PUSHING BUTTONS: A SOCIOMATERIAL EXPLORATION OF THE DISTRIBUTED LECTURE

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ABSTRACT

Current research on telepresence tends to engage a celebratory, taken-for-granted view of technology as a vehicle for improved communication and a mere backdrop against which communication unfolds. However, a growing body of literature interrogates the neutrality of technological environments in education. This paper considers the practice of lectures within distributed (multi-campus) medical education. Applying a sociomaterial theoretical lens, we analyze ethnographic data from a three-year study focused on the use of telepresence technology in the undergraduate medical program at Dalhousie University in Nova Scotia, Canada. Our research question was: How are material telepresence tools, processes and spaces enmeshed with student learning in the distributed lecture? We identified three sociomaterial complexities related to the practice of asking questions in this context: 1. Material presence and process of the button and screen in asking questions; 2. The ways in-class questions disrupt the flow of the distributed lecture; and 3. Tensions between ways in which questions are managed across sites. Attending to the seam between the social and material in the distributed lecture illuminates the challenges, barriers, and opportunities for student participation while unearthing innovative learning strategies.

1. INTRODUCTION

This article considers the practice of lectures within distributed (multi-campus) undergraduate education. Applying a sociomaterial theoretical lens, we analyze ethnographic data from a three-year study focused on the use of telepresence in an undergraduate distributed medical education program at Dalhousie University in Nova Scotia, Canada. Our research question was: How are material telepresence tools, processes and spaces enmeshed with teaching and learning in the distributed medical education lecture?

Educational spaces have changed dramatically over the past century, from the static desks and slates of the late 1800s to the highly computerized learning spaces of present (Cleveland-Innes & Campbell, 2012). Undergraduate medical programs are no different in this regard, as medical schools increasingly engage in distributed medical education (DME) to increase access to education and address critical shortages of physicians in rural areas—the theory being that those who are educated in rural settings are more likely to stay and work in those settings (Strasser et al., 2009). In Canada, DME increasingly occurs using 'telepresence', where lectures are delivered to satellite campuses using state of the art digital telepresence technology (MacLeod et al., 2016; Snadden & Bates, 2009). Given the geographic vastness, pervasive issues with respect to attracting professionals to rural areas, and the ongoing developments in Information and Communication Technologies (ICTs), it is anticipated that Canadian distributed higher education will continue to grow (Kuehn, 2012).

Current research on telepresence tends to engage a celebratory, taken-for-granted view of technology as a vehicle for improved communication and a mere backdrop against which this communication unfolds (Logdlund, 2010). However, a growing body of literature interrogates the neutrality of technological environments in educational encounters, rather approaching telepresence and similar technologies as central to how and what teaching and learning happens. This research concludes that we cannot ignore the constitutive role of material and space within learning encounters, and must examine the ways in which technology enables, constrains, and essentially constitutes teaching and learning (Logdlund, 2010; Mannion, 2003; Roehl, 2012).

Existing literature in the broad area of distributed learning has focused largely on social, pedagogical and cognitive factors. While these factors are relevant, they do not exist independently from materiality, including telepresence technologies. Rather, social, pedagogical and cognitive factors are produced through and reinscribed by material factors. Given the growing numbers of DME programs, their reliance upon both ICTs and people, and the fact that they are delivered in geographically and materially diverse locations, it is imperative that our analyses of distributed medical education take both social and material considerations into account. Our study contributes to existing literature by critically examining sociomaterial effects of telepresence on lectures.

2. METHODS

2.1 Study Design

Our study builds on a rich 50-year tradition of ethnography in medical education research. Ethnography encompasses multiple methods of data collection and analysis, but consistently "involves lengthy participation or immersion in the everyday life of a chosen setting" by joining that everyday life and observing interactions and behavior (Pope, 2005, p.1180). In this case, the setting was the distributed medical program at a Canadian university, explored through observation, critical document analysis and open-ended interviews.

This ethnography was conceptually and theoretically framed in sociomaterialism, a heterogenous body of work. Our analysis is shaped by the following theoretical assumptions about sociomateriality: (1) that material entities are just as important as discourse and language; (2) the nature of reality is that the social and material are inextricable; (3) social and material entities do not have preexisting or inherent properties outside their interaction; (4) that the line drawn between social and material entities is abstract and artificial; and (5) that research must therefore focus on practices (Jones, 2014), where the social and the material hang together. We humans are constituted via materiality: our bodies, the tools we use, food, devices, which are also produced through human practices. This makes the distinction between humans and artifacts abstract (Orlikowski, 2007).

