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GRAND CHALLENGE No. 3: DIGITAL ARCHAEOLOGY Technology-Enabled Learning in Archaeology

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Abstract

Archaeology is traditionally a hands-on, in-person discipline when it comes to formal and informal instruction; however, more and more we are seeing the application of blended and online instruction and outreach implemented within our discipline. To this point, much of the movement in this direction has been related to a greater administrative emphasis on filling university classrooms, as well as the increasing importance of public outreach and engagement when it comes to presenting our research. More recently, we have all had to adjust our activities and interactions in reaction to physical distancing requirements during a pandemic. Whether in a physical classroom or online, archaeologists must learn to properly leverage digital technology in order to create enthusiastic, engaging, respectful, and accessible (from-place and in-place) learning environments. This article brings together scholars who are learning to do just that. We apply a usable and easily navigated framework for archaeologists to consider while in either formal or informal educational environments and provide examples of how digital technologies can be applied to satisfy the three "presences"—social/emotional, teaching, and cognitive—required for a successful "community of inquiry" experience in archaeology. Examples are drawn from our personal experiences in North America, Central America, and Europe.

Introduction

> When I see the power that technology gives us in terms of the new ways of collaborating and sharing, and the quality of the resources that people are sharing, I think it's just changing everything (Tinney 2013:22).

The adoption of technology within archaeological learning environments has long been key to creating enthusiastic, engaging, and accessible educational experiences. Typically, such adoption has focused on print and visual technologies within the traditional classroom/lecture setting (Russell 2000), including slide and overhead projectors; color-image textbooks; films; and digital presentations (e.g., PowerPoint, Keynote, Prezi). Such visual technologies have been particularly critical for archaeology in that they allow us to better guide learners through the contextual data of an archaeological excavation and the immense landscapes that we are attempting to understand. More recently, sharable PDFs via learning management systems (e.g., Moodle, Blackboard, D2L) have also become the norm.

Increasingly in North America and Europe, archaeological educators are being pushed out of traditional "bricks-and-mortar" classrooms toward more blended and online forms of teaching and outreach. In general, this shift is occurring for reasons as diverse as institutional administrative decisions (i.e., increasing student numbers); cultural, societal, or environmental requirements for physical distancing; democratizing and/or decolonizing learning environments through "open education," "open archaeology," and massive open online courses or MOOCs;[1] and the professional-ethical obligations of outreach to, and inclusion of, non-traditional learners and publics[2] (Alcock et al. 2016; Atalay 2012; Lake 2012). Often this push beyond the traditional classroom setting (with the exception of laboratory and field environments) is perceived as being of lesser quality, and may even be viewed as just one more step along the slippery slope of declining standards among many post-secondary archaeology educators; the most vocal of whom are often those with no practical experience upon which to base their opinions—a common occurrence in most disciplines that are in the process of actively adopting new technologies (Hargreaves 2005; Kolowich 2012).

While we would never advocate for the adoption of new techniques or technologies for their own sake—sound pedagogy and student-oriented decision making should always take precedence—we would urge those faced with the option or need to engage in blended/online teaching to consider that the conditions under which such materials and approaches are developed, as well as the familiarity of the developer with the opportunities and limitations of such delivery, will impact its efficacy. Indeed, while the technology itself is important, the skills, knowledge, strengths, and weaknesses of the educator may be the most important factors in determining the success or failure of blended/online approaches. There is no one-size-fits-all solution here. For better or worse, institutional and legislative reactions to the COVID-19 pandemic have been driving movement in the direction of blended/online delivery to an extent that few would have imagined back in January 2020. While some educators have been able to quickly and effectively adapt to the new conditions, as is always the case, successful pedagogy requires knowledge, planning, and flexibility beyond what most educators are capable when unexpectedly pressed to react to emergency measures. When there is enough time to take a breath and plan, we hope that archaeological educators will find this article helpful.

Creating quality experiences through technology-enabled learning or TEL[3] in archaeology—typically approached as a hands-on discipline—can be challenging, especially when striving for enthusiastic, engaging, and accessible encounters in non-traditional learning environments (i.e., beyond bricks-and-mortar institutions; Politis 2008). Training for the proper development and application of TEL forms of instruction and outreach is often lacking or not properly encouraged/rewarded by home institutions (i.e., tenure and promotion). Planning for the responsible use of digital technology in the classroom, and digital literacy in general in archaeology,[4] requires a close consideration

of how such technology can be applied (i.e., the specifics of particular media) and why it should be applied (i.e., purpose[s]), taking care to avoid the adoption of digital technology simply for 'flash' value (Clarke 2004).

Many teachers/educational institutions view online learning and TEL as a straightforward re-creation of a traditional lecture within a virtual setting, such as through the use of lecture-capture technology. Unfortunately, simply recording a standard one-hour classroom lecture, typical of most post-secondary-level culture area and theory courses in archaeology, may not translate well for online delivery (Scagnoli et al. 2017; Smithers 2011); at worst, they promote a passive learning experience that does not engage the learner, and at best they provide a temporary content delivery system devoid of the critical presences required for effective learning environments (see below). Additionally, attempting to bring the hands-on elements of archaeology into more diverse learning environments presents a unique challenge, including issues of funding and imagination.

In this article, we advocate for the use of the Community of Inquiry (CoI) framework for responsible application of TEL in archaeology, and provide examples of different digital technologies, media, and platforms successfully employed by us, the authors, or with which we are currently experimenting, as well as highlighting successful cases from colleagues. The result is an adaptable pedagogical framework, with examples of TEL ranging from web-based media to virtual/augmented reality elements, couched within the required presences of any successful learning environment, and guidelines for their responsible use. When applied properly, TEL can successfully achieve both learning in place and from place (Griffiths et al. 2015).[5] This is particularly important in archaeology, where people learn best about the past when it is made relevant to where they are, where they have been, or where they are going. Although our examples are based in archaeological learning experiences, the framework we advocate can be—and has been—applied to other disciplines. This article is specifically aimed at teachers who are new to TEL in archaeology and is meant to be a 'soft' introduction to the concept.

The Community of Inquiry Framework

With the advent of social media applications, the potential for collaborative learning activities beyond the traditional classroom setting has skyrocketed (Vaughan et al. 2013). The Community of Inquiry (CoI) framework[6] developed from contemporary philosophical thought on knowledge creation and scientific inquiry, and was originally outlined to help foster groups of individuals who participate in purposeful, collaborative critical discourse, and who engage in reflection together to construct personal meaning and achieve mutual understanding (Dewey 1938, 1954; Garrison 2017; Hickman and Alexander 1998; Peirce 2009). Dewey (2009) argued that education should not be

overly didactic in form, in that the idea was not simply to impart information for students to passively absorb (the classic 'sage-on-the-stage' model); rather, proper education should aim to foster imaginative responses to new information and situations by engaging students in active, cooperative practices of learning. This idea was adapted for use in computer-mediated communication in higher education (Garrison et al. 2000), including blended and distance/online/digital learning (Swan et al. 2009), resulting in the CoI framework.

Within CoI, knowledge and its creation are embedded within social context—as is the case with storytelling and storywork (see Peuramaki-Brown, Supernant, and Kristensen et al., this issue). As a result, it fits wonderfully within archaeology—both in terms of teaching/outreach and research—which, when at its best, is a heavily team-based, multivocal, and transdisciplinary pursuit. The use of CoI allows for the creation of a deep and meaningful (collaborative-constructivist) learning experience through the development of three interdependent elements: social and emotional presence, teaching presence, and cognitive presence (Figure 1).

