM education is one factor that is often overlooked – the role of cultural backgrounds and socioeconomic factors in contributing to student success in different educational settings.

Drawing on literature that sees culture as patterns of norms and values and recognizes that a particular set of norms and values may not always be a good fit for some social settings (Markus & Kitayama, 2010; Stephens, et al. 2012), I argue that the different cultural contexts from which students come (social class contexts, in this case) predispose them to experience educational settings in different ways and with different consequences. In particular, CM and face-to-face (FtF) learning environments differ in ways that suggest students from different cultural backgrounds will experience them differently. Chief among the differences distinguishing these environments is the degree of interpersonal contact and non-verbal social information available to students (Walther, 2011). One might expect that a student from a cultural background that privileges contextual information and sees the self as interconnected with other people would benefit from the physical presence of others during their learning experience, while a student from a background that places strong value on autonomy and independence from others would benefit from a learning environment that grants them more autonomy.

In the research described here, I test the possibility that because lower social class individuals are more context-focused, they would derive an interpersonally valuable sense of shared experience and connection to others largely from physical co-presence with others, and consequently they would have more difficulty achieving a sense of shared experience and
connection to others in CM learning environments. Moreover, due to variability in measuring social class in the literature, I examine the potential for various conceptualizations of social class to predict experiences in CM and FtF learning environments. Here, I examine which aspects of learning environment and social class may predict positive social and emotional experiences during brief learning activities.

I begin by summarizing research on culture and education, specifically the role of social class background in educational experiences. I also discuss research on CM education relative to FtF instruction and the potentially important phenomenological points of discrepancy between the two media, such as shared reality, shared attention, and connectedness to others. I then briefly summarize six different studies designed to investigate the role of social class in college students’ experience of different educational settings. Because findings from these individual studies were inconclusive and mixed, and because of the exploratory nature of this topic, I focus on a pooled-data analysis in which I combine and explore the data from the six different samples, yielding a total N of 473. I discuss the observed results and their potential implications for both future research in this area and in applied educational contexts.

Culture, Social Class, and Education

Culture. Social scientists understand that many processes once considered fundamentally human can often vary considerably depending on the cultural context. Social psychology has a constantly improving grasp of many of the cultural psychological dimensions that influence how people see themselves relative to others, and the patterns of norms and values that guide their daily lives. It is within this sociocultural framework that the present research is grounded. To many contemporary cultural psychology researchers, culture is seen not as a stable trait or categorical variable but as context-specific patterns of ideas, practices, and institutions (Adams
In a cycle of mutual constitution, these patterns shape the way people think about themselves and their place in the world, and these same people go on to shape the social contexts in which they reside (Markus & Kitayama, 1991; 2010; Shweder, 2003). This understanding of the role of culture in peoples’ lives has clear significance for the way people think about and engage in a wide variety of social institutions, including educational ones.

When it comes to how people engage with cultural products like educational institutions, there are easily identifiable discrepancies between different cultural and socioeconomic groups – like differences in physical access to educational institutions and learning resources (Ross et al., 2012). But there is also strong potential for the psychological and social characteristics of different cultural traditions to influence the way in which students approach educational experiences and understand their role within an educational institution (e.g. Tobin, Wu, & Davidson, 1989). The intersection of culture and education is not a new research area. However, with a growing understanding that cultural differences often go underappreciated in social science research (Henrich, Heine, & Norenzayan, 2010), the study of the role of culture in educational experiences is increasingly recognized as crucial (Fryberg, Covarrubias, & Burack, 2013; Oyserman, 2013; Oyserman & Destin, 2010).

**Culture and education.** Among the cultural factors studied in relation to educational processes, characteristics like societal individualism and collectivism or independence and interdependence can influence the nature of educational settings and the thoughts and behavior of those who occupy those settings. Briefly, *individualism* describes a tendency to prioritize individual goals and autonomy which often leads to *independent* self-construals where people think of themselves as more distinct from others, whereas *collectivism* describes a tendency to
prioritize collective goals and relational concerns, leading to more *interdependent* self-construals where people think of themselves as intertwined with others in their social world (Markus & Kitayama, 1991; Triandis, 1989). Ethnographic research on preschools in Japan, China, and the United States (Tobin, et al., 1989) and in schools in the United States that serve students from different cultural and SES backgrounds (Kusserow, 2004; Lareau, 2003) provide compelling evidence that educational norms and practices can vary cross-culturally and in ways consistent with the norms and values of the particular cultural settings in which they are situated. Institutions of higher education in individualistic nations, for example, tend to embody individualistic norms and values (Stephens, et al., 2012) and prioritize elements like research performance over elements like organizational culture (Bui & Baruch, 2012).

**Culture and social class.** The significance for education of these cultural patterns of norms and values can be seen not only cross-nationally but also within a particular society. Social class is increasingly considered, within social psychology, to constitute an important culture context, related to but distinguishable from many other oft-studied group identities (e.g., ethnic background; Kraus, Piff, & Keltner, 2011). Within social class groups, for instance, one also sees cultural differences that are likely to impact peoples’ thoughts and behavior when it comes to educational norms and practices. Different social class groups tend to possess different understandings of their place in the world and relation to others (Grossman & Varnum, 2011) and different kinds of cultural capital (Bourdieu, 1985); that is, they possess different sets of context-specific knowledge and skills that may be better suited to some environments rather than others. Ethnographies of children from different social class backgrounds in the United States show that middle and upper class parents tend to be more directly involved with the education and day-to-day activities of their children, and that these children tend to be more assertive and
direct in their relationships with adults and authority figures; while lower class children are left to their own devices more often and their relationships with adults and teachers are more hierarchical and deferent (Calarco, 2011; Kusserow, 2004; Lareau, 2003).

Research shows that lower social class groups tend to endorse more collectivistic norms and values and they tend to have more interdependent self-concepts and more holistic cognitive styles (Grossman & Varnum, 2011; Stephens, et al., 2012). This means that lower class individuals are likely to place greater emphasis on collective goals and the nature of the interpersonal relationships within their group. Possibly as a result of this difference in focus on contextual information and interpersonal relationships, relative to middle- and upper-class individuals those from the lower class are found to be more generous (Piff, Kraus, Cheng, & Keltner, 2010) and compassionate (Stellar, Manzo, Kraus, & Keltner, 2012). Lower social class individuals are also found to be more accurate when judging the emotions of others (Kraus, Cote, & Keltner, 2010), highlighting the fact that lower class people pay more attention to, and better recognize the importance of, the nonverbal cues in their surroundings. By contrast, people from higher social class groups tend to endorse more individualistic norms and values, have more independent self-concepts and analytic cognitive styles, and exhibit less prosocial behavior (Cote, House, & Willer, 2015; Grossman & Varnum, 2011; Piff, Stancato, Cote, Mendoza-Denton, & Keltner, 2012; Stephens, et al., 2012).

This kind of cultural variation across social class groups has the potential to impact the way education is delivered and received by the individuals belonging to those groups. Because of the mutually constituted nature of individuals and culture, dominant cultural values also become enshrined in the design and practices of cultural institutions like schools and colleges (Stephens, et al., 2012). For lower class individuals, this means that the educational environments they often
find themselves in were designed by and for higher-class individuals. This means that lower class individuals tend to lack the cultural capital and knowledge for how to act in such settings (e.g. Calarco, 2011; Kusserow, 2004; Lareau, 2003), they tend to worry about whether or not they belong in those environments (e.g. Johnson, Richeson, & Finkel, 2011; Oyserman, 2013; Stephens, et al., 2012; Stephens, Brannon, Markus, & Nelson, 2015), and they may even face stereotype threat (Croizet & Claire, 1998). This lack of congruence between the “actual-own” and “ideal-other” selves of lower class students can have a negative impact on their educational experience (e.g. Oyserman 2013; Oyserman, Fryberg, & Yoder, 2007; Oyserman & Destin, 2010; Elmore & Oyserman, 2012).