2.2 Setting

Data collection took place at two distributed campuses 400km apart. Campus A (in Halifax, Nova Scotia) is located in an established university in a small city and the second campus, Campus B (in St. John, New Brunswick) was established more recently in an area that has been challenged by physician recruitment and retention.

The Campus A classroom, where the bulk of the in-person teaching takes place, is a large 134-seat lecture theatre on the main floor of the medical building. This room features three large-scale screens at the front of the room, displaying the lecturer (left), PowerPoint slides (middle), and Campus B classroom (right screen). Three much smaller screens immediately below these giant screens project the same three views. Eight wall-mounted cameras are placed throughout the room, as are several white fabric wrapped acoustic panels. Seven rows of audience desks cascade down to the front of the room. A button activated microphone is shared between every two seats. The lecturer's podium features a computer monitor displaying PowerPoint slides and a small monitor that shows a map of the distant (Campus B) classroom, and features a silver button like the students', which flashes if a student button has been pushed at either campus. In front of the podium and under the first row of seating, three screens at lecturer eye level depict the PowerPoint slides (left screen), Campus B classroom (middle screen), and the lecturer herself (right screen, with a small screen in the right hand corner that depicts Campus A's view of the B classroom). An oblong light fixture contains a red light (indicating a local question) and green light (indicating a distant question). The audiovisual control room is located across the hall. More than 400 kilometres away, medical students at Campus B attend lectures in a small 30-seat room. Their classroom is built to mirror the Campus A site, though at a smaller scale, with three rows of seating that exactly allow for the smaller class. The Campus B audiovisual control room is located adjacent to the classroom, where audiovisual staff can directly observe the classroom through a tinted window.

2.3 Study Protocol

Our analysis focused on distributed learning activities on the two distributed campuses. Data methods included observations of distributed learning activities on two distributed campuses (n= 108 h) (Angrosino, 2007; Angrosino and de Perez, 2000), in-depth interviews with faculty, students, and audiovisual professionals (n= 33) (Kvale, 2007), and a critical textual analysis of a set of institutional documents and policies (n= 65) (Hodder, 2000; Rapley, 2007).

We gathered data over three years (2012-2015), learning about the Dalhousie medical program, and collecting formal and informal data. This longitudinal approach allowed us to gather a variety of data in order to build a progressive, in-depth analysis. Rather than focusing on specific curricular elements, the focus of our data collection was the educational technology itself (the telepresence videoconferencing system) and how people interacted with it, worked with or around it, and responded to it. We therefore focused on distributed events including large group lectures, but also experiential learning sessions, and meetings. For the purposes of this article, we will draw on observations of these lectures and 15 student interviews from participants at Campus A (n=7) and Campus B (n=8).

2.4 Data Analysis

Data analysis involved categorizing data to detect and interpret themes, attending to inconsistencies and contradictions. Data were analyzed according to Wolcott's (1994) three-step approach to ethnographic analysis: description; analysis; and interpretation. We examined data to develop a coding framework. This framework was then applied as the data were independently coded and analyzed. We organized this first by method (text, observation, interview) as an individual, site-specific data set, and then for the project as a whole. A core team took responsibility for analysis, while the wider group was involved in interpretation. We used qualitative analysis software (ATLAS.ti version 7.0) to assist with data sharing and management.

3. RESULTS

We identified three sociomaterial complexities related to the practice of asking questions in telepresence lectures: 1. Material presence and process of the button and screen in asking questions; 2. The ways in-class questions disrupted the flow of the distributed lecture; and 3. Tensions between ways in which questions are managed across the two sites.

3.1 The Button and Screen

Analysis of field note and interview data illustrates that rather than simply transferring in-person interactions to a virtual space, technological tools and processes in the distributed classroom radically mediate and shape the social interactions that are possible. Sociomaterial practices related to asking questions illustrate this point. Students we interviewed described the material processes involved in asking questions in a distributed lecture:

> You push a button and the light flashes. And then when it's your turn to go, the light stays on and the camera zooms in on you, and then you see your face up on the screen. And you ask your question [into the microphone], and [the opposite campus] can see you as well. That's sort of how it goes. So while the class is going on, there's the lecturer's slides on one screen and then there's also a picture of [other campus] on another.

There is a pause every time the camera pans to another student asking a question. Students who are seated within view of a question-asker are also frequently projected on the screen. Occasionally technical glitches occur, such as students lose their place in the queue or the camera zooms to the wrong student or into blank space.