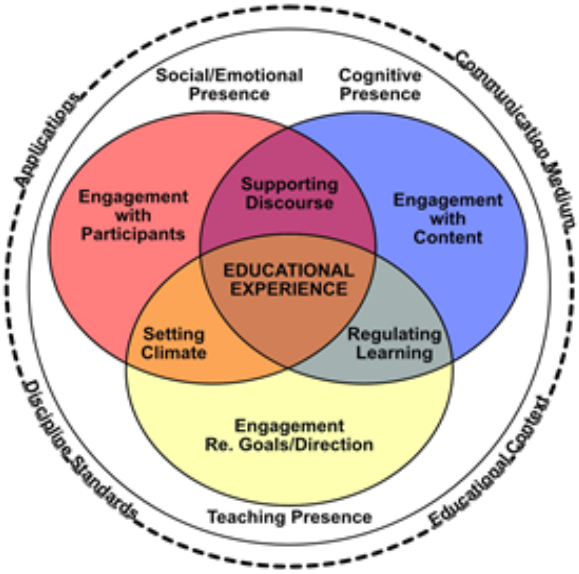

Figure 1. Graphic demonstrating the inter-relationship of presences within the Community of Inquiry framework (redrawn and adapted from Garrison et al. 2000).

The *social and emotional presence* includes the ability of all participants in a given learning experience to project themselves socially and emotionally as 'real' people, and to demonstrate emotional intelligence (also an important element of teaching presence; see Majeski et al. 2018) through the medium of communication being used (Rourke et al. 2001). In the traditional archaeology classroom, lab, or field setting, this refers to the physical and expressive presence of students and teacher. The teaching presence includes the design, facilitation, and direction of learning (e.g., cognitive and social) processes for the purpose of realizing educationally worthwhile learning outcomes that are personally meaningful—i.e., pedagogy (Anderson et al. 2001). Finally, the cognitive presence relates to the extent to which learners[7] are able to construct and confirm meaning through sustained reflection and discourse (Garrison et al. 2001). This is achieved in traditional archaeological learning environments through discussion groups, collaborative field and lab exercises, etc. All three of these presences are presented in the sections below and are highlighted through the introduction to and discussion of specific archaeology-applied TEL elements.

Social and Emotional Presence

In order to engage any successful learning experience, whether in a formal educational institution or outreach event, teachers must know their community of learners (student body, audience, etc.), and they in turn must know their teacher. In archaeological education, particularly at the beginner undergraduate level and in general public outreach, we must deal with a huge array of learner types, from diverse cultural, socio-economic, and age backgrounds. Providing safe environments where learners and teachers can introduce themselves, their needs, values, and motives, with regard to the course/research content, allows the content (lesson/course, outreach) designer to prepare or adapt an adequately engaging, facilitative, and challenging learning environment (Moshinkski 2001). In archaeology, such an environment is best reflected in visions of an "archaeology of the heart," which "speaks to the whole person—our intellectual, emotional, spiritual, and physical selves" (Lyons and Supernant 2020:1). Therefore, creating spaces where community members of all walks of life can confide in each other, tell about themselves, and learn about each other is key, and sets the climate for learning engagement (i.e., goals and direction).

TEL provides opportunities for both replacing and enhancing the interactions associated with creating social and emotional presence. Those that are easiest to apply are typically associated with enhancing such presences, where it is created and maintained both through traditional face-to-face contact and through new opportunities for virtual presences. Social media technologies remain the most popular digital technologies/platforms to help create social/emotional presence. Although we are introducing this under the social/emotional presence category, it actually spans all three of the CoI presences. In fact, all technologies that we discuss in this article can fit under all three presences, depending on how they are applied.

Web 3.0: social media and archaeology

Understanding the distinctions between Web 1.0, 2.0, and 3.0 is a necessary place to start when selecting appropriate technologies for social/emotional presence, and the most basic lesson for any TEL designer (Table 1). Dale Dougherty, Vice President at O'Reilly Media, is credited with coining the term "Web 2.0" in 2003, which became popular in 2004 (O'Reilly Media Inc. 2017). It defined the transition of internet usage from static media to user-driven, interactive platforms. This marketing term, and its successor, Web 3.0, were designed to generate buzz over changes in technologies and their applications. While there is some debate over the precise definition of Web 3.0, it involves the Internet of Things, open access, expansive social engagement, and other elements that require extensive and rapid data processing. Applying Web 3.0 is particularly useful for participant visibility and engagement, as it affords the opportunity to have both teachers and learners create profiles that emphasize their interests in

content—as if sitting in a circle introducing oneself—whether as a basic text profile on a learning platform or a visual cue, such as a photo or video (Lowenthal and Dunlap 2010). This is social media at its most basic.

Table 1. Comparative features of Web 1.0, 2.0, and 3.0.

Type	Distinguishing features	Examples
Web 1.0	Static content, no input	Basic archaeology project website: http://scraparchaeology.com/
Web 2.0	Interactive content	Blogs with comment section: http://elfshotgallery.blogspot.com/
Web 3.0	Expansive, user-generated content	Social media: *Ancient Mesoamerica* Facebook Public Group

By allowing for both individual expression and individual identity, social media is not only a tool for communication, but also for democratized representation in the learning environment (Perry and Beale 2015). Platforms and web applications that allow and encourage both self-expression and group discussion are key. One of the most basic ways to create a safe digital environment for social/emotional presence is through the provision of a learning portal, such as a Learning Management System (e.g., Moodle, Blackboard) or a closed group on a social media platform; these are often powerful platforms that rarely see all their capabilities employed by most users (Costa et al. 2012). For online courses, it has proven to be good practice to have teacher and students prepare something as simple as an introductory profile (who they are, educational background, interests, etc.) and include a photo/video/audio clip if desired; this allows for the teacher to anticipate their students' knowledge levels, learning experiences, and possible learning styles, and also more widely, to connect more personally with the teaching staff and fellow students. We recognize, however, that the effective use of such portals/platforms is highly dependent on class size. Additional activities to encourage self-expression and democratized learning may include building "selfies" of students visiting archaeological sites into assignments and discussion groups—a demonstrated way to stimulate the conversation necessary for creating a social presence (Johnson et al. 2014). Morton has used this as an effective extra credit opportunity in his introductory archaeology courses, encouraging articulation with course material outside those responsibilities/assessments that form the bulk of the class, while Peuramaki-Brown has extended this opportunity to the growing number of virtual sites/museums accessible online[8] and discussed below.

Web 3.0 applications have distinct advantages over traditional face-to-face classroom/outreach experiences, principally in that they seem to encourage the participation of voices that are unlikely to be heard in offline contexts due to factors such as social anxiety, cultural norms of expression (particularly within the power

dynamics of a classroom setting), geographic isolation, and socio-economic exclusion. While the negative aspects of this phenomenon are apparent (e.g., trolling), the positive potential cannot be denied; for instance, the empowerment of often sidelined Indigenous communities in far-off areas, such as in Seitsonen's (2017) experience in Finnish Lapland in northernmost Europe (discussed below). Several of the authors have also constructed closed and open groups on Facebook for their courses and areas of interest, encouraging learners and colleagues to post relevant experiences as well as material from around the web, and to engage in discussions based on such materials; for example, the Ancient Mesoamerica Facebook Group (created and moderated by Morton and Peuramaki-Brown) collects together more than 5,000 members interested in the archaeology of Mesoamerica, and has proven a dynamic and effective way of stimulating group discussions, sharing resources, and advertising for books and events. It goes without saying that many archaeological research projects maintain similar pages as a way of broadcasting their activities to an interested audience and soliciting feedback via opinion polls or general comments.