In short, the literature suggests that students from different class backgrounds enter higher educational settings with different cultural toolkits that may or may not prove useful to them in their efforts to learn. Lower class students in higher education settings often do not seem to benefit from the same sense of shared experience with others enjoyed by their upper class peers (Johnson, Richeson, & Finkel, 2011; Stephens, et al. 2012; Stephens, Hamedani, & Destin, 2014). Lower class students often do not feel that their peers are similar to them, nor are they convinced that they and their middle/upper-class peers are having the same experience of the college environment. I believe that above and beyond this lack of subjective and objective shared experience in traditional educational settings, certain learning environments – like CM, online settings – may make it even more difficult for lower class students to achieve a sense of shared experience with others in the learning activity.

**Computer-Mediated Learning**

Contemporary computer-mediated learning can take a variety of forms, each with its own unique set of contextual factors and characteristics. Today, computers are a ubiquitous
component of nearly all types of learning, from elementary to higher education. Even if the primary setting of content delivery is a FtF classroom, students will often use computers to access additional course material, complete and submit assignments, communicate with the instructor and other students, and so on. But computers often play a more central, mediating role in the learning process, as well. Courses can be delivered entirely online, with students accessing all necessary content via Internet connected computers or other devices and with little or no physical contact with classmates or instructors. So-called “hybrid” courses can also incorporate both FtF and CM-only aspects. Educational environments have always varied depending on aspects like instructor style, resources available, specific pedagogical choices or requirements, and so on; CM learning adds more possible variation.

Among CM courses, the precise methods of content delivery can vary substantially. CM lectures may be entirely text-based or rely on outside readings; they may take the form of video or audio-recorded lectures; or they may incorporate aspects of both. Lecture recordings can be anything from videos of a professor teaching an in-person lecture to a screen-capture video of content with audio-recorded information. Courses may require a great deal of interaction with the instructor and other students, or they may unfold without any significant interpersonal contact. Of those online courses that require interaction, it can be synchronous or asynchronous, and many courses involve a combination of both.

Given this tremendous potential for variation and innovation in CM learning, it can be difficult to synthesize relevant research into a straightforward set of findings. Each kind of CM course is characterized by unique sets of contextual information with unique implications for those engaged in the course. While little research has specifically examined the relationship
between cultural background and CM learning, there is substantial research examining some of the related components.

In educational psychology, studies comparing FtF and CM learning find little direct evidence of differences in actual academic performance (e.g. Kemp & Grieve, 2014). But many studies find evidence for differences in student experiential factors like student preferences and engagement (Kemp & Grieve, 2014), cooperative perceptions (Roseth, Saltarelli, & Glass, 2011), and motivation and competition (Saltarelli & Roseth, 2014). Studies of CM communication operationalized more broadly have revealed an abundance of differences between FtF and CM modalities. These studies primarily highlight the differences in non-verbal cues available to people and the ways people behave and adapt in the absence of those cues (e.g. Walther, Loh, & Granka, 2005; Walther, 2012) in CM contexts. The findings from the CM communication literature suggest that even if students, on average, tend to perform equally well in CM and FtF learning environments, they likely experience those environments differently, which could have implications for important outcomes such as subjective enjoyment of a learning experience. But it should also be noted that this literature has often tended to ignore the potential role of cultural differences, like social class. With the present research, I attempt to bridge the gap between the literature on CM education and communication and the literature on culture and education.

Shared Experience And Social Class

Research indicates that social class could be impacting students’ educational experience through a differential sense of shared experience with others in higher education settings. Here, the term shared experience is used as a general term encompassing various constructs that are thought to represent some sort of connection to the inner states of others above and beyond what
is merely observable (e.g. shared reality - Echterhoff, Higgins, & Levine, 2009; I-sharing - Pinel, Long, Landau, Alexander, & Pyszczynski, 2006; shared attention - Shteynberg, 2015). At a basic level, these authors tend to define shared reality, shared attention, or I-sharing as the knowledge that one is having a similar experience of an event with another person. For some other thinkers, a fundamental phenomenological point of concern is that of mutual knowledge or, rather, “how we come to know the mind of another person without being that person” (Zhao, 2007, p. 140). These thinkers and researchers, despite different operationalizations of the construct, all appear to be trying to tap into a human need or desire to feel like they are not alone in their experiences. Importantly, people are motivated to share their subjective reality with others (Hardin & Higgins, 1996) and doing so can have positive emotional consequences (Deiner & Seligman, 2002; Pinel, et al, 2006). Why not during learning experiences, as well?

It is likely that the positive effects of shared experience are stronger for people who are more highly motivated to seek out a shared sense of subjective reality with those around them (Pinel, et al., 2006) and when people perceive others to be similar to them (Shteynberg, 2015). Culturally speaking, people who have more communal values and/or interdependent self-concepts seem likely candidates to be more attuned to and to benefit the most from a sense of shared experience. For instance, Cohen, Hoshino-Browne, and Leung (2007) argue that those from collectivist backgrounds tend to adopt a “third-person” phenomenological perspective on the self, which partly involves being more sensitive to the unobservable feelings and thoughts of others and whether those are misaligned with the self’s experience. Insofar as lower class students tend to have qualities of cultural collectivism and interdependent self-construals, it stands to reason that a sense of shared experience in the educational context would be especially important for them.
With regard to the question of how social class and shared experience may impact CM learning environments, a crucial issue is how a sense of shared experience is achieved. Much of the research emphasizes access or imagined access to others’ inner, subjective states without necessarily sharing any physical space with another person (Echterhoff, Higgins, & Levine, 2009). Echterhoff and colleagues acknowledge that the nonverbal behaviors of others are likely to facilitate reality sharing, but that physical presence is not necessarily a required ingredient. Pinel and colleagues, in their work on I-sharing, propose that access to another’s inner state can be achieved without any physical presence by just imagining (Pinel et al., 2006). Shteynberg (2015) also posits that the degree to which we feel we are sharing attention with others depends, in part, on how similar we think the others are to us. Phenomenological thinkers have stressed the importance of physical co-presence and immediacy for the establishment of a sense of shared experience (Schutz, 1967). Schutz (1967) writes,

Spatial and temporal immediacy is essential to the face-to-face situation…It is further essential to the face-to-face situation that you and I have the same environment…We have, then, the same undivided and common environment, which we may call ‘our environment’. The world of the We is not private to either of us, but is our world, the one common intersubjective world which is right there in front of us (pp. 163, 171).

Given that more collectivistic people tend to be more attuned to the individuals around them, it follows that physical co-presence of the type Schutz describes may be especially important to establish shared experience for individuals from certain cultural backgrounds. I propose that situations of physical co-presence not only tend to facilitate the establishment of shared experience, but that they may play a more critical role for people from lower class
backgrounds due, in part, to differences in how similar those people feel to those around them in a given setting and how motivated they are to attend to those others in the first place. In a typical face-to-face (FtF) situation, this physical co-presence element of shared experience is taken for granted. But since CM interaction often lacks both “spatial and temporal immediacy”, how might a shared experience be achieved in this context?

**Shared Experience In CM Environments**

Phenomenological thinkers within the realm of education have criticized distance and CM learning for its inability to provide tangible, involved experiences with the world that allow students to learn and grow most effectively (Dreyfus, 2009). Traditional classrooms, even if they do not involve a lot of interaction, involve the immediate physical co-presence of the other students and the instructor, as well as the synchronicity of unfolding shared experience in real-time. This allows for the more involved kind of social experience that Dreyfus and Schutz believe is crucial for learning and development. By comparison, CM learning environments may not allow students to share experience in the same way. This possibility is supported by research showing that, compared to a CM interaction, a FtF interaction led to greater perceived self-other overlap and greater liking for one’s interaction partner (Okdie, Guadagno, Bernieri, Geers, & Mclarney-Vesotski, 2011) and research showing that CM learning environments are characterized by more individualistic thinking (Roseth, Saltarelli, & Glass, 2011).

As pointed out above, research shows that CM environments may be less effective at helping students feel connected to others or engaged in their education. This is important because connectedness to others in the educational environment – especially to others in your cultural group – along with positive attitudes about education, belonging, and overall emotional health have all been shown to improve student persistence and contribute to more positive academic
outcomes (Allen, Robbins, Casillas, & Oh, 2008; DeAngleo, Franke, Hurtado, Pryor, & Tran, 2011; Jensen, 2011; Kuh & Love, 2014; Orsuwan & Cole, 2007). Add to this the fact that retention rates in online education are often worse than for traditional higher education (Ali & Leeds, 2009; Lee & Choi, 2011) and the importance of ensuring an engaging, socially connected educational experience for students from all cultural backgrounds really comes into focus.