3.2 Buttons Disrupt the Flow

Our analysis tended to frame question-asking as a disruptive force in the distributed lecture. The convergence of social processes and material technologies in the lecture appear to discourage students (and lecturers) from asking spontaneous questions, which in more traditional lectures are typically taken as a sign of engagement and investment in the topic at hand. Instead, through both normal processes and glitches, distance technologies can draw attention to the artifice of the "digitally extended classroom" and its deviation from a "seamless" extension of an in-person experience for human actors.

Our analysis of observation and interview data suggest that the materiality of the button and screen structures student engagement and questioning practices. Field notes indicate that it was unusual to see more than two questions per lecture. Early on in data collection, we noted, "No one is asking questions… Do people feel like they can ask a question as it comes up or are they worried [because] it is disruptive?" (Field notes). As the study progressed, it appeared that the large screens visually "expose" learners in their respective classroom. Students often appeared "very self-conscious and pained when they see themselves on the screen." This exposure extended to students sitting around the question asker, who were: "even more surprised and pained [to be caught on camera]. In some ways, they are 'collateral video damage' of the student… asking the question. … Some look like they are 'caught' on the jumbotron at large sport events" (Field notes).

We asked students to describe their experiences with using the telepresence system to ask questions. We learned that the materiality of buttons, cameras, and screens involved in 'broadcasting' a question influences students' decisions to speak up. One interviewee, a first-year student at Campus B, attributed her hesitation to ask questions to "the uncomfortable nature of having your face zoomed in on when you're asking a question." In a traditional, in-person lecture, she noted, "students may turn around to look at you as you're speaking to the professor and to the class at large but you would never have such an in-your-face kind of sensation." Having your own image projected onto large screens "in-your-face" therefore can lead to a self-consciousness and sense of exposure that is heightened in the distributed classroom.

This student described technology as a distraction from learning, "particularly when you're trying to address the professor specifically and then you've got an image of yourself just adjacent, you know, watching yourself talk. It's just like an odd thing to experience." The self-consciousness sparked by being zoomed in on and projected onto large screens was one way that the material processes of telepresence are enmeshed with human actors in distributed lectures. The experience of being exposed whether one asked a question or not, underscores the inextricable nature of the social and technological processes in the distributed lecture. While students with questions can at least anticipate their projection on the screen, however uncomfortable, their neighbours may not be aware (or willing) that will be projected alongside them on the giant screen— "collateral video damage."

The distributed lecture is occasionally punctuated by glitches— visible and/or audible failures in material and virtual distributed learning spaces. During a lecture at Campus B, for example, one observer noted, "Student presses button - to turn off the mike[sic] or the camera? She presses it twice and looks unsure if it has worked but then her image shifts" (Field note). Full-on technical glitches can destabilize and disorient the human participants in distributed learning spaces. At one lecture, for example, a question is lost in the ether as the camera "pans out. [Campus A] student thinks it's her. Then the camera zooms out. It zooms around the room. Then it goes black." In the end, due to this material malfunction, "The student has no space to ask her question. It's lost. A [Campus B] student (next in the queue) asks his question" (Field note). On another day, the camera at the Campus A site fails to zoom in on the student asking a question, instead lurching around the room; "it is very disorienting as the camera zooms in it is like being on a rocky boat...then the screen focuses and then the screen turns black" (Field note). Technical glitches can also provide some levity. For example, after the "rocky boat" experience above, the class laughs and moves on to the next question.

Like students, lecturers also appeared to frame in-class questions as diversions. The material complexities of the button/screen system mean that often lecturers gloss over questions for either lip service invitations or avoidance altogether. As a researcher noted early on in the observation process: "No lecturer asks if there are any questions....which is a fairly common approach in most lectures. Is this related to the button? DISRUPTIVE?" (Field note). In one lecture at Campus A, we noted that "There has been no opportunity for interaction yet… it is unclear if the students understood the concepts – and unfortunately they did not have opportunity as they were going through to ask questions (nor encouraged to do so)" (Field note). This

glossing over interaction was echoed by another lecturer administering "an online quiz [who] seems to be answering the questions himself...not a peep from [Campus B] (Field note), while yet another lecturer "asks if there are any questions very quickly to class but doesn't look to see if there are any questions from [Campus B]... she moves on very quickly (Field note).