For public outreach, social media presence has proven to be highly successful and important in the modern media setting. This can prove fruitful when promoting presence and communicating research for a wide-range of the public, including journalists and media and research professionals (see article by Kristensen et al., this issue). Having social media presence across multiple platforms (both public ones such as Facebook, Twitter, and Instagram, but also professionally oriented ones like Academia.edu or ResearchGate) is often time consuming and necessitates a degree of insider knowledge of how the different platforms work to allow their useful utilization, to avoid contributing to the "Digital Dark Age" problem in archaeology (Jeffrey 2012), and to avoid the pitfall of 'screaming into the void' of digital space. The recent ability to connect platforms—for example, through an Instagram account you can connect to both a Facebook page and Twitter feed—means that some of the time-consuming elements of engaging across multiple platforms are removed, provided you wish to share the same material in each. Taking time to learn about the various platforms (numerous, free online tutorials are available), including their advantages and pitfalls, as well as the best times to share and what to share on each, is strongly recommended to any archaeology educator and should consider audiences, not only in terms of identities but locations around the globe; for example, although Facebook is falling out of favor among younger users in North America, in countries like Belize it remains extremely popular for people of all ages, including those in small villages with only basic smart phones to connect them to the wider digital world.

Other obstacles to effective communication and dissemination on social media are the content-weighting algorithms commonly used by Facebook, Twitter, and Instagram to populate user feeds with high-profile content. Individual privacy settings also present barriers to collaborative potential. Facebook is by far the least

user-expansive regarding privacy settings; collaborative potential on this platform is limited to topic-specific groups/pages or friend networks. Twitter, by contrast, is much more expansive if a user account is not set to "Private." With these dynamics in mind, archaeologists as content creators have greater opportunities to connect directly with colleagues and collaborators than they do with students and the public. While a savvy project member or director may be effective in this task, its most powerful implementation is in the hands of a dedicated social media officer who takes care of, for instance, public outreach, social media presence, and potentially also the traditional media coordination for a project (current attempts to allocate grant funds for such a position are routinely met with either great enthusiasm or great skepticism).

Twitter presents us with a particular case study for how social media can be used in educational contexts. The overwhelming popularity and growth of Twitter may be explained by its immediacy and simplicity. One need only visit the site's landing page to be greeted with the message "See what's happening in the world right now," and then all that is required is a valid email address to set up an account. Once on the network, users are free to share short messages—"Tweets" of up to 280 characters—which may include photos, videos, and web links. Additionally, users can include usernames in Tweets so as to address each other publicly, drive conversations, or even simply to attract attention to their Tweets by adding thematic #hashtags. Users can subscribe to others' Tweets by "Following" those accounts, "Like" others' Tweets, and communicate privately among themselves through Direct Messaging (DM). Finally, users can also Live-Tweet, which is to say, provide commentary or updates in real time on current events as they progress (note, this can also be done via video through Facetime Live and Instagram Live).

Many Twitter feeds (and linked Facebook and Instagram accounts) engage explicitly with the subject of archaeology, and are maintained by magazines and journals (e.g., @archaeologymag, @CurrentArchaeo, @populararch; @WorldArchaeo), websites (e.g., @archchannel, @HE_Archaeology), professional organizations (e.g., @SAAorg, @archaeology_aia, @AustArchaeology, @can_arch), archaeological projects (e.g., @catalhoyuk_arch, @DarkLapland), university departments (e.g., @AnthroNAU, @UoYArchaeology, @UCLarchaeology), and individual archaeologists (e.g., @DSAArchaeology, @ajtzib, @rajoyceUCB). These represent an opportunity for teachers, students, and the general public to access archaeologists and archaeological findings to a greater extent than ever before. Systematic research into the educational utility (and validity) of Twitter has been conducted as far back as 2007 (Bista 2015; Tang and Hew 2017), suggesting that early adopters were experimenting with Twitter in the classroom fairly quickly after the social network's inception in 2006. So far, the ultimate educational value of Twitter as an actual teaching tool remains to be evaluated, though its ability to create social and emotional presence is undeniable.

One example of social media employing expansive user/audience presence and engagement to produce a digital place of learning is the Public Archaeology Twitter Conference (PATC).[9] The goal of PATC is to democratize academic conferences by eliminating registration fees, travel costs, and other barriers to participation that traditional conferences often present. The 2017 PATC featured 26 presentations and discussions, all hosted on Twitter over the course of one day. In this case, users converge on a specific hashtag (#PATC) with the expectation of generating responses, retweets, and other forms of engagement. Users searching the #PATC hashtag can filter results to eliminate retweets, even removing replies, to see the thread of conference presentation posts. Another example being applied to archaeology is the #ArchWriMo (Archaeology Writers' Month) hashtag: a discipline-specific spinoff of the #AcWriMo (Academic Writers' Month) tag. #ArchWriMo is an annual gathering of users on Twitter to share ideas and references about academic writing in archaeology. More than anything, the hashtag serves as a means of building individual accountability by publicly signaling intent and goals. These models are readily applicable to classrooms. Hashtags and regularly occurring user engagement overcome challenges like content-filtering algorithms and allow for multivocality on a given subject (discussed below under cognitive presence). Additionally, the content created by these forms of collaborative engagements are searchable by the public and serve as a historical document for future reference.

As a vast, democratized communications network, Twitter's capacity to enhance the social presence of both learners and educators is much clearer. Educators can set up course-dedicated Twitter pages with official course hashtags that can be used to keep students up-to-date on assignments, exams, etc. (Tang and Hew 2017). Within these course pages, students and educators can collaborate publicly within the group—or privately amongst themselves via DM—by sharing questions, insights, and linking to outside resources. Engagement and social/emotional presence might start out haltingly, but will grow organically as the exchange progresses, as it would in a normal face-to-face setting (Bista 2015). Educators can schedule question-and-answer sessions as 'live' events, and learners and educators can collaborate to arrange panel discussions of the materials via live elements and using thematic hashtags. In this way, mini or even full-scale conferences have been successfully presented entirely online (Avery-Gomm et al. 2016). Given that there is as yet no capacity within Twitter to set up closed or private groups (one reason many prefer Facebook and institution-specific learning/sharing platforms), codes of conduct for respectful discourse on these pages should be well established from the outset. It is worth noting, since archaeology frequently deals with subjects of ethnicity, gender, and politics, that some archaeology-related hashtags have been thoroughly co-opted by pseudoscience followers and content creators—the frequent associations between #olmec and #african or #africanamerican[10] come to mind. Care should be taken to avoid this kind of 'Hashtag Hijacking,' and these

hashtags, however relevant to the discussion at hand, should be avoided or used with the recognition that they may well lead to discourse beyond the control or intentions of the teacher.

