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Untethered Lecture Capture: A Qualitative Investigation of College Student Experiences

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Abstract

Untethered Lecture Capture (ULC), a technology-enhanced teaching strategy, permits faculty to be freely mobile in the classroom (untethered) while simultaneously teaching and creating audiovisual media assets (lecture capture). Faculty, representing nine disciplines, implemented ULC in undergraduate courses. Qualitative content analysis resulted in three themes. Undergraduate participants ($n = 23$) reported ULC supports accessibility and education affordances, enhancing personalized, self-paced learning, and equal opportunities for academic success. Untethered faculty teach on our turf, teaching among rather than talking at students, enhancing time-on-task, in-class focus, and learner socialization. Understanding and retention were perceived as improved when multimedia instruction principles were integrated in the classroom.

Keywords

untethered, lecture capture, undergraduate, education, qualitative research

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The integration of technology with multimedia learning theory creates affordances that enhance both teaching methods and student learning. Faculty and Academic Technology staff at a private, faith-based University in the Pacific Northwest region of the United States collaborated to develop and implement an innovative educational strategy, which the authors have named *Untethered Lecture Capture* (ULC). ULC incorporates a variety of technologies (iPad, Explain Everything™ App, and AirServer Connect™) that collectively permit faculty to be freely mobile (untethered) in the classroom while simultaneously capturing audiovisual digital media (lecture capture [LC]) as learning resources. The combination of untethered teaching with LC has the potential to enhance learning resource accessibility, promote student–faculty engagement, and strengthen student attainment of learning outcomes. The purpose of this qualitative research was to explore how undergraduate students ($n = 23$) perceived their learning was influenced when faculty members utilized ULC methods in college classrooms.

Literature Review

The literature defines LC as using technology (classroom mounted cameras and microphones) to digitally record live lecture. Recordings are then converted into a media file and uploaded to course management learning platforms, such as Moodle™ (Freed, Bertram, & McLaughlin, 2014; Groen, Quigley, & Herry, 2016; Marchand, Pearson, & Albon, 2014; Mayer, 2008; Nashash & Gunn, 2013). LC presents both benefits and barriers to student learning. Benefits include access to digital, audiovisual recordings which may be archived as a learning resource and subsequently used for self-paced, personalized learning. LC offers students unlimited opportunities to review and rehearse desired segments of the recorded lecture while working toward understanding the whole (Freed et al., 2014; Groen et al., 2016). In published descriptive studies, students have reported that LC reduces note-taking anxiety during class, improves focus during live lecture, and instills a sense of control over their learning because they can self-pace learning outside of the classroom (Groen et al., 2016; Marchand et al., 2014; Mayer, 2008; Nashash & Gunn, 2013). Nashash and Gunn (2013) have also suggested that nonnative English-speaking students could specifically benefit from reviewing LC media at their own pace, minimizing anxiety about missing information while translating between their native language and English during live lecture.

The literature also described barriers to student learning associated with LC. For example, students reported technology glitches and faculty discomfort with technology as LC limitations, stating that such issues waste class time and minimize learning (Nashash & Gunn, 2013). In addition, classroom mounted cameras and audio recording equipment restrict faculty mobility during live lecture. Stationary cameras confine faculty members within the scope of the

camera lens and limit visibility of faculty drawn illustrations on both whiteboards and chalkboards. Audio recording equipment may limit faculty mobility within the range of the microphone (Freed et al., 2014; Groen et al., 2016; Marchand et al., 2014). Such mobility barriers could decrease student–faculty interactions, limit active teaching strategies, and thwart learner socialization.

A promising solution to address barriers, while retaining LC benefits, is to utilize technology which permit faculty members to be *untethered* in the classroom, that is, faculty simultaneously teach and create audiovisual LC recordings from anywhere in the classroom rather than being tethered to classroom technology. A literature search of nursing, allied health, and education databases was conducted using the following key words: *untethered*, *lecture*, *capture*, *experience*, *unconfined*, *unrestricted*, *mobile*, *tablet*, and *teaching*. Limited evidence regarding student experiences in untethered learning environments was located.

