

Technologies of Exposure: Videoconferenced Distributed Medical Education as a Sociomaterial Practice

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Abstract

Purpose

Videoconferencing—a network of buttons, screens, microphones, cameras, and speakers—is one way to ensure that undergraduate medical curricula are comparably delivered across distributed medical education (DME) sites, a common requirement for accreditation. However, few researchers have critically explored the role of videoconference technologies in day-to-day DME. The authors, therefore, conducted a three-year ethnographic study of a Canadian undergraduate DME program.

Method

Drawing on 108 hours of observations, 33 interviews, and analysis of 65

documents—all collected at two campuses between January 2013 and February 2015—the authors explored the question, “What is revealed when we consider videoconferencing for DME as a sociomaterial practice?”

Results

The authors describe three interconnected ways that videoconference systems operate as unintended “technologies of exposure”: visual, curricular, and auditory. Videoconferencing inadvertently exposes both mundane and extraordinary images and sounds, offering access to the informal, unintended, and even disavowed curriculum of everyday medical

education. The authors conceptualize these exposures as sociomaterial practices, which add an additional layer of complexity for members of medical school communities.

Conclusions

This analysis challenges the assumption that videoconferencing merely extends the bricks-and-mortar classroom. The authors discuss practical implications and recommend more critical consideration of the ways videoconferencing shifts the terrain of medical education. These findings point to a need for more critically oriented research exploring the ways DME technologies transform medical education, in both intended and unintended ways.

Distributed medical education (DME) involves delivering curriculum to geographically separate campuses. The Council of Ontario Universities defines DME as “a model of medical education that uses a teaching and learning network that is integrated in and accountable to communities.”¹ Although models of DME vary, one common factor is the use of technology to connect multiple sites.² Increasingly, videoconferencing facilitates lectures and other large-group activities for medical schools with DME programs. We recognize that DME is a broad

endeavor with goals that include, among others, building capacity in rural settings, addressing issues of equity by providing community access to medical education, and maximizing economic investments; however, these issues are not the focus of our work. Rather, our sociomaterial ethnographic study, described herein, focuses on videoconferenced distributed medical education (VDME).

One researcher has previously defined videoconferencing as “technologies utilized to transfer digitized data in the form of images and audio, including video clips, photographs, music and other information.”³ One scholar has suggested that the technology is especially ideal for fields such as medicine, “in which interpersonal skills are a large component of the students’ education.”⁴ Used for over 30 years in higher education, videoconferencing systems have allowed curriculum delivery across sites through high-speed broadband networks.⁵ Specifically, in medical education, videoconferencing is often used to extend undergraduate curricula to learners at regional campuses, helping to ensure comparability.⁶

When the undergraduate program in the Faculty of Medicine at Dalhousie University became fully distributed, it invested in VDME. As VDME users and observers, we were impressed by its reliability and utility. Yet we observed that in addition to connecting sites, VDME technologies did other, unexpected things. We noticed that the technologies were playing a central mediating role in both teaching and learning.

The rapid pace of emerging technologies has meant that few investigators have examined distance learning tools like videoconferencing^{3,5} in medical education.^{6,7} VDME scholarship requires a critical perspective that unsettles taken-for-granted notions about technology as a neutral background to human interaction. We believe the tools and spaces of videoconferencing—the buttons, screens, cameras, microphones—are central actors that facilitate, restrict, and complicate medical education.³ This perspective echoes Lögdlund,³ who described videoconferencing as a practice constituted through human and nonhuman actors; however, few researchers have applied this approach

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Acad Med. 2019;94:412–418.