As we discuss below, social media's efficacy as a teaching tool remains to be proven. A recent study conducted by Manca and Ranieri (2016) concluded that social media engagement in the sciences is most effectively conducted when research material, collaborative opportunities, and events are shared, rather than educational material. This might seem counterintuitive to educators at first glance, but social behaviors centering on social capital, sunk costs, and migration lead to a complex human-technological environment that can be difficult to affect (Ries 2011). It should also be recognized that effective engagement within this environment represents something of a moving target, as new technologies/platforms will open up new doors to generating social and emotional presence, and waning popularity will close others; for example, there is already an emerging #archaeology on TikTok.

Teaching Presence

The second key element in establishing an effective CoI is teaching presence. In order to successfully deploy teaching presence, the teacher requires three sets of knowledge (Mishra and Koehler 2006): content knowledge (archaeology), pedagogical knowledge (how to teach archaeology effectively), and technological knowledge (which tools are most useful, why, and how). While a framework such as the CoI emphasizes the what and why of effective TEL use in archaeology, it is even more powerful if used alongside other frameworks that discuss the how of adopting TEL tools that lead to active, collaborative, constructive, authentic, and goal-directed learning, such as the Technology Integration Matrix[11] (Jonassen et al. 2003).

What any teacher in a hybrid or online setting must acknowledge is that typical verbal communication may be absent, and the amount of non-verbal communication (e.g., body language/action, facial expression, intonation) transmitted is reduced. If this reality is not considered, the fatal mistake that new teachers can make is viewing this new medium through the lens of the old (i.e. the standard bricks-and-mortar classroom setting); thus, they simply attempt to recreate the old context through technologies such as lecture capture, or to apply pedagogical styles not developed for online settings, which prevents them from truly engaging with the new medium (or realizing its full potential).

In the online setting, the function of teaching does not change, but its manifestation is significantly altered, and the thoughtful design of learning activities is critical to the development of meaningful educational experiences. This can be done by using TEL Activity Plans—such as that presented in Appendix A, which deals with introduction to stone tool technology—and considers important questions regarding the

goals and length of any activity (as well as the degree of immediacy), the resources required on the part of both teacher and student (e.g., equipment, internet bandwidth), copyright of educational resources, etc. As much as possible, incorporating elements of reading, writing, watching, listening, feeling/manipulating/applying (a tangible element), and talking/discussing (e.g., with teacher-tutor and/or other students) in each lesson is desired (Beetham 2007; Rodríguez-Álvarez 2017). Additionally, online teachers and content developers must continuously ask what the primary message should be for each lesson, given the diverse student body often attracted to archaeological study and to online activity in general. What is the most important takeaway and how can it be adequately addressed in what are, ideally, a single ≤ 20-minute chunk (small, digestible) or multiple ≤ 20-minute chunks? A good rule of thumb for this is the ROPES communications model: Review of prerequisites, Overview of objectives, interactive Presentation of new material, lesson-related Exercises, and brief Summary (Moshinskie 2001; educators may also be familiar with the similarly constructed BOPPPS).

Additionally, how to make hands-on archaeological lessons available in a virtual setting for anywhere from a single to 100+ students at any given time is a special requirement for online instruction and outreach in our discipline. If it cannot be accomplished through activities that students can conduct in place—wherever they are located and with materials at hand (e.g., the lithic experimentation portion of the lesson in Appendix A)—this can require the additional burden of gaining familiarity with many new and developing technologies. As a result, teachers themselves must act as learners, as many of us have not grown up in an online learning environment. One quick way to learn about how to learn and teach effectively online is through MOOCs offered for almost any specific digital technology as well for teachers at all levels for blended and online instruction.[12]

Tools that lie well within the grasp of the average educator include the aforementioned Learning Management Systems, such as Moodle, which are extremely powerful platforms that incorporate tools that satisfy all three presences but are rarely used to their full potential in traditional educational settings. These systems are especially well suited for technologically oriented coursework, such as Geographical Information Systems (GIS) teaching (common in archaeology) or digital documentation practices. When adopting such activities, it is proven good practice to set times when the teacher is present online to discuss issues with the students (digital office hours), related to both content and technological issues. These forms of online coursework necessitate a greater degree of preparation from the organizer than is the norm for face-to-face teaching, as it is necessary to develop detailed instructions (written or video/audio with imagery to demonstrate) to avoid confusion, starting from installing and setting up the used software(s) to taking into account participants' differing backgrounds and technological skills. On the other hand, this allows students to have detailed and

practical handouts to use as future reference and provides valuable lessons in digital literacy—both on the part of the learner and content generator (teacher).

Today, and in the future, much of the teaching of archaeology focuses on demonstrating to students how to ethically generate and curate archaeological knowledge, and how to enable this archaeological knowledge and associated tools so that students can take these lessons back and apply them within their own communities (Atalay 2012; Silliman 2008). We (the authors) have found that certain technologies greatly enhance this aspect of teaching presence through various educational and outreach experiences (discussed below), which allow us to regulate the learning environment and engage the learner with the content. As when creating a social/emotional presence, the degree to which an educator relies on tools within the realm of TEL can vary. One of the keys to engaging the student in the learning process is to move them from the role of passive recipient to active collaborator. One of the strengths of TEL is, thus, the opportunity it provides for 'flipping the classroom,' whether through activity-based content delivery, problem-based learning, group work/discussion, etc. (the options are nearly endless).

Augmented and virtual archaeology

Digital technologies that exemplify the ability to maintain, enhance, or re-create the 'real' physical elements of the traditional archaeology classroom, lab, or field setting (and indeed, for experiences that go even beyond these), allow for effective and affective teaching. An example of this is through the adoption of augmented reality (AR) and/or virtual reality (VR) learning environments. AR/VR offer multiple potential ways to connect students and wider publics in a more direct, face-to-face engagement with the past (taught content) and the various targets of archaeological inquiries (e.g., Casella and Coelho 2013; Davies et al. 2013; Haugstedt and Krogstie 2012; Seitsonen 2018a:158–159). Virtual models and worlds can be visualized with mobile or fixed devices and can be as simple as 360-degree videos and photos; these allow the observer to engage more fully (including emotionally) with representations of the invisible, such as 'lost' features, faraway landscapes, or other inconspicuous material heritage (Elmenzeny et al. 2018; Gardiner 2019).

AR has been used in heritage education for more than a decade—finding its way onto ancient sites and into museum exhibitions—as a way of merging relatively static environments with dynamic information/display through an interactive interface. This is contrasted with VR, which provides a digitally simulated environment for immersive experiences. In other words, AR enables new forms of storytelling that allows virtual content—including three-dimensional (3D) models, soundscapes, and social media—to be connected in meaningful ways to particular loci, whether those are places, people, or objects. In contrast to virtual reality or web-based interfaces, AR is intended to enhance a physical and social experience, rather than to replace it. AR interfaces have served

to breathe new life into sites such as the Lisbon Aqueduct (Marques et al. 2017) and Olympia in Greece (Vlahakis et al. 2002), among many others. While several such interfaces encourage learners to engage with broader publics through social media, the persistent physical element to AR means that the process of creating a social presence changes little from traditional learning environments, but the content aspect of teaching presence is greatly enhanced.