CM learning environments provide an interesting and previously unexplored limit case for current ideas about how a sense of shared experience is established. As mentioned, most perspectives (e.g., the work of Echterhoff, Higgins, and colleagues as well as the research on I-sharing) emphasize the importance of cognitive factors, e.g., the conscious perception that others are having reactions to an occurring event similar to the self’s own reactions. Yet classic phenomenology (e.g., Schutz) emphasizes the importance of physical co-presence and embodied cues to suggest (nonconsciously) that the self and others have shared the same reality in the course of an unfolding event. The surprisingly under-researched question arises as to whether CM environments can really create a sense of shared experience.

Echterhoff (2013) has suggested the untested possibility that CM environments may afford shared reality to the extent that they promote processes of self-disclosure (i.e., interlocutors directly reporting on their subjective processes to each other). While this may be true, it represents a culturally biased perspective, insofar as self-disclosure processes are typically more valued by individualist (Kurtis & Adams, 2013) and upper-class individuals (Bernstein, 1990). In the current study, we are exploring a different possibility: namely, that CM environments may afford less shared experience for lower class students specifically because they lack the quality of physical co-presence and the important social cues and information it affords.
Overview of the Present Study and Predictions

Over the course of approximately two years, I conducted six separate studies with the goal of quasi-experimentally testing the relationship between learning environment and cultural background (social class background, in this case). Each study either experimentally manipulated or naturally observed variation in learning environment. Specifically, there were three general kinds of environment examined in these studies: FtF learning, operationalized either “artificially” in a laboratory or “naturalistically” in a classroom; CM learning operationalized “artificially” in a laboratory; or online learning, operationalized “naturalistically” by allowing students to complete learning modules on their own via the Internet (see Methods for details). In addition to examining learning environment, each study also measured social class (subjective social class, annual family income, generational status) and assessed several outcomes related to learning experience.

When examined independently, none of these studies provided definitive statistical evidence (by conventional null-hypothesis significance-testing standards) of a relationship between student social class and learning environment on our outcomes of interest. However, analyses of these studies did reveal consistent, albeit often statistically non-significant, patterns in the data (information about these individual studies is available upon request). Motivated by these patterns, I conducted a large-scale, multi-sample analysis of these six studies to see if greater statistical power would permit more confident interpretations of any patterns in the data.

Across all studies, I expected that, because of lower social class individuals’ tendency to be more interdependent with others and to focus more on contextual factors, these individuals would experience more difficulty achieving a sense of shared experience in a CM (compared to a FtF) learning environment and, as a result, they would have more negative experiences. For the
multi-sample analysis that is the focus of this document, I expected to see similar patterns. However, I also acknowledge that the analyses reported here were conducted more in a context of discovery and exploration than one of justification and confirmation. As alluded to in the Introduction, detailed experimental research on the intersection between social class, shared experience, and different learning environments is practically non-existent. Moreover, each of these topics on its own represents an area of relatively novel and contested research in the purview of social psychology. Different researchers disagree and little consensus has been established as to how to operationalize each of the relevant constructs. Accordingly, I pooled the data from my different studies and adopted a more exploratory approach to the analyses in the hope of laying some groundwork for future research efforts in this area.

**Method**

**Samples and Procedures**

Important information about each sample is summarized in Table 1. All participants in these studies were undergraduate students enrolled at the Main Campus of the University of Arizona.

**Sample 1.** This study occurred in a laboratory setting with CM and FtF conditions. Forty-one students participated in a short lecture about social psychology in a laboratory setting and completed a questionnaire about their learning experience. The lecture was either delivered in-person to a small group of participants by a trained research assistant or via computer in an isolated cubicle.

**Sample 2.** This study occurred in a laboratory setting with CM and FtF conditions. One hundred four students participated in a short lecture about social psychology in a laboratory setting and completed a questionnaire about their learning experience. The lecture was either
delivered in-person to a small group of participants by a trained research assistant or via computer in an isolated cubicle.

**Sample 3.** This study occurred in a laboratory setting with CM and FtF conditions. One hundred twenty-five students watched a short, educational video in a laboratory setting and completed a questionnaire about their experience watching and learning from the video. Participants watched the video either together in small groups or separately in isolated cubicles.

**Sample 4.** This study was comprised of a FtF “classroom” condition and an Online survey condition. Sixty-two students participated in a short lecture about social psychology in either an in-person classroom setting or via an online survey and completed a questionnaire about their learning experience.

**Sample 5.** This study was administered entirely via online survey. Ninety-nine students participated in a short lecture about social psychology and completed a questionnaire about their experience via an online survey.

**Sample 6.** This study was conducted naturalistically and was comprised of a FtF “classroom” condition and an online “classroom” condition. Forty-two students who were enrolled in one of two selected University of Arizona courses completed a questionnaire via online survey about their learning experience in that course. The courses were selected because

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1 Originally, 219 participants were recruited for this sample, of whom 120 were randomly assigned to a “shared reality induction” condition. In this condition, each page of the online survey contained a fake “online now” graphic meant to indicate that others were simultaneously engaged in this activity with the participants. The “online now” participants were identified with generic avatars and participant IDs that would not convey information about sex, race or other potentially confounding variables. The IDs and number of “other” participants changed during the course of the survey to make others’ participation seem more dynamic. This shared experience induction had an unpredicted opposite effect on participants such that participants felt less shared reality than those in the no-induction condition. Because of this unexpected result, the 120 participants in the “shared reality induction” condition were excluded from analysis in the current research.
they had online and in-person sections taught simultaneously by the same instructor. The instructors of the courses informed their students of the study and provided them with a link to an online survey, where they consented electronically. This study was IRB-approved and students participated on a strictly voluntary basis with assurance that their participation, or lack thereof, would have no impact on their academic performance in the class.

For each of Samples 1-3 (the lab samples), the procedures were essentially identical. Participants would come to a psychology laboratory three at a time and were randomly assigned (as a group) to either the FtF or CM condition. In the FtF condition, participants did a passive learning activity together in the main room of the laboratory after which they would enter separate cubicles with computers where they completed a survey about their experience. In the CM condition, participants immediately entered the cubicles with computers and completed the learning activity on the computer before completing the survey about their experiences. For Samples 4-5, participants did a learning activity and follow-up survey via online questionnaire from a location of their choosing. And for Sample 6, participants completed an online survey from a location of their choosing asking about the class they were enrolled in.

The final combined sample consisted of 473 University of Arizona undergraduate participants (280 women, 118 men, 75 missing gender data; mean age [for 398 Ps] = 19 years). All participants except those in Sample 6 were recruited through the SONA experiments website. Participation in any one of the studies reported here precluded a student from participating in any of the others through the SONA system, so we can be reasonably confident that all observations are independent.

Social Class
For my analyses in the following studies, I operationalized social class primarily as a trichotomous lower/middle/upper class variable derived from participants’ self-reported social class on a 1-6 scale (1 = Lower class; 2 = Working class; 3 = Lower-middle class; 4 = Middle class; 5 = Upper-middle class; 6 = Upper class; in Sample 3, lower and working class were collapsed into a single category). I trichotomized participant responses, such that those who selected options 1-3 were categorized as “lower class,” those who selected option 4 were “middle class,” and those who selected options 5-6 were categorized as “upper class.” This trichotomous conceptualization of subjective social class was chosen for several reasons.