First published online November 21, 2018

doi: 10.1097/ACM.0000000000002536

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Supplemental digital content for this article is available at <http://links.lww.com/ACADMED/A615>, <http://links.lww.com/ACADMED/A616>, and <http://links.lww.com/ACADMED/A617>.

to videoconferencing and other communication technologies in medical education. To date, most of the research on videoconferencing that does exist has described student satisfaction, and a smaller number of studies have examined learning outcomes across sites.⁶

We decided, therefore, to conduct an ethnographic study to explore how human and nonhuman elements come together to produce VDME. Our ethnographic research was theoretically framed in sociomaterialism,⁷ which is increasingly recognized as a powerful theoretical orientation in social science research including medical education.⁷⁻⁹

Sociomaterialism is an umbrella term for a variety of approaches that consider both social and material elements.^{10,11} In the context of our research, we drew on the following five principles: (1) that material elements are as important as discourse and language; (2) that the social and material are inseparable; (3) that social and material elements do not have intrinsic properties outside of their interaction; (4) that the line separating social and material elements is abstract and artificial; and (5) that research, therefore, must focus on practices.^{10,12} This framework facilitated our data collection and analysis of the entanglement of the material aspects of the learning environment (e.g., technology, classroom spaces) with the social elements (e.g., relationships, interactions).

Method

Research setting

Since September 2010, the undergraduate program in the Faculty of Medicine at Dalhousie University has been fully distributed across two campuses: (1) the original site in Halifax, Nova Scotia (80 students per year); and (2) the extension site, Dalhousie Medicine New Brunswick, 400 kilometers away in Saint John, New Brunswick (30 students per year).

The main lecture theater in Halifax has three 78" × 140" screens and three projectors. The connection is facilitated through a videoconferencing control system, 52-inch main displays, and 40-inch confidence monitors (monitors only visible to the instructor). The school has placed a series of cameras throughout

the classroom, a gooseneck microphone at each lecture podium, small dome-shaped microphones at student desks, and a collection of speakers in the ceiling. The equivalent classroom in Saint John is smaller and equipped with the same technologies.

Sociomaterial ethnography

To explore VDME in detail, we conducted a sociomaterial ethnographic study. Ethnography involves long-term immersion in the everyday work and practices of a chosen setting.¹³ Ethnographic studies include a variety of data collection strategies (e.g., observation, interview, photograph and document analysis) that collectively build a detailed picture of a setting.¹⁴ A sociomaterial approach to ethnography means that (1) we studied the assemblage of social and material rather than focusing more on social constructions (i.e., we examined more than just the human elements); (2) we remained attuned to *emerging* practices rather than focusing on only existing social or cultural representations; and (3) we considered the researchers (i.e., ourselves) as part of the assemblage being studied, rather than focusing on "insider/outsider" status.¹⁵ In other words, we focused on material elements, as forces equal to humans, in VDME encounters.

In taking a sociomaterial perspective, we theorized that videoconferencing technologies were not simply the backdrop for learning but, rather, functioned as agents that "work" to produce VDME. Beginning from the position that social and material actors are symmetrical (equally important), our work shifted the emphasis from traditional studies of DME, which have focused exclusively on human concerns (e.g., satisfaction, learning). Sociomaterial scholars propose a posthumanist approach that "calls into question the givenness of the differential categories of 'human' and 'nonhuman.'"¹⁶ Instead, sociomaterial scholars consider the everyday practices through which the boundaries between human and nonhuman are negotiated and renegotiated moment to moment.¹⁶ This approach reintroduces the material, empirical world as knowable, and it allows scholars to move beyond both a positivist concern for preexisting objective knowledge and a semiotic

concern with language, toward, instead, a focus on the material world as a rich tangle of emergent phenomena.¹⁶

While merging ethnography and sociomaterialism, we faced the inevitable tension of examining material VDME elements through historically human-focused social science research methods such as interviews.¹⁷ We attempted to use this contradiction as a strength; for example, although interviews are human focused, they often provided insight into material actors.

Role of the researchers

Sociomaterial research positions the researchers themselves as constitutive elements of the phenomenon being studied and, thus, as mediating features of the research setting.¹⁵ We recognize that our observations of the videoconferencing materials have been both constraining and enabling, which, in turn, has influenced our data collection and analysis.

In other words, we operated with the understanding that the VDME environment was not stable, passively awaiting observation but, rather, that we influenced and, in fact, became part of the practices we observed. This understanding was especially pronounced for those of us who have used the VDME system in our work (A.M., O.K.): Separating our reflections on our teaching from our fieldnotes was difficult and somewhat artificial.