One empirical study describing untethered teaching was found in the literature. Lumkes (2010) described the following student perceptions about the benefits associated with faculty tablet use and faculty mobility in the classroom: (a) ability to use and easily expand high-quality graphics and multimedia during lecture, (b) ability to record and post lecture online, (c) better student–instructor interaction during the lecture, (d) ability to use different digital ink colors to annotate and illustrate content during lecture, and (e) students are able to see from anywhere in the classroom (view not impeded by podium, equipment, or teacher). No additional recent literature describing student perceptions of untethered teaching was located.

The key words were also searched via Google, which resulted in locating information about untethered teaching from a variety of anecdotal teaching blogs (Coffey, 2015; Reiff, 2012). No operational definition of untethered teaching was located; however, teaching blogs and vendor websites describe *untethered* teaching as the use of multimedia technology to present course content while freely moving throughout the classroom. Being untethered means being unrestricted by stationary and fixed technological resources (Barnett, 2014; Coffey, 2015; Porter, Frizelle, & Brokhaus, 2014; Reiff, 2012). These aforementioned anecdotal narratives and vendor information identified that untethered teaching is possible through the integration of screen-casting technology (such as AirServer Connect™), a hand-held tablet (such as an iPad™), and interactive whiteboard software (such as Explain Everything™).

In addition to literature describing LC technology and untethered teaching, we sought additional evidence about multimedia instruction best practices. Mayer's (2008) Cognitive Theory of Multimedia Instruction (CTMI) provided empirical evidence to guide effective implementation of multimedia resources within college classrooms. Building on cognitive learning theory principles (Sweller, Ayres, & Kalyga, 2011), Mayer and Fiorella (2014) suggest that multimedia resources, when appropriately configured, may reduce cognitive load

and optimize learning. Specifically, Mayer and Fiorella recommended the following:

- Narrations should simultaneously accompany corresponding illustrations (*temporal contiguity*).
- Essential text should be written next to corresponding graphics (*spatial contiguity*).
- Signaling should be used to emphasize essential information (*signaling principle*).
- Words, pictures and sounds that are not relevant to instructional goals should be eliminated (*coherence principle*).
- Graphics with spoken narration are preferred compared with graphics, spoken narration, and written text (*redundancy principle*).

In addition, Sweller et al. (2011) suggest that student learning is enhanced when extraneous load is minimized and intrinsic load is managed. Multiple authors recommend multimedia resources should be designed to reduce extraneous processing associated with reconciling auditory, printed words, and graphics by eliminating items which are unnecessary (Mayer & Fiorella, 2014; Park, Moreno, Seufert, & Brunken, 2011; Sweller et al., 2011).

While there was abundant literature describing student experiences with LC, and limited literature describing student experiences with untethered mobile teachers, no literature existed describing students' learning experiences with the combination of untethered teaching with LC while also incorporating the CTMI. Thus, the purpose of this descriptive qualitative research was to explore the lived experiences of undergraduate students who experienced ULC methods in college classrooms.

Research Question

How do undergraduate students perceive ULC methods influenced the educational environment and learning?

Faculty Development and ULC Methods

Prior to conducting the research study, an interdisciplinary team of faculty members who volunteered to integrate ULC within classrooms met to discuss, review, and rehearse multimedia instructional principles. Master's prepared Academic Technology Services and Innovation (ATSI) employees with instructional design expertise and a PhD prepared faculty member with ULC experience (ATSI Faculty in Residence [FIR]) facilitated ULC faculty development meetings. It was important that the technology would be appropriately used to enhance and not detract from learning (Lumkes, 2010; Mayer & Fiorella, 2014).

Fifteen faculty members, representing nine disciplines, partnered with ATSI staff and an ATSI FIR to implement the ULC project within their courses. Each faculty member participated in a 90-minute, face-to-face orientation session. The orientation session emphasized the integration of cognitive load theory, CTMI principles (Mayer & Fiorella, 2014; Sweller et al., 2011), Explain Everything™ tutorial, and iPad instruction. Faculty orientation was supplemented with additional "just-in-time" and scheduled mentoring both in-person and online. For example, ATSI staff and the FIR conducted in-class observations, provided technical assistance, answered questions, created training videos, and provided online resources available through the University learning management system.