3.3 Questions Across Sites

Data indicate that questions shape and are shaped by material forces in the distributed classroom, an effect experienced unevenly across campuses. Most lectures are delivered in person on the main (Campus A) campus, with the distributed (Campus B) class joining in via telepresence. Our field notes indicate that it was unusual for a question to originate from a distant site, which we linked to a sense of disconnection from the lecturer. Student interview data echoed this association. As one Campus B student noted:

> There really wasn't a lot of people asking a lot of questions on our end. And we would get teased for that. But it was like, "Well, come on, do you talk to your TV at home?" So there's sort of this feeling that we're kind of passive recipients.

We observed the frequent practice of students with questions waiting to approach the lecturer following the session, rather than using the telepresence technology. Another Campus B student was critical of Campus A students' tendency to approach the lecturer after class rather than asking questions during the lecture. This was substantiated by the lecturers we interviewed, with one saying: "always there would be 5 or 6 [students waiting to ask questions after the lecture] there was never anybody from [the distant site]." While asking questions after a lecture is not an occurrence unique to distributed medical education, we were surprised that the number of questions asked following the lecture outweighed the number asked during the lecture. Certainly, there are educational inequities associated with this practice, related to the physical location in which a learner is situated and the access to the physical presence of the lecturer as students navigate questions across sites.

When someone at a distant site did ask a question, there were sometimes elaborate workarounds put in place to make the question possible. As one second-year Campus A student noted: "They usually have a spokesperson that asks all the questions that's more confident talking in front of the class…they talk about which questions they want to ask and then he [confident person] would present them." Other strategies to avoid having to 'broadcast questions' were apparent and described by participants. One of the most interesting strategies involved self-directed or peer-supported teaching. One interviewee, a first-year Campus B student, noted: "We often just kind of try and figure out the answers to questions on our own or maybe we'll try and like email the professor afterwards rather than actually go ahead and ask the questions during class."

Students also noted that their smaller size and virtual participation in a lecture provided space for satellite students to override the technology (i.e. to keep microphones turned off) to create a student-centred space where they can collectively work through their questions. One first-year Campus A student described the class at Campus B as

> just very tight-knit and everyone knows each other a little better than here. ... there most of the time, the mic isn't on and they can kind of chat without the lecturer here knowing that they're chatting. So I find there's a lot more collaboration that goes on there.

The flip side to invisibility, in this case the satellite students' literal silence in the distributed classroom, is their ability to form a cohesive group and reclaim student centeredness for themselves. Learners thereby use their distance from the lecturer as an opportunity to engage with key concepts, problem-solve and work collaboratively, engaging in more self-directed learning.

Rather than technology extending the classroom space to the satellite site, and thereby enhancing communication and inclusion, telepresence appears to constructs two parallel but unequal worlds. These students also, however, in turn "push back" on the technology by enacting various material strategies to have their questions answered, including appointing informal "spokespeople" on either campus and creating alternative spaces (both virtual, via Facebook and texting, and in person, with the classroom microphones turned off) in which they collectively work through their own questions rather than disrupt the lecture with questions directed to the lecturer. In these cases, the classroom technologies both enable and make necessary creative workarounds for students to get their voices heard and learning needs met.

4. DISCUSSION

In distributed lectures, social practices regarding student questions are enmeshed with the materiality of distance technologies. These technologies constitute questions as disruptive within a distributed lecture. Asking a question leads to exposure for the asker and their neighbours, or "collateral video damage"—the price a student has to pay to formally ask a question during a lecture. Material telepresence tools and the students and lecturers come together in a way that constitutes spontaneous questions by students and lecturers as disruptive elements in the classroom. Unintended technical slips, however small, shape the quality and flow of learning in the distributed classroom, thereby complicating asking questions and drawing attention to the unfulfilled promise of the seamless extension of material into virtual space. Even with highly skilled audiovisual technicians helming the control room, there are moments of hesitation and uncertainty where learners and lecturers are unsure whether the button/microphone/screen process will work. This affirms sociomaterialists' challenge to the material as "neutral, passive and conformed by practice", reframing the ways in which telepresence technologies constrain, enable, and actually constitute, student learning in the distributed classroom— thus acting as "forcible mediators of communication" (Logdlund, 2010, p.183).