Primarily, given my guiding analysis in this set of studies, I understand social class as a “cultural context” (Kraus & Stephens, 2012). In other words I propose that – although individual differences play an important role in any situational or cultural factor – by and large the developmental and ongoing experience of people who subjectively identify as “lower class” will have phenomenological and material qualities more in line with cultural collectivism than that of those who identify as “upper class.” The day-to-day experienced world of a subjectively-identified lower class individual is in important ways qualitatively distinct from that of an upper class individual. Research shows that different status groups are accompanied by different perceived and actual correlates that could make the experience of different class groups distinct, and not necessarily in a linear way. Lower class individuals tend to engage in certain prosocial behaviors more frequently than their higher class counterparts (Piff, Kraus, Cheng, & Keltner, 2010) but they are still subject to an array of negative stereotypes like being lazy and responsible for their social standing (Cozzarelli, Wilkinson, & Tagler, 2001). Likewise, upper class individuals benefit from plentiful material resources, higher self-esteem (Twenge & Campbell, 2002), and judgments of higher competence and ability (Cuddy, Fiske, & Glick, 2007) but also
have to contend with negative stereotypes suggesting that the upper class is out of touch and cold (Cuddy, et al., 2007). The average person is likely to be aware of these stereotypes and whether or not they apply to their own social class group or not, and they will be able to, and perhaps be motivated to, see themselves as distinct from the other groups in a self-serving way. Research finds that individuals’ judgments about their social class trend toward middle class (Sosnaud, Brady, & Frenk, 2013) so it follows that those who self-identify in the upper and lower strata of subjective social class are distinct from those who self-identify in the middle in that they recognize that their social class group is clearly not just middle class. From this perspective, treating social class as a trichotomous categorical variable is reasonable and likely to convey important, unique information.

Social class is usually operationalized in ways that allow it to be treated either as a binary categorical variable (e.g. generational status, Stephens, et al., 2012; lower/upper class, Johnson, et al., 2011; working/middle class, Stephens, Markus, & Townsend, 2007) or a continuous, interval(ish) variable (e.g. family income, Oaks & Rossi, 2003; subjective social status, Adler, Epel, Castellazo, & Ickovics, 2000; Kraus, Piff, & Keltner, 2011; occupational prestige, Nam & Boyd, 2004). Conclusions drawn about the upper and lower socioeconomic strata using these conceptualizations of social class often take the form, either intentionally or unintentionally, of relatively linear explanations. Increases or decreases in social class are thought to be accompanied by more or less linear changes in other variables. I originally began my analysis for the current research relying on a dichotomous conceptualization of social class (lower/middle versus upper class) not unlike those used by other social class researchers, hoping to draw similar kinds of conclusions. While such a distinction is still likely to shed light on some important inter-class differences, my initial analyses and further consideration of the literature led me to believe...
that a binary or linear conceptualization of social class may not properly capture class effects for many important psychological outcomes.

Relative to other measures of social class, a trichotomization of subjective social class is likely to provide an analytical advantage for several reasons. It is difficult to treat measures of social class continuously (i.e., in interval terms) due to issues such as individual differences in the way people understand specific social class labels or family income ranges and how they apply to themselves. For instance, demographers and academic models of social class stratified by income settle on different income ranges for different social class labels (e.g. Beeghley, 2004; Pew Research Center, 2015; Thompson & Hickey, 2005) and individuals in the samples presented here whose families had the same income level often labeled themselves in widely different ways. Also bear in mind that individuals tend to judge their own class as closer to middle class than may be objectively true (Sosnaud, et al., 2013).

It is also difficult to treat social class as a binary categorical variable because of the ways in which it oversimplifies the differences we are likely to observe among different social class groups. Research shows that subjective social class is a meaningful construct because of the way it makes people think and behave and compare themselves to others (Kraus et al, 2012), and as such a comparison of self-identified lower versus higher class is likely to grant meaningful insight into the psychological processes inherent in different subjective experiences of social class but it is also likely to be missing some important variation at different levels of SES. Generational status, for example, is a useful way to compare college students in terms of how prepared they are for the norms, values, and behaviors typical of college, but it is often interpreted in terms of working versus middle class differences (e.g. Stephens, et al., 2007) which risks missing important nuances among the upper social strata, or those who feel they
reside there. Other research (Johnson, Richeson, and Finkel, 2011) created a binary social class variable using a cut off of $90,000 annual income and found meaningful differences between lower and upper class in terms of academic fit in college and self-regulatory processes. But again, this conceptualization limits the conclusions a researcher can draw.

Ultimately, I made the decision to trichotomize the measure of subjective social class to better capture what I felt were the differences between subjective class groups. If, as research suggests, social institutions are built with the norms and values of the middle class in mind and if intergroup processes are likely to differ for high status, low status, and middle status individuals (and not just for high relative to low; Fiske, 2010) then it seems prudent to examine high and low relative to middle. Across the board, the continuous measures of social class failed to produce any consistent, strong effects, suggesting that if there is a relationship between social class and our outcomes, it may not be explained very well by linear statistical models. Indeed, my data demonstrate that this is the case. However, at the individual sample level the studies were underpowered and there were too few lower class individuals to be statistically confident in the patterns observed. And while it may be difficult to nail down a precise definition of middle class (Cashell, 2007), people certainly understand that it is desirable to be middle class. For these reasons, I treated social class as a trichotomous variable in our analyses of the combined sample data here.

In addition to subjective social class, each sample contained at least two other indicators of social class: a 1-8 scale measure of family income (1 = $9,999 or less, to 8 = Greater than $200,000), and parental education (1 = Some high school or less, 2 = High school diploma, 3 = Some college [1 year to less than 2 years], 4 = Two year college degree, 5 = Four year college degree, 6 = MA/PhD, MD, MBA, JD, or other advanced degree) for each parent. Parental
education could be further simplified to a measure of generational status at college by classifying any student with at least one parent who had a four year degree or more as a continuing generation (CG) student and all others as first generation (FG) students. Samples 3 and 5 also included the MacArthur subjective social status ladder measure (Adler, et al., 2000) wherein participants would indicate on 1 to 10-scale (accompanied by an image of a ladder with ten rungs) their relative status in American society. Information about intercorrelations between social class measures can be found in Table 2 and objective social class descriptive statistics for each trichotomous class category can be found in Table 3.

**Measures**

Most studies contained at least some items that measured the constructs described below. In an effort to be as comprehensive as possible, all items that were thought to capture each construct of interest were averaged within each sample, converted to z-scores and POMP (percent of maximum possible) scores, and merged into a single data file. Z-scores were chosen because they would allow me to standardize the different measures between samples and make them more comparable. However, since this procedure converts all variables to a common mean of zero, any z-score analyses speak more to group differences in variance patterns and less about how the mean scores differ from each other on their original metric. For this reason, variables were also converted to POMP scores. This would also allow some degree of standardization across varying measurement scales while allowing us to interpret the results in terms of each sample’s observed means and respective scales. According to Cohen, Cohen, Aiken, & West (1999), both z-scores and POMP scores allow researchers to resolve questions concerning variability from sample to sample and POMP scores uniquely allow a researcher to compare
alternative operationalizations of constructs. Together, these two measurement strategies should allow greater ability to properly interpret the combined data.

Z-scores and POMP scores were strongly positively correlated with one another (see scale info below) but not perfectly correlated. This is because z-scores were computed for each individual study before combining the data since some of the studies had different measurement scales. As a result, z-scores reflect relationships to sample means rather than to the grand mean of the combined sample.

All items were measured on 1 to 7 Likert-type scales where high scores indicated greater endorsement of item, except for items from Sample 4, which were measured on 1 to 6 scales. Important information about measurement scales in each sample is summarized in Table 4.

**Shared experience/Connection to others.** Measures of the extent to which participants felt they were connected to and/or sharing an experience with other participants during the learning activity. E.g. “I felt like I was sharing an experience with the other participants in the learning module.” (Correlation between z-score and POMP, $r = .963, p < .001$).

**Similarity.** Measures of how similar participants felt to the other participants in the learning activity. E.g. “To what extent are you similar to the other students who participated in this learning module with you?” (Correlation between z-score and POMP, $r = .971, p < .001$).

**Satisfaction.** Measures of how much participants liked the learning activity. E.g. “I like this kind of learning environment.” For some samples, the Satisfaction scales included the Comfort items described below. This was done in an attempt to capture a construct that can be, and is, measured in a wide variety of ways. Including the comfort items in an overall satisfaction construct seemed to be the best way to examine participants’ general liking of the learning experience. However, analyzing comfort scores independently also seemed important in order to
capture what could be a distinct aspect of participant experience. (Correlation between z-score and POMP, \( r = .886, p < .001 \)).