In the classrooms, screen mirroring technology (AirServer Connect™) was utilized to screencast teaching resources from the handheld tablet onto a screen. The interactive whiteboard application (Explain Everything™) permitted faculty to synchronously record narration, handwritten annotations, illustrations, animations, and written text. Because the tablet was untethered, faculty could "hand off" the tablet to students, affording opportunities for students to contribute annotations, illustrations, and additional educational resources during live lecture. All learning resources used during live lecture were recorded on the interactive whiteboard application on the tablet. The ULC project was saved as a digital media asset on the tablet, uploaded to a secure University media website, and embedded in the University learning management system where students accessed the material. Media access was private and only available to students enrolled at the University.

Research Design

An exploratory, qualitative design was used to collect, analyze, and report narrative data. Convenience and snowball sampling procedures were used to recruit participants for focus group interviews. According to Plummer (2017), focus group interviews can encourage people to elaborate on a topic, eliciting a range of experiences, ideas, views, and attitudes from the participants. Focus group interviews were facilitated with an interview protocol, starting with a broad opening question and followed by probing questions (see Figure 1). Semistructured focus group interviews were conducted, audiorecorded, and transcribed verbatim.

Subjects

Following institutional review board approval, potential subjects were recruited via e-mail and asked to participate in a 60-minute focus group. Convenience and snowball sampling strategies were utilized, and recruitment continued until narrative redundancy and content saturation were attained. Study participants

Questions	Field notes/observations:
Broad opening question: Tell me, now that you have participated in a class where the faculty member utilized ULC teaching strategies, how has this teaching modality influenced your learning? **Probing questions** (as needed) Tell me, how do you *feel* about the influence ULC had on your educational experience?	
Broad question: Tell me a story about an ULC educational experience that you felt was *powerful* in terms of supporting your learning. **Probing questions** (as needed) What is the meaning of that *powerful* educational experience? Compare the meaning of this *powerful* educational experience with other educational experiences and share your *feelings* about the similarities and differences.	
Closing question: Is there anything else you would like to tell me about your education and learning experiences related to ULC teaching methods?	

Figure 1. Interview protocol: Untethered Lecture Capture.

signed a research consent form, a confidentiality agreement, and a consent to be audiotaped. The final sample consisted of 23 students at a private, faith-based University in the Northwest region of the United States. Participant ages ranged from 18 to 22 years (average 20 years old). Six participants were male and 17 were female. Participants reported experiencing ULC methods in nursing, chemistry, theology, biology, mechanical engineering, and math courses.

Content Analysis Procedures

The researchers read the transcribed text multiple times, seeking commonalities in language and redundancy in thought. Narrative responses were analyzed using qualitative content analysis (Elo & Kyngas, 2007; Lambert & Lambert, 2012; Sandelowski, 2010). Throughout the content analysis process, text segments from the data were classified as belonging to specific codes. A code book (Fonteyn, 2008; MacQueen, McLellan, Kay, & Milstein, 1998) was utilized throughout the iterative content analysis process to enhance reliability among the findings. Researchers collapsed codes into categories that shared general meanings. Researchers frequently returned to the data, checking text segments against category definitions, compared codes and categories, discussed variations, and arrived at final agreement.

Findings

Three central categories emerged from the narrative data. Categories and corresponding text data will be presented.

ULC: Accessibility and Affordances

The most prevalent narrative emerging from the text data revealed evidence about ULC and learning. Every study participant verbalized the affordances that ULC creates. The most notable affordances were accessibility to audiovisual lecture recordings and the option to "play back" these LC media assets. LC provided the ability for all students to "go deeper" into lecture content and to enhance class notes and course comprehension through self-paced, personalized learning. The ability to review and rehearse on demand was seen as especially critical for students who have learning accommodations. According to this student, "the lecture capture was super super good because when I was in class, I wasn't stressed about writing all the notes. I could listen and know that I could go back. I could process at my own pace." Another student said,

> I liked it because it allowed me, as a student, to take my learning into my own hands. I have different learning needs because of [accommodation plan]. This equalized the learning field. Because of ULC, everyone has the same opportunity, so it is like equality for all learners.

Another student stated,

> Everyone is different, has different learning needs. It [ULC] is nice for me, sometimes I feel at a disadvantage. But I know that I have that resource that I can go back to, so I feel like I am equal with my friend over here who learns and processes differently.