Data collection

We (A.M., O.K., J.T.) used a progressive suite of data collection strategies (described immediately below) to achieve our goal of developing a rich description of the VDME environment. We collected both formal and informal data at two campuses between January 2013 and February 2015.

Critical textual analysis. Our initial step was to conduct an environmental scan to identify documentation related to DME. This included Internet searches and consultations with key informants. We (A.M., O.K., J.T.) reviewed 65 texts related to DME in our local context. These included planning, accreditation, and curriculum documents, local technology policies, and technological guidebooks. We developed and used a

document review form (see Supplemental Digital Appendix 1, available at <http://links.lww.com/ACADMED/A615>) that helped us focus on implicit messages and positioning of the DME program.

Observation. We (A.M., O.K., J.T.) developed an observation guide (see Supplemental Digital Appendix 2, available at <http://links.lww.com/ACADMED/A616>) that oriented the observer to both the social and material features. We developed the template based on classic ethnographic¹⁸ and sociomaterial¹⁰ literature. It provided some structure but left considerable space for description and reflection. A team of six researchers used this template to conduct observations over 18 months; however, three core researchers (including A.M. and O.K.) conducted the majority of the observations.

Our ethnographic study focused on the videoconferencing technologies mediating DME; therefore, observations centered around technologies. We generally observed undergraduate medical education lectures; however, we also observed extracurricular events, conferences, and meetings for a total of 108 observation hours. Observations were supplemented with photographs of spaces and technologies.

Interviews. Following our observations, we (A.M., O.K., and others) conducted 33 in-depth, semistructured interviews with faculty, administrative staff, audiovisual (AV) professionals, and students (Supplemental Digital Appendices 3–6, available at <http://links.lww.com/ACADMED/A617>). Rather than focusing on social relations, our interviews were designed to further our understanding of VDME. Consistent with sociomaterialism, we considered each interview as a means for us and our fellow researchers to learn of interactions and associations that we could not directly observe.^{19–21} Specifically, interviews with faculty members ($n = 7$) focused on teaching with videoconferencing technologies; those with administrative staffers ($n = 5$) focused on planning the DME program to coordinate with videoconferencing tools; those with AV professionals ($n = 6$) focused on videoconferencing functionality; and finally, those with students ($n = 15$) focused on how VDME shaped the learning environment.

Data analysis

Our approach to data analysis was iterative. Analyses focused on how technologies enabled members of the medical school to see and hear things that would not have otherwise been accessible.

We (A.M., P.C., O.K., J.T.) worked with a modified version of Wolcott's description, analysis, and interpretation approach²²—with the explicit addition of a focus on the mediating role of the VDME system. This approach allowed us to iteratively capture and analyze themes but still provided the flexibility to explore emerging practices.

We considered each data source individually (i.e., each analyzed document, each observation, each interview) to develop a coding framework. We then applied these frameworks and independently coded and analyzed the data by method: first, documents; next, observation (including photographs); then, interviews. Lastly, we interpreted data for the project as a whole. We used qualitative data analysis software (ATLAS.ti version 7.0; Berlin, Germany) to manage, code, and share data. Three researchers (including A.M. and O.K.) took the lead on coding the data and shared their interpretations and analysis with a larger group for consideration. We managed the few disagreements about coding that arose through discussion.

Ethical approval

The Dalhousie University Social Science and Humanities Research Ethics Board approved this research.

Results

Over the course of our field work, the reality that, in addition to connecting the two regional campuses, the videoconferencing technologies accomplish other, unintended work became clear. Frequently, this unintended work took the form of “exposures,” which the Oxford Dictionary defines as “the revelation of an identity or fact, especially one that is concealed or likely to arouse disapproval.”²³ We identified three such exposures, classifying them as visual, curricular, or auditory.

Visual exposures

Many of the exposures we documented in our data were visual in nature, afforded

by the cameras and/or screens of VDME spaces. These visual exposures occurred on large, high-definition screens, magnified in a way that is literally larger than life. Without exception, faculty and student interview participants described at least some degree of discomfort with being on the big screen. In addition, we regularly observed people appearing to be self-conscious or embarrassed on the screen, or attempting to move out of view of the camera.