AR applications and models that add elements to archaeological reality (e.g., a site)—in the same vein as the popular interactive Pokémon GO mobile game (gamification discussed below)—and are presented on site with a mobile device, are especially well suited for creating location-based, explorable heritage experiences, by embedding the observer into the modelled (past) landscapes and allowing some engagement with them. Freely modifiable open source tools for this have been recently developed by Michigan State University (mbira n.d.) and hold high potential for future development. These tools allow for additional interactivity, such as crowdsourcing public knowledge (discussed below) and make it possible to engage and empower the wider public in data creation and curation and sustaining mobile heritage experiences in a democratic manner at scale (Watrall 2018; see http://hauyat.ca/ for an amazing example of a collaborative effort between an Indigenous nation, researchers, and other partners). As mentioned above, AR models work well for enlivening museum exhibitions or posters with added virtual elements; for instance, this has been used in museums to present photographs that 'wake up alive' by having a character in a photograph, performed by an actress or actor, so that the acted character appears to turn toward the observer and tells a story of the situation when observed through a mobile device, in an attempt to bring the past to life and bring the audience closer and face-to-face with the material culture item/art piece being observed (e.g., Herva et al. 2016).

TEL opportunities adopting digital elements that seamlessly integrate into the physical experience—whether explicitly AR or not—may offer a new and significant means for communicating the value of heritage sites to various publics. For a pilot project currently under development by Morton and Peuramaki-Brown, with funding provided by National Geographic, local students will be able to explore the ancient Maya site of Alabama, Belize (the focus of ongoing research by the Stann Creek Regional Archaeology Project). Local schoolteachers and archaeologists working at the site may physically lead students along a prescribed path through the site[13] with supplemental materials (e.g., photos, videos, audio files, interactive 3D models of artifacts, and text blocks) accessed at designated nodes or sign-posts. Virtual re-creations of excavations allow students to view examples of archaeological deposits "in situ" and foster group discussion. As this program is aimed at drawing ties between the local communities and Alabama (thus, encouraging community involvement in the stewardship of the site), the project also encourages content development and curation by students and teachers who will be able to add content to the application over the years—the result of

"mini-projects" such as drawings, stories, videos, etc.—that subsequent visitors will be able to view. While Belize is an English-speaking country, ideally, all content would be translated and made available in several languages (as much as possible), including those indigenous to the local communities (e.g., Mopan Mayan).

While the dangers (or ineffectiveness) of simply throwing technologies into the mix were highlighted above, it should be clear from these examples that, if employed thoughtfully, TEL affords opportunities for designing, facilitating, and directing learning outcomes in personally meaningful ways to a degree that traditional 'sage-on-the-stage' models of pedagogy simply cannot. One of the greatest impediments to the effective use of TEL in archaeology is the aptitude of those employing it in the various realms of teaching. This is an issue that the aforementioned AR project explicitly engages with, and the preliminary solution illustrates the value of collaborative work. While Peuramaki-Brown and Morton, as directors of an archaeological project that has been investigating the site of Alabama since 2014, and with over two decades of archaeological fieldwork under each of their belts, are able to contribute content knowledge, neither is an extensively trained pedagogue, nor are they experts in programming or digital design. As such, the successes of such projects rely heavily on multiple experts, including the local schoolteachers and principal (curriculum design and teaching), and designers from Northern Arizona University's Immersive + Interactive Virtual Reality Lab.

VR models (observable through special viewers or simply via computer screen), or even simple 360-degree imagery or fly over shots (available for free online for most famous archaeological sites and landscapes), are additionally well suited for organizing 'field excursions' to places that are beyond physical reach for most learners (Dawson et al. 2011; Pfeil et al. 2009; Stoddard 2009). An example of this are the VR models and 3D panoramic tours developed for a conflict archaeological project documenting the remote, abandoned Gulag work camps in Russian Siberia, observable and downloadable online.[14] Analogous models also hold high potential for developing VR-based teaching and 'hands-on' presentation of important archaeological sites and finds for the students, without the need for travel funds.

Detailed 3D documentation of archaeological sites and excavation processes can allow for simulated virtual excavations, which act both as visual teaching tools and documents, based on which others can judge and evaluate the work process and decisions made by the excavators in the field. Much 3D documentation can now be done with simple smart phone technology and open-source imaging software. This would also be useful when utilizing archaeological techniques in forensic studies, which is increasingly popular around the world, to ascertain the unobstructed chain of custody of the documented evidence (Seitsonen 2018b). Additionally, the use of open-source 3D models of artifacts can easily enhance any activity in a classroom setting or beyond, particularly if learners do not have access to a physical lab setting and 'real' artifacts or casts. A great source for such materials is the Sketchfab platform where models are

open to view and manipulate, and many are free to download and embed in course content or to print off with a 3D printer (available in many public and university libraries today).[15]

Unfortunately, the AR/VR/3D approach can only take archaeology teaching so far, and is best suited for younger learners, general publics, and basic undergraduate courses. In the more advanced levels of study, learners will still need to leave the (online) classroom to gain solid hands-on experience (Zutter and Grekul, this issue); or, if exposed to significant hands-on experience early on, online studies and virtual scenarios in archaeology can be pursued at the graduate level (Welch and Corbishley, this issue). It should be noted that hands-on learning can, in some instances, still be connected to TEL in archaeology; for instance, by including outdoors-based tasks, such as visiting archaeological sites in the vicinity of the students' homes and documenting them with photographs/videos, which are then shared and discussed with others online, or collecting lithic raw materials suitable for knapping practice, as in the TEL activity plan presented in the Appendix A.

Gamification

Another avenue for creating teaching presence (as well as cognitive and social/emotional presences) is through gamification. Defined by Karl Kapp (2012:23) as the process of "using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems," gamification is quite simply a way of using the most entertaining elements of gaming to stimulate successful learning.

The elements of gaming that are typically brought to bear to engage learners include challenges, a points system, levelling, rewards, and ranking (Kiryakova et al. 2014), and have the benefit of stimulating our sense of competition, risk and reward, and achievement, while delivering social interaction, an enhancement of skills, and learning retention through storywork (Dieck et al. 2016; Livingstone et al. 2016). Gamification also incorporates a spectrum of gaming mechanics depending on the level of education or training that the "game" is meant to deliver. These potentially overlapping mechanics may range from playfully engaging design elements, to fully integrated "serious" games in which reaching the predetermined learning objective is the win condition, to immersive simulations that train learners to prepare for real-world scenarios (Kiryakova et al. 2014).

There is certainly no shortage of possibilities for introducing game mechanics into learning archaeology online. One might introduce the basics of a culture history through a simple identification activity, matching artifacts or locations with their dates or cultural significance.[16] 3D models might be incorporated into a simulation in which the learner must first organize and then reassemble a set of broken artifacts. Learners

could be given photographs of a site, from different angles and orientations, with the task of creating a plan of the site and its various landmarks. One of our favorite teaching/learning games is the Arctic Sledging Challenge in the Science and Survival at Fort Conger exhibit of the Virtual Museum of Canada; the learner/gamer is sent on a mission to recreate a northern journey, making informed decisions about food and equipment, hauling loads, etc., to learn about the realities, history, and archaeology of Arctic exploration.[17]

Podcasting

Podcasting, like other audio/visual broadcasting media (Bonacchi 2017), relies increasingly on user engagement and transmission through social networks to effectively accomplish teaching presence (outreach and education). While many podcasts have seen incredible surges in popularity and wild successes as business models, archaeology podcasts are niche products at best, in the context of multi-million-listener, high-profit, heavily advertised shows. Several archaeology podcasts are active at the time of publication and, while many run the gamut of fine-grained topics in the discipline, there is also a great deal of overlap. Differences in interview style and show format create artificial specialization and compete for listenership by providing variety.