These participant experiences highlight the impact of ULC and the affordances offered for diverse student populations who present with varied and unique learning styles. These findings also highlight ULC as a mechanism supporting universal design, that is, ULC methods minimize barriers and maximize student learning.

All students can personalize how they study for a course because ULC media assets are digitally available on the course learning management system. Thus, students may go back to review and rehearse as needed.

> You could look through them [ULC media assets] and see the parts that were missing in your notes and where you didn't understand as much as you thought you did, so you could go back and check and relearn by yourself.

Another student said,

> It [ULC] was also good for me to *own* my learning and save time. I wouldn't have to schedule office hours and walk over there and then discuss it and then possibly forget it. I could just pull it up and listen to it and get my questions answered almost immediately, which is really nice.

This student commented,

> I think a big part was being able to go back to things when I needed it, like especially for me, when I was studying for exams. It was good to go back to where I didn't remember so much, and just to even go back to that 1 or 2 minutes and make sure that I understood that part.

Additionally, for students with approved accommodations for a "note taker," ULC affords opportunities to reduce anxiety associated with incomplete or even inaccurate notes.

> I had the option to go back to the video and go over it. That really impacted learning because in a normal class, where you don't have lecture capture recording or any kind of recording, you might miss a whole section. So, unless you have a classmate's notes, you just kind of miss some parts of lecture and that can really impact learning.

These findings illustrate the following benefits of LC: (a) personalized and self-paced learning, (b) to fill in gaps in classroom notes, (c) to strengthen course comprehension, (d) to study for examinations, (e) to promote learning efficiencies, and (f) to support an internal local of control over one's learning.

In addition to the aforementioned advantages, the LC portion of ULC was specifically described as reducing note-taking anxiety and therefore enhancing focus and attention during live lecture. "One thing I benefitted from in class was I wouldn't stress as much about getting it all down. I could concentrate on what they [faculty] said because I knew I could go back to the lecture capture and get it from there." Another student said,

> I would put an asterisk in my notes and stop writing things down. That way, I could listen and watch and follow along in class. That gave me less urgency to write everything down and, it was like I was paying more attention.

This student commented,

> I feel like when you are always concentrating on taking notes, you are always thinking about the words they [faculty] were saying and you are always juggling

> them in your head and it almost becomes like a word vomit. I didn't know what it all meant, it was just a bunch of words I wrote down. Versus now, I sit and listen and actually understand what they [faculty] are saying within the context. Like, letting it all sink in.

When reviewed as a whole, these student experiences suggest LC reduces extraneous load. Specifically, the combination of note-taking anxiety coupled with the formidable task of writing down words creates extraneous cognitive load, inhibiting student ability to develop appropriate mental models, congruent schemata, and to comprehend course content. As described by Sweller et al. (2011), such extraneous load should be minimized while also managing intrinsic load with the goal of enhancing germane load and, thus, learning. Findings from this ULC research suggest that intrinsic load is managed and germane learning enhanced when ULC methods are utilized. Specifically, LC creates affordances that support learning by facilitating accessibility to LC media assets. Access to LC media assets are perceived as creating opportunities for efficient and self-paced personalized learning that equalize opportunities for success, minimize note-taking anxiety, and improve in-class focus. Time-on-task and enhanced focus were further supported by untethered faculty who were freely mobile in the classroom.

Untethered and on Our Turf

By teaching untethered, an instructor can enhance student–faculty collaboration and strengthen student–faculty relationships. The consistent narrative was, "faculty were on our turf, they weren't talking at us, they were teaching with us." This student stated, "there is some interesting component, faculty weren't just stuck at the front of the classroom, it felt more interactive and more personal." From another student's lived-experience, "In classes where they aren't untethered, they are just standing there and I am just staring at them and you start zoning out because they are just talking at you." Another student stated, "I felt more connected because they [faculty] were moving around, I felt like they noticed me and that I was there." According to this student, "so they were teaching among us, it is a very open, fluid, collaborative and comfortable environment." These narratives provide insights about the capacity for ULC methods to enhance classroom milieu and address college students' desire for collaborative and active learning environments. In addition to strengthening student faculty interaction and learning environments, narrative data also revealed how ULC teaching methods enhanced student accountability and focus during lecture.