Our findings affirm a materialist emphasis on space within teaching and learning, conceptualized in two overlapping and equally important ways: first, a more traditional understanding of space as concrete (facilities, technical artifacts, and bodies), and second, space as social, that is, a set of relations between people within cognitive and virtual realms (Logdlund, 2010; Soja, 1985). Our findings underscore the ways in which concrete material space constrains and enables student learning through their manipulation (and/or avoidance) of the button and screen, and they ways in which telepresence technologies can resist and evade human manipulation through technical glitches. Tools and technologies implemented to facilitate communication in the distributed classroom can in fact encourage student passivity in distributed lectures by constructing student questions as disruptions. This finding echoes Logdlund's observation that student passivity in distributed learning largely takes root in students' hesitation to be visually exposed by the cameras and on the screen. Learners may not know exactly who is watching at any given time, and like lecturers, can seldom gauge the response of the audience at the other campus. Here material tools and technologies can be viewed as actors in the distributed lecture rather than passive and neutral backdrops to the educational encounters (Waltz, 2004).

This construction of questions as disruptions is experienced by students at both sites due to the presence of material technologies. Equally important as these concrete physical processes, however, are the social spaces in which learners inhabit and construct meaning. When we consider the findings in light of relations between individuals and groups within virtual and cognitive learning spaces, students at both campuses have equal access to these spaces. On the other hand, Campus B's physical participation, presence, and access to the lecturer in the physical learning space is usually mediated and at times silenced; their bodies are muted to the lecturer in a way that their colleagues on Campus A are not. In the physical space, their informal strategies to overcome or mitigate this unequal access includes participating in informal peer support and teaching, as well as relying on their colleagues on the Campus A to communicate their questions and concerns to lecturers. Peer-teaching by students at Campus B is therefore both facilitated and made necessary by the material realities of the distributed classroom. This affirms Logdlund's (2010) finding that activity in the distributed classroom appears to be divided between the main and distributed learning sites, the latter an alternative space where events can be seen (but not heard) as "a hidden 'secondary plot'" (p.189). This de-centering of both student and teacher by videoconferencing technology echoes Logdlund's finding that in distributed lectures, students participate as audience, while "the teacher is replaced by a television screen and authority that comes with the teacher's position in the classroom seems to be transferred to material design and technical artifacts" (p.190).

Our findings challenge the assumption that distance learning technologies simply extend the classroom into virtual space, thereby including a new group of learners as equal partners in the learning encounter. Instead, our findings resonate with Fenwick's (2014) assertion that "materials act together with other elements and forces (discourses, symbols, desires, etc.) to exclude, invite, and regulate particular forms of participation" (p.269). While distributed lectures can spark student engagement, it appears that due to significant tensions that emerge between students and technologies, this engagement often occurs in spite of, rather than because of, telepresence technologies and even most lecturers' attempts at student engagement. Due to these material technological constraints, however, student engagement, at least for distance students,

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spills outside the confines of traditional classroom participation with its reliance on asking questions in live time. Instead students improvise by engaging in peer supported learning. While distributed technologies clearly exclude certain kinds of participation, particularly for distance students, they also enable and invite others.

In Callon's (1986) words, the cameras, microphones and screens of the distributed medical lecture become an "obligatory point of passage," through which all players in the lecture: objects, bodies, and texts, must flow (Fenwick, 2014). Material practices in the distributed medical education classroom therefore shape and control the telepresence lecture in profound ways, from question-asking practices constrained and enabled by the button, microphone, and screen, to the social relations between local and distant site, including differently experienced classroom encounters for distance students inhabiting virtual space.

5. CONCLUSION

Everyday practices within distributed medical education are inextricably entangled with materiality of distance learning technologies. By resisting the tendency to render these educational technologies as neutral and passive background to the educational encounter, this research sheds light on the ways learners engage with and are engaged by these concrete tools and spaces. Theorizing materiality enables a more critical consideration of the ways educational technologies transform pedagogy by foreclosing certain teaching and learning practices and requiring, enabling, and shaping others. Before we can theorize about these practices we need to understand teaching and learning as an assemblage of human and non-human actors. Further qualitative research is required that takes a sociomaterial approach to teaching and learning in digital contexts in higher education, troubling the supposed inevitability, invisibility or neutrality of technological tools and spaces and critically considering what is gained, lost, and transformed in these contexts.

Sociomaterial perspectives and concerns can richly inform our efforts to move beyond taken-for-granted assumptions about "seamless" learning and teaching, to instead consider the often messy, contradictory, dynamic and multiple assemblages of tools, spaces, bodies and practices within distributed learning. Attending to the seam between the social and material in the distributed lecture illuminates the challenges, barriers, and opportunities for student participation while unearthing innovative strategies—as their learning shapes, and is shaped by, material technologies in the distributed classroom.

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