Some of the challenges for archaeology podcasts to reach legitimacy are presented by funding and production models. Costs associated with podcasting include hosting the episodes on a site, recording equipment, and editing software licenses. These costs often act as barriers to entry for beginners. Overcoming the finance and resource deficit to producing readily-consumable podcasts requires crowdsourcing, selling advertising, operating as a subsidiary of a larger funded organization, or some combination of the above. This is one of the reasons, along with issues of quality control, copyright, and proper use of technology, why online distance education universities, such as Athabasca University in Canada or The Open University in the UK, provide production teams to work alongside educators compiling course content and establishing the three presences.

Some successful examples of high-production, niche-audience podcasts, such as Lore, Serial, and even Chapo Trap House,[18] overcome the pitfalls of poor audio recording quality and inconsistencies in presentation—pitfalls that are of perpetual concern even among aware producers (see Sims' own Go Dig a Hole podcast[19]). As Daniel Kwan (host of the Curiosity in Focus podcast) explains, far more people will be reached by podcasts than by journal publications (Kwan 2017:35). While some attempts have been made (perhaps in vain) to quantify listenership of (very cherry-picked) archaeology-themed podcasts (Boyle 2017), podcast metrics remain largely elusive across the media format. Regardless, the potential for wide dissemination of archaeological knowledge and cross-promotional (or interdisciplinary) collaboration should give archaeologists reason to be optimistic in utilizing podcasts to promote their

research and engage learners with content. Furthermore, podcasts are a more easily consumed format for some users (barring hearing disabilities) and integrate well with blogs and social media; in fact, many archaeology science news outlets now offer audio editions of their articles.[20] Similar to blogs, the quality of information has the potential to be comparable to peer-reviewed journals when the speakers or guests on a given episode are discussing topics with academic rigor.

Cognitive Presence

Technologies that encourage cognitive presence in the online learning environment are those that allow for the supporting of critical discourse and participation between students and teachers/researchers, which, in turn, encourage the engagement of participants. Currently, there is a huge range of options for this type of activity—many of which have already been presented—allowing for diverse forms of expression and engagement, which is one of the best ways in which to begin truly decolonizing and democratizing traditional learning environments in archaeology (see article by Supernant, this issue). These technologies simultaneously offer 1) learning contexts, 2) open collections of knowledge, and 3) communications for critical discourse, reflection, and practical inquiry. As mentioned above, basic audiovisual elements should be included to create presence—both social/emotional and cognitive—on the part of the teacher, but should not be over relied upon in the online setting, as this simply attempts to recreate a passive lecture format (see discussion above).

Discussion Boards

The ability to engage in critical discussion seems to be the most influential feature when it comes to student perceptions of learning quality and cognitive presence, particularly in online courses (Swan et al. 2000). Over the course of a discussion, several stages are encountered (Garrison et al. 2001:4-5): 1) initiation through a triggering event (e.g., question, issue, dilemma, problem posed by teacher or other participant); 2) engagement through exploration, moving from the private, reflective world of the individual to the social discussion, expanded through exchange of information by multiple participants; 3) integration by constructing meaning/further discussion from the ideas generated, requiring active teaching presence to point out misconceptions, provide probing questions/comments/additional information to further encourage cognitive development and critical thinking; and 4) the ultimate resolution of the dilemma/problem through consensus building or practical application and experiment.

Encouraging discussion in an online setting, often through learning management systems or closed group pages, particularly that which is not required for evaluation in a course but builds toward later evaluated assignments, can be a matter of trial by fire but creative solutions can help; for example, several of the authors have found the

use of “selfies” to engage interest is particularly useful for broad portions of today’s learners/audiences, as is audio/visual self-recording. Within the learning management system discussion board for her asynchronous—education, instruction, and learning that does not occur in the same place or at the same time, vs. synchronous, which does (as in semester- or quarter-system classes)—individually paced, online courses on archaeological theory, prehistoric archaeology, ancient cities and civilizations, etc., Peuramaki-Brown has successfully engaged learners by encouraging them to post responses to questions that are highlighted with photographs around their home (e.g., dishes in kitchen cabinets when discussing issues of classification), or ‘selfies’ at relevant archaeological sites/features/exhibits they have visited or analogous shots from modern urban environments with suitable, relevant captions (demonstrating more meaningful purposes for this seemingly shallow/narcissistic act; Johnson et al. 2014). This continues with a follow up question/problem/dilemma and responses to other posts. These discussions and their outcomes then feature in various exam questions later on in the course; incorporating the personal elements seems to help many students in recalling discussions and the outcomes. In the authors’ experiences, when students are asked to bring in elements/experiences from their personal lives to address or provide examples in typical classroom discussions, they are almost 100% more likely to contribute voluntarily to such dialogue.

As is the case with any productive discussion environment, within a formal course or part of an outreach initiative, administrators (e.g., teachers, tutors, teaching assistants, researchers) must monitor discussion and discourage any inappropriate engagement (e.g., ‘troll’ comments or distracting triggering events), while taking care not to stifle critical conversation. Additionally, attributing honest individual identities/tags (e.g., participant name) to contributions is critical as it forces participants to take responsibility for their roles in the discussion.

Crowdsourcing platforms

Crowdsourcing (obtaining information or input from a large number of people via the Internet) of public knowledge holds significant potential for developing ways to democratize the production, collection, co-curation, and transmission of archaeological and heritage content, and in general, engages all three presences. Crowdsourcing can be used, for instance, for public outreach, collecting landscape data through participatory GIS activities, or working with museum collections. As an example, the University College London and the Bartlett Centre for Advanced Spatial Analysis have developed a QRator tool for the co-curation of exhibitions and collections (QRator 2011), by allowing the collection of user-generated knowledge of museum objects. This permits interactive two-way public participation and outreach within a museum space.

Public endeavors, such as online crowdsourcing of Indigenous knowledge, enable local communities and interested enthusiasts to take part in, target, and even

direct archaeological practices in their "own lands." A great example can be found by visiting the Arctic IQ website,[21] which provides the digitized crowdsourcing platform for the originally paper-based archaeology/oral history mapping initiative described by Lyons and colleagues (2010). This type of online interaction with local communities, while encouraging in-place and from-place engagement and cognition, also makes it possible for researchers to maintain a presence in their respective study areas outside their typically short field seasons and to trigger more active dialogue with the communities that have relation to, and feel connected with, the targets of archaeologists' research interest. Ultimately, these tools serve to empower neglected or silenced communities and gain wider recognition for their idiosyncratic heritage perceptions. In the case of many Indigenous groups around the world, overarching, fluid, and embodied relational worldviews are contrasted against static Western dichotomies of "culture" vs. "nature" (e.g., Harrison 2015; Seitsonen 2018a:21, 145); these kinds of all-embracing differences in cosmologies and understandings of the world should be taken into account when designing crowdsourcing projects—particularly those tied to issues of geographic localities—to avoid potential fundamental misunderstandings, and allow for Indigenous communities to be given a voice to assess the variations in heritage perspectives in a more democratic manner.