Focus group participants reported that untethered faculty moved freely throughout the classroom. Such mobility was perceived as enhancing focus and attention while also promoting time-on-task. "It keeps you off Facebook,

for sure! You have this faculty walking around and you feel more accountable." Another student stated, "I felt more accountable because they were moving around, so I couldn't just goof off. Because they are so close to you, you can't slack off." According to this student, "it was helpful in math. She was walking around and asking questions and sort of keeping everyone focused on the subject at hand. I felt like walking around definitely helped me to stay awake." The capacity of untethered faculty to enhance focus was further identified in text data such as this student's comment,

> I liked how they could pass it [tablet] off to students and we could fill out information and everyone could see it, versus having people come up to the board. You didn't know if or when you might be asked to fill out the information, so, yeah, it just kind of keeps us on our toes.

Finally, this exemplar text statement was persistent within the accountability and focus narrative:

> you [student] are more engaged while in class, so you don't have to think as hard when you go back to study because you were more focused in class and it clicks. Compared with classes when you are zoning out, then you have to try to learn it all again independently when you are outside of class.

The narrative text data consistently validated strengths associated with untethered teachers. Specifically, untethered teachers were perceived as being freely mobile in the classroom and this mobility created learning environments that were interactive, collaborative, engaging, personable, conversational, and inviting. In addition, whether intentionally or unintentionally, untethered faculty were perceived as *watching* student behavior during class. According to the narratives, faculty mobility and proximity to students encouraged in-class focus, time on task, and accountability. Collectively, these findings suggest ULC teaching strategies could enhance learning and knowledge retention while also promoting student–faculty collaboration.

Multimedia Instruction Principles

Text data provided evidence revealing how faculty integrated CTMI principles within ULC teaching methods. According to Mayer and Fiorella (2014), student understanding and retention can be improved when multimedia instruction principles are utilized. Study participants described classroom experiences perceived as promoting knowledge construction and retention. While participants did not specifically identify or name multimedia instruction principles, the narratives align with Mayer and Fiorella's definitions for both *temporal* and *spatial* contiguity. For example, a student said, "I was like, wow, I have never had this

happen before. It [ULC] combined personalized drawings and explanations right there with the content on the slides. I felt it was more efficient." Another student said,

> In my other classes, when they [faculty] write things on the board, it is just reiterating what is already on the PowerPoint, but when they [faculty] are writing on the PowerPoint using the tablet, it goes deeper, you get more depth to the topic.

According to another student,

> there is something about having all three methods combined into one, like their voice, the pictures and their drawings. I don't know quite what it is that makes it so fantastic – there are pictures, recording and writing – somehow, having them all together works really well.

Another student stated, "It [ULC] incorporates everyone's learning style. Faculty are not up there just talking or just showing pictures, it is like they combine things together – that is really important." These text segments align with the principle of *spatial* contiguity, that is, people learn better when text is presented next to corresponding pictures rather than far apart from each other. The text segments also align with the principle of *temporal* contiguity, that is, people learn better when narrations simultaneously correspond with illustrations. In addition to the aforementioned principles, narrative data also revealed experiences associated with the CTMI *signaling* principle.

The *signaling* principle promotes learning by highlighting and drawing attention to essential features within learning resources. *Signaling* principle examples included the use of color to highlight words and diagram elements as well as using digital pointers and zoom functions to focus attention on specific processes. Faculty use of *signaling* was identified within the data. This student stated,

> in chemistry, we have a lot of things going, we have a bunch of stuff on one slide. With the technology, we can zoom in on things, use different colors for different things, he [faculty] can separate things, so it helps to organize information better.

Within the same context, a student (biology major) said, "she [faculty] could use different colors. I noticed that when we learned transcription and translation, she used different colors and that made things a lot easier." Finally, this student said,

> with tethered professors, they have prepped PowerPoint and they just kind of point at the screen. But, the untethered professor, they can draw on it [Explain Everything™ whiteboard app on tablet] with different colors and do everything live with their voice, pointing out things. That feels more important.