**Comfort.** Measures of how comfortable participants felt during the learning activity. E.g. “I am comfortable being a student in this kind of learning environment.” (Correlation between z-score and POMP, \( r = .908, p < .001 \)).

**Belonging.** Measure of how much participants felt they belonged in the learning environment. E.g. “During the learning module, I felt like I belonged in the environment.” (Correlation between z-score and POMP, \( r = .967, p < .001 \)).

**Performance.** An assessment of how well participants were able to recall content from the learning activity they participated in, expressed as a simple proportion of answers correct.

**Results**

**Patterns of Association**

Similarity and shared reality positively correlated overall across all conditions (POMP, \( r = .377, p < .001 \); z-score, \( r = .421, p < .001 \)) and strongly correlated within middle (POMP, \( r = .426, p < .001 \); z-score, \( r = .431, p < .001 \)) and upper class (POMP, \( r = .435, p < .001 \); z-score, \( r = .459, p < .001 \)) participants, but only weakly correlated for lower class participants (POMP, \( r = .19, p = .103 \); z-score, \( r = .224, p = .103 \)). Additionally, comfort was positively correlated (POMP, \( r = .349, p < .001 \); z-score, \( r = .352, p < .001 \)) with performance but only in the online conditions.

**ANOVA**s

Using the combined sample data, two primary sets of analyses were conducted for each outcome of interest (both z-score and POMP score): 3 (trichotomous social class) X 3 (condition: CM, FtF, Online) ANOVAs for all samples (or as many samples as contained to the outcome of
interest), and 3 (trichotomous social class) X 2 (condition: CM, FtF) ANOVAs for all samples from whom data were collected in a laboratory setting. There are some notable advantages and disadvantages to each approach. The 3 X 3/all-sample analyses allow for a more thorough comparison of conditions, particularly, distinguishing between how an artificial CM setting compares to a more naturalistic online setting. The 3 X 2/lab-only sample analyses provide the advantage of limiting the data to those participants over whom we had complete experimental control. There are fewer participants of this sort, which reduces power; but the power required to detect effects may also have been smaller in these studies, due to a presumably lower level of random error variance. In general, my analyses were taken as an opportunity not only to test the guiding hypothesis on a large sample but also to treat the data in a more exploratory fashion and gather information about the utility of different operationalizations of social class and CM learning.

Shared experience.

Note that there was no measure of shared experience for Sample 4.

All samples. There was a main effect of condition with POMP scores as the outcome, $F(2, 395) = 4.56, p = .011, \eta^2 = .005$, such that, on average, the online condition ($M = 36.42, SE = 2.24$) was lower than both CM ($M = 44.00, SE = 2.27$) and FtF ($M = 44.81, SE = 1.93$). See Figure 1. No significant effects for z-score.

Lab samples only. No significant effects for z-score or POMP score.

Similarity.

Note that there was no measure of similarity for Sample 2.

All samples. There was a main effect of condition with POMP scores as the outcome, $F(2, 421) = 3.81, p = .023, \eta^2 = .002$; online was highest ($M = 49.71, SE = 1.75$), and FtF lowest
\(M = 43.6, \text{SE} = 1.49\), especially for lower and upper classes. See Figure 2. No effects for z-score.

**Lab samples only.** There was a significant interaction with z-scores as the outcome, \(F(2, 263) = 3.44, p = .03, \eta^2 = .026\), in which upper class participants felt more perceived similarity in the CM condition \((M = .24, \text{SE} = .12)\) than FtF \((M = -.31, \text{SE} = .12)\), \(F(1, 263) = 10.11, p = .002, \eta^2 = .038\). Within the FtF condition, upper class participants \((M = -.307, \text{SE} = .12)\) felt less perceived similarity than middle class participants \((M = .136, \text{SE} = .14)\), \(F(2, 263) = 3.00, p = .051, \eta^2 = .023\). See Figure 3.

There was a marginal interaction for POMP scores, \(F(2, 263) = 2.94, p = .055, \eta^2 = .002\), with a similar pattern as for z-scores. Upper class participants in CM experienced greater perceived similarity \((M = 50.68, \text{SE} = 2.19)\) than in FtF \((M = 40.79, \text{SE} = 2.29)\), \(F(1, 263) = 9.78, p = .002, \eta^2 = .005\). And within the FtF condition, upper class participants \((M = 40.79, \text{SE} = 2.29)\) felt less perceived similarity than middle class participants \((M = 48.17, \text{SE} = 2.50)\), \(F(2, 263) = 2.53, p = .081, \eta^2 = .003\). See Figure 4.

**Satisfaction.**

**All samples.** No effects were observed for z-scores but there was a marginal interaction for POMP scores, \(F(4, 457) = 2.14, p = .076, \eta^2 = .001\). Upper class individuals were most satisfied in a CM environment \((M = 73.94, \text{SE} = 2.45)\), followed by a FtF environment \((M = 66.43, \text{SE} = 2.19)\), and least satisfied online \((M = 58.1, \text{SE} = 2.45)\), \(F(2, 457) = 10.56, p < .001, \eta^2 = .004\). See Figure 5.

**Lab samples only.** No effects were observed for z-scores but there was a marginal main effect of class with POMP scores, \(F(2, 263) = 2.59, p = .077, \eta^2 = .001\). Lower class individuals
were less satisfied ($M = 63.80, SE = 3.16$) than middle ($M = 71.79, SE = 1.99$) and upper class individuals ($M = 71.39, SE = 1.71$). See Figure 6.

**Comfort.** Note that there was no measure of comfort for Sample 4. Also note that these items were part of the satisfaction scales but were treated separately here because the items assessing comfort were more consistent across samples and I suspected that a more straightforward measure of comfort might reveal a unique pattern.

**All samples.** The comfort outcome yielded the clearest pattern of results. For z-scores, there was a significant interaction, $F(4, 395) = 2.58, p = .037, \eta^2 = .025$. Lower class individuals felt most comfortable in the online setting, scoring high above the mean ($M = .342, SE = .22$), whereas comfort for lower class participants in FtF ($M = -.29, SE = .20$) and CM ($M = -23, SE = .24$) was well below the mean, $F(2, 395) = 2.57, p = .078, \eta^2 = .013$. Within the CM condition, upper class individuals ($M = .23, SE = .12$) felt more comfortable (above the mean) than both middle ($M = -.17, SE = .15$) and lower class individuals ($M = -23, SE = .24$), who were below the mean, $F(2, 395) = 2.87, p = .058, \eta^2 = .014$. See Figure 7.

There was also a significant interaction for POMP scores, $F(4, 395) = 2.82, p = .025, \eta^2 = .001$, with a similar pattern as for z-scores. Among upper class individuals, the CM environment ($M = 80.07, SE = 2.34$) was more comfortable than both FtF ($M = 73.46, SE = 2.28$) and online ($M = 69.29, SE = 2.61$), $F(2, 395) = 4.97, p = .007, \eta^2 = .001$. Within CM, upper class individuals ($M = 80.07, SE = 2.34$) were more comfortable than lower class ($M = 68.63, SE = 4.69$), $F(2, 395) = 2.84, p = .06, \eta^2 = .001$. And within FtF, lower class ($M = 66.13, SE = 3.79$) felt less comfortable than middle class ($M = 77.41, SE = 2.50$), $F(2, 395) = 3.10, p = .046, \eta^2 = .001$. See Figure 8.
Lab samples only. There was a significant interaction with z-scores, $F(2, 263) = 3.21, p = .042, \eta^2 = .023$. Upper class were more comfortable in CM ($M = .23, SE = .12$) than FtF ($M = -.11, SE = .12$), $F(1, 263) = 3.84, p = .051, \eta^2 = .014$, Within the CM condition, upper class individuals were also more comfortable than middle class in CM ($M = -.17, SE = .15$), and lower class ($M = -.23, SE = .24$), $F(2, 263) = 2.91, p = .056, \eta^2 = .022$. See Figure 9.

With POMP scores there was only a main effect of class, $F(2, 263) = 4.05, p = .019, \eta^2 = .002$, in which lower class individuals ($M = 67.46, SE = 3.17$) appeared to be less comfortable on average than other class groups (middle-class, $M = 77.00, SE = 1.99$; upper-class, $M = 77.34, SE = 1.71$). See Figure 10.