The limits and potential bias of crowdsourcing need to be acknowledged prior to planning and carrying out public participatory endeavors as part of interactive teaching efforts and cognitive presence. Recent analyses of crowdsourcing cultural heritage have recognized the following basic concepts that affect such activities (Seitsonen 2017; also, Howe 2008:280–288) and should be acknowledged/assessed as soon as possible:

- User forum: Number of people reached and their user profile, which affect the results.
- User interface: A user-friendly and reliable interface enhances participation, whereas the opposite dissuades participation.
- Outlining the subject case: Outlining of the public endeavor can direct user-entries.
- Promoting: Dynamic promotion, for instance through active social or traditional media presence, enhances the participation.
- "Pride of place": Attachment to a place and promotion of personally important locations appear to be strong motivators (also Coleman et al. 2009: 343–44; Olsson 2010).
- "Law of the vital few" (a.k.a. "Pareto principle"): It has been noted that in crowdsourcing, and in other online activities, typically few active contributors provide the majority of input, which can bias the data (e.g., Bonacchi et al. 2014; Chrons and Sundell 2011).

- Anonymity: Anonymity might encourage some users to take part in the online activities, but can result in intentional or unintentional bias, which should be recognized in the analyses of the data (e.g., with topic modelling). On the other hand, some users appear to be willing to authenticate themselves, especially in more dedicated assignments—and in teaching contexts this should be a prerequisite—and some might be motivated to gain social and cultural capital within the online user-community, such as self-satisfaction and self-esteem of showing their personal knowledge (Lietsala and Sirkkunen 2008: 84; Murzyn-Kupisz and Działek 2013; see above).
- "Games with a purpose": The gamification of cultural and scientific user-interfaces has been one way to motivate participation (von Ahn and Dabbish 2008; see above). This has been recently criticized by some as trivializing the user's input (Bogost 2015; Todd 2016), but the critics have not recommended alternatives for enticing people to participate especially in the more time-consuming activities. It appears that different kinds of gamification platforms might be needed to encourage participation by differently motivated people (Randall 2015). Gamification is yet to be robustly tested in archaeological TEL activities, at least to our knowledge, but it could allow interesting new insights into organizing online teaching.

Conclusion

By contemplating the digital technology you wish to adopt in archaeological education and outreach within the three presences of a CoI framework, it is much easier to develop smart and effective TEL strategies. TEL in archaeology provides many fertile niches in which to adapt and promote outreach, engagement, and collaboration (Figure 2). At the time of writing, social media platforms have the highest potential for generating social/emotional presence and encouraging collaboration; podcasts, along with other audio/visual formats, when well produced and publicized, can disseminate archaeological knowledge to and generate teaching presence for far greater numbers than traditional print media; augmented and virtual realities are the ever changing and increasingly affordable and accessible future of archaeology teaching presence; and learning and crowdsourcing platforms that facilitate vibrant, responsible discussion and collaboration are key to cognitive presence. Archaeologists-as-users must determine their goals for dissemination—whether that be outreach, pedagogy, collaboration, or self-promotion—and craft a digital technology strategy that appropriately applies the tools discussed above. Expansive, user-driven, interactive media also present opportunities to democratize and even decolonize pedagogy. By eliminating the physical act of travel, the financial burdens of conferences, and speeding up the life cycle of knowledge generation and dissemination, archaeologists-as-users of TEL seize the

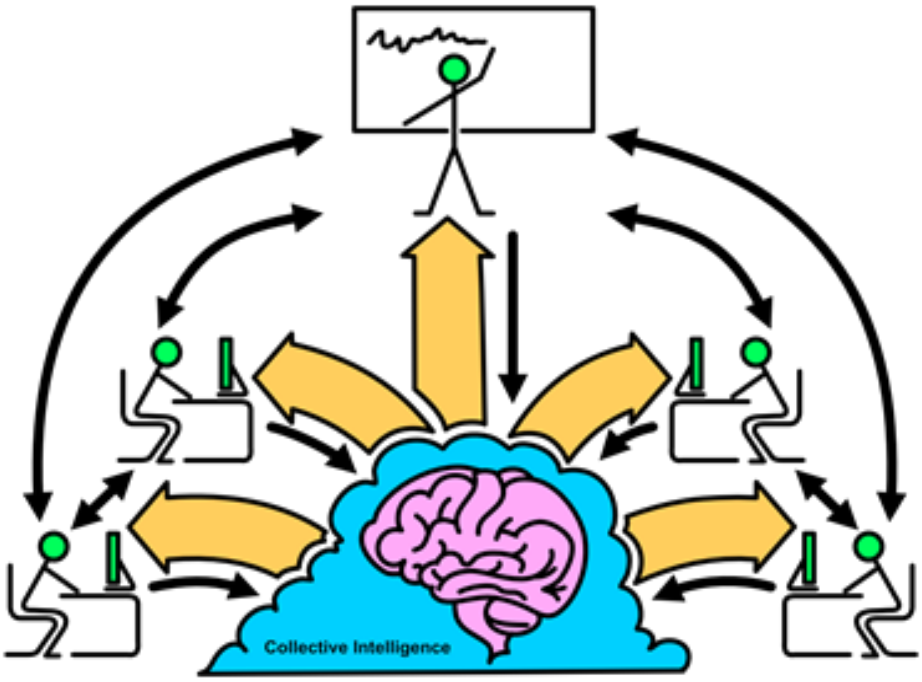

Figure 2. Graphic illustrating relationships fostered through TEL between individuals (both teacher and student) and the collective with respect to social/emotional presence (sp), cognitive presence (cp), and teaching presence (tp). Inputs include the use of crowdsourcing in data creation/mining/manipulation (sp/cp), individual profile creation (sp), and contributions to discussion boards (sp/cp/tp). Outputs include fostering a sense of community (sp), sharing generated experiences such as websites, AR/VR (cp/tp), and knowledge dissemination/content delivery (sp/cp/tp). Note the unbalanced but cyclical relationship between the collective and the individual.

means of dissemination beyond traditional barriers. When properly configured, these tools are ready to enhance archaeology and its lessons at a pace traditional venues have yet to fully realize.

We would end this article with a word of caution: with respect to the application of TEL for archaeology (or in general), things are not all rosy. As pointed out by one of the initial reviewers for this article, it must be recognized that the rapid pace of technological development carries with it an inherent danger of ghettoizing those lacking the resources and capacity to keep up. There is a very real danger of defining new sectors of people who will become disenfranchised. This returns us to a point we made in the beginning of this article. We must resist the temptation of utilizing new technologies simply for the sake of innovation; as in all elements of teaching practice, the educator must make decisions surrounding the use of TEL with consideration to the suitability of the technique/technology in accomplishing the purpose of the lesson, given the technological capabilities of the institution and student (see Appendix A). As explored by Williams and Atkin (2015), neither does the application of digital methods for the instruction of archaeology absolve the teacher from ethical responsibilities related to

sensitivity or representation.[22] Indeed, in light of the broader audiences that TEL makes it possible to reach, the potential for conversations/content to escape the control of the teacher, and their lingering presence in the digital world (vs. the quickly fading voices of teachers and students in live conversation at brick-and-mortar institutions), such ethical considerations are made that much more important. Newer is not always better. More complexity does not always mean more opportunity. Sometimes, it is better to follow than to lead. While it is important to recognize these limitations, we hope that educators are not discouraged from engaging head-on with the possibilities of TEL in archaeology.

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Endnotes

1 By open education, we refer to a teaching and learning approach that emphasizes the student's right to make decisions and that views the teacher as facilitator of learning rather than as transmitter of knowledge (Evans 1994). It includes various forms of instruction, such as independent study, individualized pacing, and unstructured time/curriculum. Open archaeology refers to concepts of open publishing and free access to archaeological datasets (Edwards and Wilson 2015).