While the preponderance of text data identified positive aspects of signaling, the text data also identified student experiences associated with excessive signaling that detracted from the learning experience. "Sometimes, she [faculty] would underline certain things, but it didn't feel like it added anything to what we were learning." Another student commented, "just underlining words does not add. If they are just going to read words on the slide and underline them as they read them, then that is distracting." The key message emerging from the narratives identified *signaling* as a helpful teaching strategy while also indicating a need for judicious use. As noted by this student, "basically, they should use it [*signaling*] with a purpose."

Discussion, Limitations, and Conclusion

This research contributes to the existing body of knowledge, providing evidence to guide effective integration of technology within teaching strategies. Foremost, ULC methods have the capacity to enhance access to learning resources for all students while offering additional affordances that may be especially beneficial for students with learning accommodations. Participants described ULC as a strategy that enhances the classroom environment, supports equal academic achievement opportunities among diverse student populations, and is perceived to positively influence learning outcomes. Untethered teaching was described as promoting student–faculty interactions and collaborative learning environments in which students experience increased focus, time on task, and accountability. Finally, while participants did not explicitly mention instructional principles, the narrative data provided evidence indicating positive learning experiences connected with the integration of CTMI principles. A higher view of the findings suggests that learning and retention are augmented through a combination of untethered teaching, CTMI principles, and access to LC digital media assets.

An important supposition emerging from the findings is that knowledge construction and thus, learning, will be enhanced when ULC methods are implemented in classrooms. According to Brookfield (2015), learning is enhanced when college students actively participate in knowledge construction. Findings from this research suggest ULC methods with CTMI integration are perceived to actively engage students in the coconstruction of knowledge both inside and outside classrooms. Certainly, students who report increased accountability, focus, time-on-task, enhanced classroom collaboration, improved access to learning resources, self-paced learning efficiencies, and decreased note-taking anxiety may well exhibit an increased proclivity toward active involvement in learning.

All study participants were enrolled in courses at a private, faith-based University with small classroom sizes; for example, 25 to 40 students per class. As such, findings may not resonate with faculty who teach classes with higher student enrollments. Specifically, we imagine that auditorium seating

classrooms could inhibit untethered teaching, and thus, ULC benefits would be constrained. Despite these limitations, the findings support recommendations for educators and for future research.

First, educators are encouraged to collaborate with academic support staff, including instructional design experts and information technology personnel to implement untethered teaching and LC technology within classrooms. These support staff and experts are essential for ensuring appropriate technology infrastructure and ongoing support. In addition to such collaboration, faculty members should intentionally strive to integrate CTMI principles and cognitive load theory when implementing ULC methods. As noted in the findings, using technology without integrating instructional principles may result in teaching behaviors that detract from learning. Thus, we recommend revising teaching resources such as lecture resources, slides, and handouts so these resources align with CTMI best practices.

A second recommendation for educators is to leverage educational technology in a manner that actively involves students during class. For example, participants talked about the ability to contribute to LC by writing on the tablet. While only one exemplar statement was provided in the findings section, the preponderance of data revealed that students preferred to write on the tablet via the whiteboard application versus writing on the chalkboard or whiteboard. As a point of discussion, students like to be involved and yet fear making mistakes in front of learning peers. The tablet offers a mechanism for students to actively participate without having to do so in front of the class. Such activities may be accomplished in a variety of ways using the Explain Everything™ whiteboard application. For example, faculty could invite all students to form small workgroups and begin working on a case study or worksheet. After students form small workgroups, faculty would invite a specific workgroup to write their contributions on the tablet. In this way, students contribute and yet they are not visibly standing up at a chalkboard or whiteboard in front of peers. A second option offered by Explain Everything™ is the "collaborate" feature. This feature invites students to "join" the faculty member's Explain Everything™ project. This option requires students to have the whiteboard application on their personal digital device. Faculty send students a "join" code, and then students may contribute words, drawings, pictures, and videos within the LC media asset. Faculty are encouraged to explore Explain Everything™ tutorials, available on the internet, to learn more about the variety of whiteboard applications that may be used to support ULC methods.

Extending beyond teaching recommendations, a priority recommendation for future research is to conduct studies that measure learning outcomes among students who are taught via ULC methods compared with students who learn in classrooms where faculty are tethered, and LC is not provided. Such research will guide future teaching recommendations and provide evidence to support additional learning technology innovations. A second recommendation is to

study student experiences in classrooms where specific aspects of ULC are implemented. For example, what student experiences emerge when faculty are untethered and freely mobile but LC is not provided? Conversely, what student experiences emerge when faculty only provide LC and remain tethered to classroom computers, whiteboards, chalkboards, and screens? Such research would provide clarity and depth about the specific benefits of each respective ULC aspect.