Although people opting to use the VDME system understood that their image would be projected on a screen, the sheer size and degree of detail displayed was surprising, and even alarming, for some. To illustrate, one student commented during an interview,

I sent [a friend at the other campus] a photo once of how big they are [on-screen].... And he, like, couldn't believe it.... I think that they forget that they're that big.

Further, according to our fieldnotes, one lecturer remarked:

As a lecturer, I was really shocked! shocked! by how exposed I felt being behind the fancy new technogizmo lectern system.... It was very hard to get a sense of where my body started and where it stopped. It was everywhere! I could see my body on several screens, including in front and behind me. I was seen at local and satellite sites from multiple angles and it is anxious making. In addition, I know I was being taped. Not to mention that there are people in the control room ensuring that technologically all goes okay. I felt like saying, “Does the camera add x number of pounds?” Everyone is watching and I felt super conscious.

The element of surprise further amplified students' and faculty members' discomfort. For example, students sometimes appeared on the screen when they were not expecting it. This often happened when they were unwittingly in the frame of the camera shot as a peer asked a question. Further, it was not unusual for students to unintentionally hit the button that activates a camera. One student explained in an interview:

So if someone puts their laptop down [in a certain way], it triggers the button. And a lot of people have just done it by mistake. So it usually happens maybe a couple of times a month that someone [on either campus] comes up on camera and they're just so unaware that they're on camera.

The videoconference system also allowed for people at one campus to intentionally watch those at the other when the latter appeared on the large, high-definition screen. One student interviewee remarked:

And sometimes you're like, "Oh my god, I'm being so creepy." Like they're over there and the lecturer is over on the other side. So it's quite obvious if you're making a choice to look at them.

Curricular exposures

Another type of unintended consequence that VDME has made possible are curricular exposures—that is, the distribution of curricular content, including lecture slides, photographs, teacher commentary, and other educational artifacts, across geographic sites. In other words, the sociomaterial elements producing VDME lead to the potential broadcast, in high definition, of curricular materials to people other than the intended audience. An AV professional described one such incident to us in an interview:

We had a clerkship session that was dealing with some aspect of human sexuality... And there were some relatively explicit materials that were being shown as part of the educational experience. And no one communicated to anyone [at the other site] that that was going to occur. So there were people walking into rooms that were misbooked. And you're walking into what was relatively hard-core pornography...

In the unanticipated incident described above, the clerkship students were briefed in advance about the nature of the curriculum; however, no one briefed other members of the medical school at the distributed education site. This oversight meant that other students, faculty, and staff—members of an unprepared, but captive audience—were taken by surprise by the explicit images.

The nature of medicine and medical education means that graphic materials, including diseased organs, surgical procedures, representations of sexual organs, and images of violence, are necessary curricula. Videoconferencing technologies broadcast material outside the medical education lecture theater, potentially exposing this content to audiences beyond the intended medical student. One of our researchers, sitting in on a lecture to observe, experienced such

an exposure and wrote the following in the fieldnotes:

It's bad enough to have to look at a skin malignancy. But seeing it on the big screen is pretty intense. It's literally bigger than me. I'm so squeamish. I keep trying to look away, be cool, thinking I didn't go to grad school for this...

The AV professionals working behind the scenes to facilitate the delivery of the curriculum are particularly susceptible to these curricular exposures. Because of the nature of their work, they are sometimes unable to avoid it. During an interview, one AV professional remarked:

They were made known in advance of becoming part of this team that they would be privy to some information, there would be some things that they may see that may be disturbing. And you know, we've let them know that they can kind of opt out. But if you have one person responsible and they're the only one there, and they're not comfortable.... What do they do?

Auditory exposures

Videoconferencing also allows for auditory exposures, as people hear and are heard, intentionally and unintentionally, by students, lecturers, meeting attendees, and AV professionals across sites. Auditory exposures are relatively common in DME contexts because of the mediating work of buttons, microphones, and speakers. Distributed learning spaces are equipped with many microphones, often placed on tabletops or desktops, at podiums, and in ceilings. Perhaps because of the omnipresence of these mics, members of the DME community seem to lose sight of the fact that they can be, and frequently are, heard by people who are not physically present in the same physical place. For example, one fieldnote described a meeting attendee in a room at a distant site not realizing his microphone had been activated during a faculty meeting:

I can hear him breathing into the microphone. It sounds like when someone puts the telephone too close to their face. Everybody's kind of uncomfortable in this room. We all hear it, but he has no idea.