Belonging.

All samples. No significant effects were observed for z-scores but with POMP scores, there was a marginal main effect of condition, $F(2, 395) = 2.72, p = .067, \eta^2 = .002$, where an online setting seemed to result in the lowest belonging. See Figure 11.

Lab samples only. No significant effects for z-score or POMP score.

Performance.

Note that there was no measure of performance for Sample 2.

All samples. No significant effects observed.

Lab samples only. No significant effects observed.

Discussion

Having observed a series of consistent but non-significant patterns in earlier studies of the relationship between social class and learning environment, the present research details results of analyses conducted on the combined samples from these earlier studies. In general, these analyses reproduced the patterns I observed in the earlier, weakly powered studies, and
brought some of them to a threshold of conventional statistical significance. A major reason for
the current project’s ability to detect some of these effects was the use of a trichotomous rather
than dichotomous or continuous operationalization of social class that allowed me to detect
certain non-linear patterns in the data. These data also contribute a valuable perspective
regarding learning and conducting research in different computer-facilitated media.

**Shared Experience and Connection to Others in CM Learning**

Even though research comparing CM and FtF learning finds little difference in actual
performance (Kemp & Grieve, 2014), it also finds that student retention and persistence in
education, particularly online education, is strongly related to students’ sense of involvement at
school, their sense of connection to others in that environment, and their overall satisfaction
(Allen, Robbins, Casillas, & Oh, 2008; DeAngleo, Franke, Hurtado, Pryor, & Tran, 2011;
Jensen, 2011; Kuh & Love, 2014; Orsuwan & Cole, 2007). With this in mind, the data presented
here have some very important implications for the way students learn in CM settings and for the
types of learning environments educators create for diverse students. In these data we see several
ways in which both learning environment and student social class background can affect
students’ subjective feelings while engaged in learning activities at college.

My primary prediction when embarking on this research was that more context- and
relationship-focused people, like lower class individuals, would have difficulty having a sense of
shared experience with others when learning in settings characterized by the physical absence of
others, like CM and online environments. While not stated outright, I originally assumed I would
see relatively linear effects – the lower one’s social class, the more interdependent they become,
and thus, the more shared and positive one’s experience in FtF settings (and the less shared and
more negative one’s experience in CM settings). The data presented here provide mixed support
for this prediction, but it is clear that the relationship is not always linear, betraying some flaws in my initial theoretical assumptions.

Contrary to predictions, lower class individuals did not consistently receive a boost from the FtF settings and the ostensible physical co-presence that setting was thought to afford. With the lone exception of the shared experience outcome, lower class participants generally felt less similar to others, less comfortable, and less satisfied in a FtF setting than their middle and upper class counterparts. Even in the case of shared experience, the average lower class participant was in the middle of the scale, apparently not feeling a noticeable abundance or scarcity of shared experience, suggesting, perhaps, that a FtF setting buffers lower class individuals against losing that sense of shared experience rather than granting them more of it.

Middle class participants were notable for the relative absence of large experiential differences between conditions and, in some cases, like comfort and similarity, even receiving what seems like a bit of a (n.s.) boost in the FtF condition. Consistent with research showing that middle class norms and values are the most likely to be widely endorsed in American colleges, it appears that middle class students tend to feel most at home in the most traditional of learning environments, FtF with an instructor, and not drastically different in other environments.

The observations for upper class participants were often unexpected and did not always follow the linear trajectory I originally assumed they would. On nearly all outcomes, upper class participants scored higher in the lab CM setting than middle and lower class participants and higher than FtF and Online settings. Based on these data, an isolated, lab CM experience seems to be the preference of upper class students. By contrast, an online setting clearly does not afford upper class participants an equivalent CM experience. Upper class participants felt less shared
experience, comfort, and belonging in an online setting compared to a lab CM setting and sometimes compared to a FtF setting.

A closer examination of effects for the online and CM learning environments raises some interesting questions. Lower class participants appeared to get a boost in terms of comfort (and a boost for similarity, relative to FtF) while learning in an online setting, which is particularly interesting in light of the fact that an online setting simultaneously denies a sense of shared experience for lower class individuals. Considered in conjunction with the finding that a lab CM setting seemed to be optimal for upper class participants, the data suggest that it is not just the medium that matters (i.e. a computer) for students at each end of the class spectrum; rather, it is the broader context surrounding that medium.

The findings regarding similarity may help shed some light on the importance of the physical location of the activity. In one of the more prominent examples of a non-linear finding in these data, lower and upper class participants both felt less similarity than middle class participants in a FtF setting. To gauge similarity in this research, participants were asked questions that would likely prompt processes of social comparison with their co-participants. In a FtF setting, participants have immediate access to information-rich non-verbal cues like appearance, clothing, and mannerisms that could serve not only as information about how similar one is to others but also information about one’s relative status in that setting (e.g. Kraus & Keltner, 2009). In other pilot research I have done, it is clear that college students use cues like brand name clothing, style of dress, fraternity/sorority letters, and other physical cues to determine the status of those around them. Considering peoples’ tendency to rate their social class as nearer to the middle, regardless of objective class, and given the measure of subjective social class from which this study’s trichotomous class variable was derived, we can probably
conclude with some confidence that those who rated themselves as something other than middle class are aware that they are different, status-wise, than people elsewhere on the SES spectrum. A FtF environment is more likely than a CM or online environment to make those perceived differences salient and affect subsequent judgments and experiences, which may explain why lower and upper class participants felt less similarity compared to middle class participants in this environment. Online and CM environments remove non-verbal cues (CM to a lesser extent, because participants still began the experiment together in the lab) and participants are left to imagine how similar the others are in the absence of such cues, leading to slightly higher ratings of similarity.

Moreover, feeling similar to others in a FtF setting is likely to be important for phenomena like shared experience to occur. Work examining shared attention, for example, shows that people are more likely to share attention with similar others and feeling similar to others may, in fact, be a prerequisite for shared attention (Shteynberg, 2015). This would explain why lower class students did not experience a boost to shared experience in the FtF setting, as originally predicted. If the FtF setting and its non-verbal information signal to lower class students that they are different from the others in that setting, it likely undermines any potential for shared experience afforded to lower class students by the physical co-presence of others.

The discrepant results for comfort are similarly revealing. Middle class participants showed little variation in comfort, while lower class individuals benefited from an online setting and upper class individuals benefited from a CM setting. Reminiscent of other research on class differences in higher education, lower class individuals in the lab CM and FtF conditions may be cued by the university setting that their norms and values are different than those of the typical university student. In contrast, the flexibility to take the survey online may allow these
participants to complete the survey in the company of friends or family or simply not at school, which may afford them greater comfort. Upper class participants on the other hand, felt most comfortable in the lab, CM environment. In a way this is more consistent with my original predictions – upper class individuals should be the most independent and benefit most from a setting that rewards autonomy and separates students from others. But it is unclear why the online environment did not also grant this sense of comfort to upper class students. One possible explanation is that the contrast of beginning the lab CM experiment with others, under the direction of an authority figure, followed by being allowed freedom to do the learning activity and survey on one’s own is experienced more positively than just being self-directed from the start, as they were in the online conditions.

Another potential alternative explanation for the different levels of comfort felt by students in the different environments is differences in exposure to technology growing up. A survey of AP and National Writing Project teachers reveals important differences in how lower-income and higher-income high school students use technology and the amount of access they have (Purcell, et al., 2013). Quite simply, lower class individuals are not able to afford as many or as current pieces of technology. Thus, we might expect upper class individuals to feel more comfortable engaging in any activity alone on a computer. The fact that lower class individuals felt more comfortable online could still be explained by the comfort of the surrounding context trumping their comfort with the learning medium. However, it is also worth noting that in the data originally collected for Sample 6 I included additional measures that revealed no class differences in computer literacy or time spent using technology, suggesting that students from all class backgrounds (at least among those who end up in college) are likely to have similar experience with technology and computers. If familiarity with technology has an impact on
comfort in different learning environments, further research is needed to come to a definitive conclusion.