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References

Barnett, B. (2014). *Five ways to untether the classroom*. Retrieved from http://doceri.com/blog/5-ways-to-untether-your-classroom/

Brookfield, S. (2015). *The skillfull teacher: On technique, trust, and responsiveness in the classroom*. San Francisco, CA: Jossey-Bass.

Coffey, C. (2015, February 24). *Teaching untethered: Wireless technology in the classroom presentation*. Retrieved from https://miscellaneousme.wordpress.com/2015/02/24/teaching-untethered-wireless-technology-in-the-classroom-presentation/

Elo, S., & Kyngas, H. (2007). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. doi:10.1111/j.1365-2648.2007.04569.x

Fonteyn, M. E. (2008). Developing a codebook to guide content analysis of expressive writing transcripts. *Applied Nursing Research*, *21*(3), 165–168.

Freed, P., Bertram, J., & McLaughlin, D. (2014). Using lecture capture: A qualitative study of nursing faculty's experience. *Nurse Education Today*, *34*, 598–602.

Groen, J., Quigley, B., & Herry, Y. (2016). Examining the use of lecture capture technology: Implications for teaching and learning. *The Canadian Journal for Scholarship of Teaching and Learning*, *7*(1), 8.

Lambert, V., & Lambert, C. (2012). Descriptive qualitative research: An acceptable design. *Pacific Rim International Journal of Nursing Research*, *16*(4), 255–256.

Lumkes, J. (2010). Survey of three different methods of delivering engineering content in lectures. *Journal of Educational Technology Systems*, *38*(3), 349–366.

MacQueen, K., McLellan, E., Kay, K., & Milstein, B. (1998). Codebook development for team-based qualitative analysis. *Cultural Anthropology Methods*, *10*(2), 31–36.

Marchand, J. P., Pearson, M., & Albon, S. (2014). Student and faculty member perspectives on lecture capture in pharmacy education. *American Journal of Pharmaceutical Education*, *78*(4), 74.

Mayer, R. (2008). Applying the science of learning: Evidence-based principles for the design of multimedia instruction. *American Psychologist*, *63*(8), 760–769. doi:10.1037/0003-066X.63.8.769

Mayer, R., & Fiorella, L. (2014). Principles for reducing extraneous processing in multimedia learning: Coherence, signaling, redundancy, spatial contiguity and temporal contiguity principles. In R. Mayer (Ed.), *The Cambridge handbook of multimedia learning* (pp. 279–315). New York, NY: Cambridge University Press.

Nashash, H., & Gunn, C. (2013). Lecture capture in engineering classes: Bridging gaps and enhancing learning. *Journal of Educational Technology & Society*, *16*(1), 69–78.

Park, B., Moreno, R., Seufert, T., & Brunken, R. (2011). Does cognitive load moderate the seductive details effect? A multimedia study. *Computers in Human Behavior*, *27*, 5–10.

Plummer, P. (2017). Focus group methodology. Part 1: Design considerations. *International Journal of Therapy & Rehabilitation*, *24*(7), 297–301. doi:10.12968/ijtr.2017.24.7.297

Porter, I., Frizelle, S., & Brokhaus, A. (2014, February 7). *Building the architecture of classroom teaching: Lessons from an "untethered teaching" pilot project*. Retrieved from https://events.educause.edu/educause-connect/2014/portland/proceedings/building-the-architecture-of-classroom-teaching-lessons-from-an-untethered-teaching-pilot-project

Reiff, L. M. (2012). Untethered teaching: Using Apple TV in the classroom. Retrieved from http://wirededucator.com/untethered-teachers-using-appletv-in-the-classroom/

Sandelowski, M. (2010). What's in a name? Qualitative description revisited. *Research in Nursing & Health*, *33*, 77–84. doi:10.1002/nur.20362

Sweller, J., Ayres, P., & Kalyga, S. (2011). *Cognitive load theory*. New York, NY: Springer.

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