The AV professionals who work behind the scenes are (as we have previously described) largely invisible actors in VDME,²⁴ yet potentially they have visual and auditory access to all lecture and

meeting spaces at the medical school. These professionals, therefore, have ample opportunity to overhear. For example, when we asked one AV professional whether he received feedback on the functionality of the videoconference system, he told us he did not formally; however, he qualified his answer:

We overhear a lot of what goes on in the classroom. So we get feedback through that means.

The fact that the technologies are designed to optimize hearing across sites has been the source of some challenging situations, potentially exposing communications intended to be private. Such exposures have occurred both in smaller settings, such as meetings, and on a larger scale, as described in an interview with another AV professional:

Following [a] panel, there was a discussion going on about something that was taking place in the class. There was some sort of rift forming with some of the students, and tempers were beginning to flare a bit. The students are very comfortable in the classroom, and they know when their light is not on, their mic is not on. So they knew full well that their microphones were not on but they forgot that the panel was active. And what was clearly intended to be a private conversation was going on. And the voice was actually being piped into [the large-group lecture].

Discussion

Videoconferencing enables a comparable educational experience across multiple sites; however, our results highlight an interesting phenomenon in which VDME technologies, in their potential for delivering on the promise of comparability, afford members of the medical school community the unanticipated chance to see and hear things that would otherwise have been invisible and inaudible. These exposures are produced through the social and material actors that constitute VDME (cables, cameras, classrooms, curricula, lecturers, microphones, screens, speakers, students).

In a typical face-to-face encounter, social norms dictate the amount of time that is appropriate to look at another person. Through our conversations with students, we came to understand that VDME technologies somehow changed the way

classmates looked at one another. That is, the VDME environment created a degree of removal, dulling or even obscuring the humanity of classmates by rendering them two-dimensional. This dimming of colleagues' humanity, in turn, allowed participants to passively watch lecturers or their fellow students on the screen, as a viewer might watch a television. Confounding this already-complicated situation is the fact that people in VDME settings can never know for certain whether they are being observed at any given moment. While this reality can mean greater self-consciousness in many cases, the ever-present cameras can also become mundane and therefore easily forgotten. Further—although none of the participants directly addressed the idea of perpetuity—we note that many of the lectures were also recorded so they would be available to students, both present and absent, for later viewing. Recording adds an additional layer of uncertainty and, potentially, permanence to these auditory, curricular, and visual exposures.

We believe that these exposures may have been dismissed as incidental without examining them through a sociomaterial lens. In considering them from a sociomaterial perspective, the medical education community may come to understand that exposures are not meaningless accidents, nor are they isolated moments that could have been avoided if only someone had done a better job or used a more advanced type of technology; rather, they are the unintended consequence of human and nonhuman actors producing VDME.

We believe the value of theorizing VDME as a sociomaterial practice is that, in directing our inquiry toward the material elements of the learning environment, we have been able to unsettle or problematize taken-for-granted discourses of “seamlessness” that are often associated with videoconferencing and VDME. We acknowledge that distributed campuses can, and do, connect dispersed learning communities through VDME; however, we have also observed and documented, applying a sociomaterial perspective, the “seams” or potential drawbacks of VDME, some of which took the forms of unanticipated exposures.

Many scholars have recognized the important roles of humans as well as things (tools, technologies, classrooms)

in teaching and learning^{3,8,25}; however, in general, the medical education community has traditionally conceptualized the social and the material as distinct elements. In this binary articulation, things, or materials, have been discursively constructed as passive and dependent, existing only to be used by humans.²⁶ This ontology promotes an exaggerated sense of human control²⁷ with respect to VDME. It positions humans, in our case medical educators, administrators, AV professionals, and medical students, as authorities who seamlessly use videoconference technologies to achieve comparable educational experiences across dispersed sites. Our position is that this binary conceptualization is not reflective of the reality of VDME, through which technologies operate in ways humans do not intend or necessarily foresee. VDME is thus a messy amalgam of heterogeneous social and material factors in constant motion, working beyond human intent—that is, a sociomaterial practice.