In all, these data provide some interesting evidence that one’s social class background may, indeed, influence one’s experience of different types of learning environments. Also, that the effects are not simply explained by the medium through which educational content is delivered but also likely the characteristics of the physical location in which participants complete the educational activity.

**Studying CM Learning And Conducting Research Online**

Following from the study’s main results is another, not entirely unexpected, lesson regarding the importance of distinguishing between different types of CM environments and accounting for the differences between them. It is an oversimplification to refer to “CM learning” broadly when some of the participants in the current research participated on a computer in a lab while others completed the study from a location of their own choosing.

Engaging in activities on a computer or similar device does inevitably separate a person from other people, to some degree. There are ways to foster interaction with others via computer and to enhance the realism of such interactions but the computer is the medium by which these interactions happen and that has certain implications for interpersonal interaction and social activities done on computers. The relative absence of certain non-verbal information certainly impacts the nature of such interactions. That said, the physical and social context in which the computer-mediated activity occurs is also important, especially when the outcomes of interest are social outcomes. There are some very important qualitative differences between doing a task on a computer in laboratory cubicle and doing the same task on a personal computer in your apartment or home with friends or family nearby. The computer as a context for an activity
cannot be entirely separated from the actual physical and social context in which the computer
resides. This is a somewhat obvious observation in hindsight but it is certainly something about
which not enough is said in the literature on CM education. Research has many ways to refer to
CM learning – e-learning, online learning, MOOCs, hybrid learning, etc. – but most of the focus
is on the pedagogical strategies involved in delivering educational content effectively when the
instructor and students are separated by the Internet and little is said about the effects of the
actual physical location in which learning takes place.

Researchers have already made note of some of the problems with conducting online
research. The current project serves as a useful reminder of the control experimenters lose when
exporting data collection outside of the lab and giving participants control over where the
research ultimately happens. However, it also offers some insight into some specific potential
ways that participating in online research may be experienced differently by students from
different cultural backgrounds.

**Measuring Social Class in Psychological Research**

Social class has obviously become a popular topic of research in social psychology of late
and researchers tend to leverage all sorts of measurements to act as proxies of social class in their
studies. As is quite common in research, the measurements chosen often reflect matters of
convenience – using generational status in college as an indicator of social class makes a lot of
sense when your sample is undergraduate students, for example. Researchers then often simply
use the term “social class” to refer to whatever measure (or composite of measures) of
socioeconomic status they employ in a given study. But this is problematic because it obscures
the differences between different types of social class research and the important differences
between various measures of SES. As a result, researchers and those who build on past research
may fail to account for the specific differences in what is being measured and the unique implications of particular measures of social class.

Clearly, many researchers also care a great deal about what their measures of social class say that is distinct from other measures and they care about being specific in their interpretations of their particular social class data. But the fact remains that a large proportion of psychological social class research relies on binary and/or linear measures of class and, as the current data show, such measures are likely to overlook certain effects. This is not to say that binary and linear operationalizations do not provide useful information, they most certainly do. But as with any topic of study, social class researchers will benefit from incorporating a variety of measures and analyses and interpreting data in the context of the measures used and not just generalized to social class as a whole.

**Limitations**

This project had several limitations. First, the assessment of my outcomes of interest across the samples studied was inconsistent and relied on my subjective judgment about which items should be included and which not. While this strategy was chosen for pragmatic and exploratory reasons, it certainly limits the extent to which I can claim that these items have high construct validity, with the possible exception of some of the single- or two-item measures used.

Second, when claiming that the conditions are either CM, FtF, or online, I am sometimes combining into one category, two or more settings that may, in fact, be quite different from each other. Within the FtF condition category, for example, were samples collected in a laboratory with a research assistant, a sample collected in a controlled classroom setting with a researcher, and a sample enrolled in an in-person class at the University of Arizona. While these settings share in common the central component of interest – the physical co-presence of an instructor.
and other students – there are clearly many other ways these settings differ: the authority and
credibility of the instructor, the relationship of students with the instructor and with each other,
the number of other students present during learning, the duration of learning, and so on. Any of
these things could potentially complicate our findings in ways that we are as yet unaware.

Also, within the Online condition I, as experimenter, have almost no control over, or
knowledge of, the precise setting in which participants completed the study. Among the potential
factors that could have influenced our outcomes of interest in this project are whether or not
other people were around when they did it; if there were other people around, who were they and
what sort of relationship did the participant have with them; were they engaging in the study in a
public place like a library at school, or in a private place like a bedroom at home, and so on.
These are all very interesting in their potential implications but because these kinds of
confounding variables have the potential to impact the outcomes of interest in this study and I
have no knowledge of them in this case, their unknown variability is an obstacle to interpreting
these data.

Third, even with the increased sample size afforded us by the combined samples, the
number of lower class individuals remained relatively low across conditions, meaning that cell
sizes for lower class individuals in our analysis were bordering on being too small and were
often dwarfed by the cells for middle and upper class individuals. As with many studies of this
kind, our analysis would have benefited from a greater number of observations of this particular
subgroup of interest and we are limited in the confidence with which we can draw conclusions
about these results.

Fourth, I took some license with what could realistically be considered a “learning
experience” in the context of this study. The learning activities were quite short and artificial and
the assessments were also short and exclusively tested participants’ ability to recall material from the short activities. Missing are data about other real-world, important learning outcomes, like application of relevant content. Also not available in the current data are measures of student persistence, or any longitudinal assessments. These data simply cannot tell us about the long-term consequences of learning in different environments or the ways in which students may adapt or adjust to them over time.

**Conclusion**

This analysis of these combined samples provides some important and timely insight into a complex, applied psychological issue. Online, CM education is quickly becoming ubiquitous around the world and students and educators expect it to be part of their future. In many ways, this is a good thing, especially for historically underrepresented groups and lower SES individuals – online learning can be more affordable, more convenient and accessible, allow greater flexibility for students who need to simultaneously manage work or childcare, and, as we learned here, allow students to choose the most comfortable setting for their learning. Online, CM learning has the potential to help ameliorate the achievement gap in many ways. But CM education also varies tremendously in terms of how content is delivered, the amount and type of contact with the instructor and other students, the flexibility afforded to students, and much more. It is hardly a one-size-fits-all world. Given this, it is difficult for any one research project or even a series of studies to say anything particularly definitive about the nature of CM learning. Despite its potential advantages for lower SES students, relatively little is known about how these variations in CM learning, in combination with the phenomenological experience of learning while physically separated from others, might affect students differently depending on their social class background and other cultural factors. Lower SES students’ cultural values are
not often taken into account in traditional education settings, let alone the newly developing world of online education. Considering the importance of things like satisfaction and connection to others for persistence and retention in college, the possibility that CM learning may not be adequately meeting the social needs of the students it seeks to recruit merits closer examination. The data presented here begin to more clearly illuminate what the relationship between social class and learning environment looks like and offers some fruitful possibilities for additional research and potential interventions to help improve the academic experiences of the growing online student body in the United States and around the world.
Table 1. Important Sample Information

<table>
<thead>
<tr>
<th>Sample Information</th>
<th>Social Class (n)</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting N % Female Mean Age (years)</td>
<td>Lower Middle Upper</td>
<td>Shared Reality Similarity Satisfaction Comfort Belonging Performance</td>
</tr>
<tr>
<td>Sample 1 CM/FtF 41 n/a n/a</td>
<td>9 13 19</td>
<td>x x x x x x</td>
</tr>
<tr>
<td>Sample 2 CM/FtF 104 69 18.9</td>
<td>18 37 49</td>
<td>x x x x x x</td>
</tr>
<tr>
<td>Sample 3 CM/FtF 125 75 18.7</td>
<td>12 48 64</td>
<td>x x x x x x</td>
</tr>
<tr>
<td>Sample 4 FtF/Online 62 55 19.3</td>
<td>7 27 28</td>
<td>x x x x x x</td>
</tr>
<tr>
<td>Sample 5 Online 99 (219) 70 18.8</td>
<td>15 (36) 37 (86) 47 (97)</td>
<td>x x x x x x</td>
</tr>
<tr>
<td>Sample 6 CM/FtF 42 81 19.7</td>
<td>9 10 17</td>
<td>x x x x x x</td>
</tr>
</tbody>
</table>

Note. Sample 2 was missing gender and age information for 32 participants. The reported information for Sample 2 reflect only participants for whom gender and age data was available. For Sample 5 social class data, the numbers in parentheses are the n for the entire sample before removing the induction condition participants.
Table 2. Social class correlations.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Subjective Social Class</td>
<td>4.28</td>
<td>1.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Family Income</td>
<td>6.00</td>
<td>1.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Father’s Education</td>
<td>4.04</td>
<td>1.61</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Mother’s Education</td>
<td>4.07</td>
<td>1.49</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Subjective Status</td>
<td>6.57</td>
<td>1.54</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Correlations reported here are for the complete combined sample, including the induction condition of Sample 5 that was excluded from analysis in the Results section (n = 575). Correlations for Subjective Status include participants only from Samples 3 and 5 (n = 343) as those were the only samples that included the measure. **p < .001

Table 3. Continuous social class measure means by subjective social class category

<table>
<thead>
<tr>
<th></th>
<th>Family Income</th>
<th>Father Education</th>
<th>Mother Education</th>
<th>Subjective Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Upper Class</td>
<td>7.02</td>
<td>1.04</td>
<td>4.53</td>
<td>1.43</td>
</tr>
<tr>
<td>Middle Class</td>
<td>5.59</td>
<td>1.44</td>
<td>3.89</td>
<td>1.56</td>
</tr>
<tr>
<td>Lower Class</td>
<td>3.85</td>
<td>1.78</td>
<td>2.85</td>
<td>1.59</td>
</tr>
</tbody>
</table>

Note. One-way ANOVAs by class were significant at p < .001 for all variables listed here.
Table 4. Scale Items for each Sample

**SHARED REALITY**

Overall POMP – M = 38.83, SD = 22.78

<table>
<thead>
<tr>
<th>Sample 1 (α = .66)</th>
<th>Sample 2 (α = .58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The other participants in the learning module were probably having the same reactions to the module that I was having.</td>
<td>I felt connected to the other participants in the learning module.</td>
</tr>
<tr>
<td>I felt like I was sharing an experience with the other participants in the learning module.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample 3 (α = .77)</th>
<th>Sample 5 (α = .82)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I felt connected to the other participants who were watching the video.</td>
<td>I felt like I was sharing an experience with the other participants who were watching the video.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample 4</th>
<th>Sample 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>I felt a sense of connection to the other students in the course with me.</td>
</tr>
</tbody>
</table>

**SIMILARITY**

Overall POMP – M = 47.21, SD = 17.22

<table>
<thead>
<tr>
<th>Sample 1 (α = .70)</th>
<th>Sample 2 (α = .62)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The other participants in the learning module had similar goals as myself.</td>
<td>To what extent are you similar to the other students who participated in this learning module with you?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample 3 (α = .78)</th>
<th>Sample 5 (α = .70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am similar to the other students who were watching the video with me.</td>
<td>The other participants who were watching the video had similar goals as myself.</td>
</tr>
<tr>
<td>The other participants who were watching the video with me have a lot in common with me.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample 4 (α = .77)</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I feel like the other students enjoy the same things as I do.”</td>
</tr>
<tr>
<td>“I feel like the other students come from the same kind of background as I do.”</td>
</tr>
<tr>
<td>“To what extent are you similar to the other students?”</td>
</tr>
</tbody>
</table>

| Sample 6 | N/A |

**SATISFACTION**

Overall POMP – M = 65.85, SD = 19.89

<table>
<thead>
<tr>
<th>Sample 1 (α = .92)</th>
<th>Sample 2 (α = .90)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am comfortable being a student in this kind of learning environment.</td>
<td>I like this kind of learning environment.</td>
</tr>
<tr>
<td>I feel good about being a student in this learning environment.</td>
<td>I feel good about how things go when I perform learning tasks like the one I just did.</td>
</tr>
<tr>
<td>I am comfortable performing learning tasks like the one I just did.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample 3 (α = .89)</th>
<th>Sample 5 (α = .90)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I was comfortable watching a video in a setting like this.</td>
<td>I am comfortable participating in activities like the one I just did.</td>
</tr>
<tr>
<td>I felt good about being a participant in this activity.</td>
<td>I enjoyed the experience of watching this video.</td>
</tr>
<tr>
<td>I liked the setting of this activity.</td>
<td>I would enjoy doing similar activities like this in the future.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample 4 (α = .88)</th>
<th>Sample 6 (α = .87)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel like this learning environment is a good place for me to learn.</td>
<td>I feel good about how things go when I take courses like this one.</td>
</tr>
<tr>
<td>I feel like this learning environment is a good place for most students to learn.</td>
<td></td>
</tr>
<tr>
<td>COMFORT</td>
<td>Overall POMP – M = 73.14, SD = 19.10</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Sample 1 (α = .79)</td>
<td>I am comfortable being a student in this kind of learning environment.</td>
</tr>
<tr>
<td>Sample 2 (α = .74)</td>
<td>I am comfortable performing learning tasks like the one I just did.</td>
</tr>
<tr>
<td>Sample 3 (α = .83)</td>
<td>I was comfortable watching a video in a setting like this.</td>
</tr>
<tr>
<td>Sample 5 (α = .77)</td>
<td>I am comfortable participating in activities like the one I just did.</td>
</tr>
<tr>
<td>Sample 4</td>
<td>N/A</td>
</tr>
<tr>
<td>Sample 6 (α = .71)</td>
<td>I am comfortable participating in courses like this one.</td>
</tr>
<tr>
<td></td>
<td>How comfortable did you feel participating in this course?</td>
</tr>
<tr>
<td></td>
<td>How comfortable are you asking for help from the professor in this course?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BELONGING</th>
<th>Overall POMP – M = 62.24, SD = 22.73</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1-3, 5-6</td>
<td>During the learning module [video activity], I felt like I belonged in the environment.</td>
</tr>
<tr>
<td>Sample 4</td>
<td>I feel like this learning environment is a good place for me to learn.</td>
</tr>
</tbody>
</table>

*Note. All items were answered on a 1-7 scale except for Sample 4 which had 1-6 scales.*
Figures

**Figure 1. Condition X Social Class Interaction on Shared Reality POMP score - All Samples**

*Main Effect of Condition: $F(2, 395) = 4.56, \ p = .011, \ \eta^2 = .005$*

**Figure 2. Condition X Social Class on Similarity POMP score - All Samples**

*Main Effect of Condition: $F(2, 421) = 3.81, \ p = .023, \ \eta^2 = .002$*
Figure 3. Condition X Social Class on Similarity Z-scores - Lab Samples

Interaction: $F(2, 263) = 3.44$, $p = .03$, $\eta^2 = .026$

Figure 4. Condition X Social Class on Similarity POMP scores - Lab Samples

$F(2, 263) = 2.94$, $p = .055$, $\eta^2 = .002$
**Figure 5.** Condition X Social Class on Satisfaction POMP score - All Samples

Interaction: $F(4, 457) = 2.14, p = .076, \eta^2 = .001$

**Figure 6.** Condition X Social Class on Satisfaction POMP scores - Lab Samples

Main Effect of Class: $F(2, 263) = 2.59, p = .077, \eta^2 = .001$
Figure 7. Condition X Social Class on Comfort Z-scores - All Samples

Interaction: $F(4, 395) = 2.58, p = .037, \eta^2 = .025$

Figure 8. Condition X Social Class on Comfort POMP scores - All Samples

Interaction: $F(4, 395) = 2.82, p = .025, \eta^2 = .001$
Figure 9. Condition X Social Class on Comfort Z-scores - Lab Samples

Interaction: $F(2, 263) = 3.21, p = .042, \eta^2 = .023$

Figure 10. Condition X Social Class on Comfort POMP scores - Lab Samples

Main Effect of Class: $F(2, 263) = 4.05, p = .019, \eta^2 = .002$
Figure 11. Condition X Social Class on Belonging POMP scores - All Samples

Main Effect of Condition: $F(2, 395) = 2.72, p = .067, \eta^2 = .002$
References


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