To be consistent with the principles of sociomaterialism underpinning our work, we conceptualize each of the three types of exposures we have described as the product of social and material elements becoming entangled to produce VDME.^{10,27–30} We believe that exposures are not something anyone can eliminate or avoid. Rather, they are to be expected because they represent the ongoing work of establishing and reestablishing the social and material elements that constitute the practice of VDME.^{31,32} The existence or observation of these exposures was not surprising to us as sociomaterial ethnographers. Our work focused on, instead, *identifying and documenting* them. Further, in tracing them through our fieldwork, we observed that some outcomes of VDME were intended by humans (connecting campuses across distance), while others fall outside human intent (auditory, visual, and curricular exposures).

To consider VDME as a sociomaterial process is to understand that encounters that would have been invisible/in audible in traditional face-to-face education are always potentially visible and audible. The human actors in a VDME context (students, lecturers, AV professionals, and others) can never be certain if or when they will be exposed to material

not meant for them, nor whether they are being observed or overheard. That is, the omnipresence of videoconferencing technologies affords a degree of exposure that complicates the learning environment, allowing an eye or ear into formal curriculum, but also into the lived experience of the informal,³³ unintended,³⁴ hidden,³⁵ and even disavowed³⁶ curriculum in ways that are not possible in traditional face-to-face medical education.

This is not to say that exposures, or other unintended occurrences, do not occur in face-to-face medical education. They do as this, too, is a sociomaterial practice. However, the nature of the elements producing VDME, and therefore the exposures themselves, are different. Certainly, being magnified and watched on a huge screen is different from being watched across a classroom. Scholars such as Introna and Ilharco³⁷ and Land and Bayne³⁰ have written about how screens locate and attract our attention and, therefore, mediate the ways in which we engage and act. Further, the entire VDME classroom is designed to focus participants' attention toward the screen. Likewise, being overheard by virtue of physical closeness is different from having your voice amplified and projected into a space hundreds of kilometers away, where the potential “overhearers” are unknown entities in a space that is distant from your physical body.³⁸ Furthermore, the potential for your voice and image to be recorded for later distribution and viewing may exacerbate these exposures. We believe that to overlook or ignore the exposures facilitated through the sociomaterial practice of VDME is to oversimplify or misunderstand the realities of this approach to teaching and learning.

The technologies producing VDME add layers of potential exposure to the classroom, opening the proverbial doors of the once-closed lecture theater. Notions of privacy and control that are implicit in traditional face-to-face learning are reshaped in the context of VDME. The possibilities of being indirectly or unknowingly watched, subjected to uncomfortable curricular materials, and/or overheard in a private conversation existed, but were minimal, in a traditional setting. The affordances of videoconferencing technologies, on the other hand, facilitate exposures,

inevitably making visible and audible the everyday intricacies and workings of medical education to people near and far.

We believe that the exposures we have documented have both ethical and professional implications. We therefore encourage programs using VDME to explicitly address the following questions (which do not constitute an exhaustive list) with students, faculty, and staff:

- What should I do if I overhear a private conversation through the VDME system?
- What should I do if I notice someone is on-screen but not aware of it?
- How can I minimize the risk of exposing unintended audiences to difficult or unsettling material?

Addressing these considerations could take the form of a code of conduct, a policy, or, more simply, an open and ongoing discussion.

Recommendations

As a general practice, we encourage regular orientation, and reorientation, to the VDME technologies and their affordances. This orientation should be available in a just-in-time fashion and should be tailored for both regular and periodic users of VDME. Rather than making this a traditional faculty development offering (i.e., a face-to-face opportunity), we suggest making this available as a short video, podcast, or handout that could be updated and reshared as changes are made to the VDME system.

With respect to visual exposures, we note that people felt most exposed when they appeared on a screen unexpectedly. To reduce this possibility, we suggest consulting with AV professionals to fine-tune the functionality of the VDME tools. For example, adjusting the camera range to ensure that only the person asking the question appears on-screen is a straightforward change. As a general practice, we encourage regular consultation with AV professionals, who have significant VDME expertise which is often unrecognized and underused.²⁴

With respect to curricular exposures, we encourage curriculum developers to remember the breadth of the VDME

community (which, though extensive, remains largely invisible²⁴). Although health professionals or biomedical scientists may be somewhat desensitized to graphic curricular materials, others who are essential to the practice of VDME, including administrators and AV professionals, may find these resources upsetting. Including a trigger warning and/or an opt-out option whenever possible may help. Predicting every instance in which curricular materials may be upsetting is impossible, but this very impossibility highlights the benefits of both (1) maintaining a clear, well-planned, and openly accessible curriculum map or topic list and (2) sharing this resource in advance, thereby allowing those with potential sensitivities to plan ahead.

With respect to auditory exposures, we believe that reminding users that their conversations are always potentially overheard, and even recorded in perpetuity, is essential. Again, we believe that working collaboratively with AV professionals to develop strategies is important. Creating a visual or auditory signal indicating that microphones are activated would be useful. Rather than making this a subtle indicator, we suggest making it obvious and easy to identify, even for those who are less familiar with the VDME technologies.

We make these suggestions in an effort to reduce the discomfort associated with being exposed, or with being subjected to exposures, through VDME; however, we want to state clearly that we believe predicting all possible exposures is impossible—as is perfecting VDME. We believe no technological or educational solution can completely eliminate the possibility of unintended exposure; rather, in theorizing VDME as a sociomaterial practice, we acknowledge the element of unpredictability that is always present when human and nonhuman elements assemble.

Certainly, we are not implying that videoconference technologies are somehow bad, nor are we sounding the alarm that everyone need be wary and watchful when in their presence (although this is probably wise). Further, we appreciate the important goal of facilitating comparable educational experiences to learners at all sites and

the affordances of videoconference technologies that make this goal possible. We do, however, believe it is critically important to consider not only the ways videoconference technologies alter the social, physical, cognitive, and emotional spaces of VDME programs but also how the technology and the exposures it creates shape the ways people experience medical education.

VDME is not simply an extension of in-person classroom learning; rather, it changes the context for learners, teachers, and other members of the medical education community. Thus, from a scholarly perspective, we believe the research and theories of VDME must evolve to include a critical orientation that accounts for the unintended and unanticipated ways in which VDME reconfigures education. Our position is that videoconference technologies significantly change the experience of teaching and learning and add a new layer of complexity to medical education.

Limitations

We acknowledge the limitations of our study, which occurred in the context of just one VDME program. Although we believe our insights have theoretical generalizability³⁹ to other medical and health professional schools that use videoconferencing to connect campuses, the exposures we describe are limited to our specific context.

Conclusions

Considering VDME as a sociomaterial practice allows scholars, educators, and learners to pay attention to what videoconferencing technology is facilitating beyond simply connecting different campuses. In illuminating the ways in which humans and nonhumans produce VDME, we have shown that social and material elements sometimes come together in ways that are neither predictable nor intended. Rather than attributing this either to a videoconference system that does not work or to human error, we suggest applying a sociomaterial approach, which reminds users—faculty, staff, learners—that there will always be an element of unpredictability and, in this unpredictability, perhaps exposure, associated with VDME. Medical

educators should, perhaps, therefore best direct their efforts toward familiarizing themselves with the sociomaterial realities of VDME, and thinking critically about how to reduce and respond to them.

Acknowledgments: The authors acknowledge their broader research team, particularly Cathy Fournier for her contributions to data collection. The team is grateful to the Faculty of Medicine at Dalhousie University for their support and, in particular, recognize the MedIT staff for their commitment, professionalism, and expertise. The authors also sincerely appreciate the contributions of their research participants who were generous with their insights and time.

Funding/Support: This research was made possible by a Social Sciences and Humanities Research Council (SSHRC) Insight Grant 435-2012-462.

Other disclosures: None reported.

Ethical approval: This research was approved on June 18, 2012, by the Dalhousie University Social Science and Humanities Research Ethics Board. Approval no. 2012-2705.

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