2 An example of professional-ethical obligations of outreach activity can be found in the Principles of Archaeological Ethics of the Society for American Archaeology (http://www.saa.org/career-practice/ethics-in-professional-archaeology).

3 Technology-Enabled Learning or Technology-Enhanced Learning encompasses online learning (e-learning) as well as technology-enhanced classrooms and learning with technology, rather than just through technology (Brown and Lippincott 2003).

4 Digital literacy includes the knowledge, skills, and behaviors involved in the effective use of digital devices (e.g. smartphones, tablets, laptops, desktop computers) for the purposes of communication, expression, collaboration, and advocacy (Eshet-Alkalai 2004).

5 This paper by Griffith et al. serves as an introduction to a special section in the journal Internet Archaeology. The papers in this section were in-turn based on papers that came out of a Theoretical Archaeology Group (TAG) session held at Manchester University in 2014. The papers from this session can be viewed on YouTube at https://www.youtube.com/playlist?list=PLBjeGwwG0rtRFWr8LjBmDICvRzrNPidCM.

6 Visit www.coi.athabascau.ca for a wealth of resources.

7 Note that the terms learner, student, and public are used interchangeably, as are teacher and researcher.

8 For example, virtualmuseum.ca; wearemuseums.com; archaeologymuseum.ca/virtual-reality/; and youvisit.com/tour/machupicchu

9 http://publicarchaeologyconference.wordpress.com

10 The hashtags #african or #africanamerican are commonly used as qualifiers for #olmec in pseudo-scientific (and thoroughly disproven) claims that the ancient Olmec of Mexico's Veracruz-Tabasco area were Black Africans, entirely unrelated to the region's current Indigenous population.

11 Visit www.fcit.usf.edu/matrix/ for associated resources.

12 AU's TEL-MOOC is a great place to start (http://cde.athabascau.ca/courses/mooc.php) as is this list of general resources for moving your teaching online (http://www.movingeducationonline.org/higher-education/).

13 Visit http://www.youtube.com/watch?v=VauZN1Zg2uY for an example of a typical tour route.
14 www.gulag.cz
15 For an example of a Sketchfab lab, you can visit the Athabasca University Virtual Archaeology Lab at http://sketchfab.com/meaghanp.
16 See many examples of simple games at http://planeta42.com/archeology/
17 http://fortconger.org/page/expedition_en_traineau_dans_larctique-the_challenge_of_arctic_sledging#modal
18 http://www.lorepodcast.com/, http://serialpodcast.org/, http://soundcloud.com/chapo-trap-house
19 http://soundcloud.com/godigahole
20 For a great archaeology example, visit www.hakaimagazine.com/features/hidden-coastal-culture-of-the-ancient-maya/
21 www.arcticiq.ca
22 In this case, Williams and Atkin are explicitly discussing the ethics, politics and public engagements of mortuary archaeology, including how we handle, write about and display the archaeological dead. Principle No. 2 of "Ethics in Professional Archaeology" for the Society for American Archaeology (as it relates to accountability to affected group[s]) or the "Statement of Principles for Ethical Conduct Pertaining to Aboriginal Peoples" of the Canadian Archaeological Association, come to mind as relevant examples of ethical principles that may guide the teacher with respect to the digital display and discussion of human remains.

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Appendix A: Example of a Technology-Enabled Learning Activity Plan

Activity Name: Introduction to Stone Tool Technology in Archaeology

Course: ANTH XXX Introduction to Archaeology

- First-year university, online, individually-paced, asynchronous.
- Easily adapted for a blended course or face-to-face

Length of Full Activity: approx. 70-90 minutes total

Lesson Summary:

Students will review the basics of lithic (stone) tool technology and flint knapping (process of making chipped stone tools), with the ultimate goal of learning how to distinguish a human-made flake from a naturally occurring flake.

Lesson Objectives:

- To provide students with the basic archaeological terminology for stone tool technology.
- To provide students with identification techniques for human-made chipped stone artifacts.
- To provide students with an introduction to the skills and physics/mechanics required to produce chipped stone artifacts.
- To provide students with an introduction to various artifact visualization techniques (e.g., video, drawing, 3D scans).

Resources/Technology – Teacher

- Computer, internet (high-speed for scan uploading), 3D scanner.
- Moodle course platform including share/discussion board, Sketchfab, YouTube.

Resources/Technology – Students

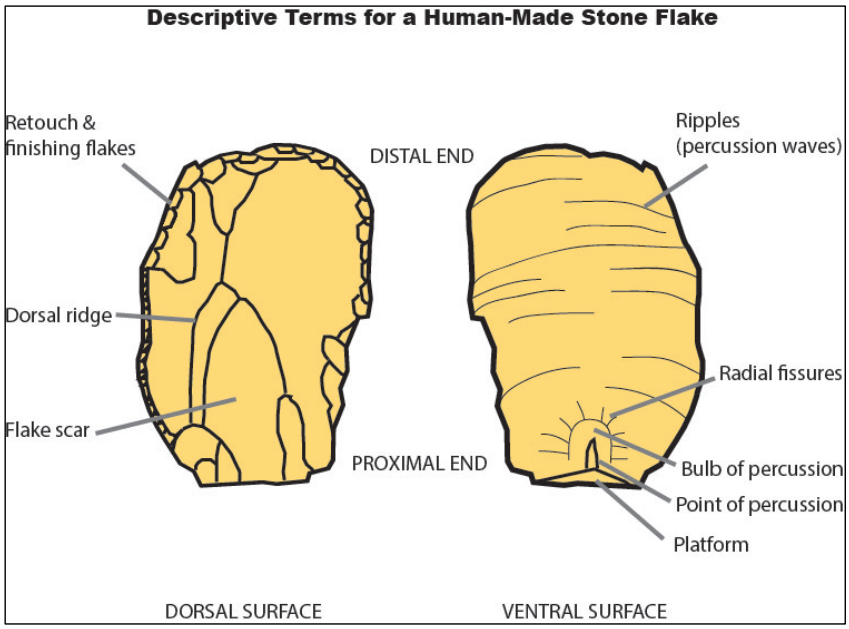
- Computer, internet (high-speed preferable for 3D scan manipulation).
- Moodle course platform including share/discussion board, Sketchfab, YouTube.
- Rounded cobble/rock (fits comfortably in palm of hand, roughly 400-1000 grams/0.8-2.2 lbs.), found anywhere (backyard, park, river, etc.); thick piece of glass (e.g., wine bottle base) or porcelain (e.g., old toilet piece); sandpaper (dollar store purchase)

Online Resources

- VIDEO: “Basics of flintknapping.” (Filmed and uploaded by Paleoman52, 2014.) https://www.youtube.com/watch?v=AJk1qfRczLI
  - Shows tools and techniques involved in flint knapping (16:03).
  - Creative Commons License (CC BY, share and adapt)
- MANIPULABLE 3D IMAGE: “Chert flake – 134”. (Scanned and uploaded by M. Peuramaki-Brown, 2016.). https://sketchfab.com/models/bb7237b7183847348016f2ce42031eff
  - Shows a complete, human-made flake recovered from an archaeological context. Student can use mouse/track pad to manipulate object in 3D space.
  - Hosted on Sketchfab platform. Free to join (www.sketchfab.com).
  - Creative Commons License (CC BY, share and adapt).

Other Learning Materials

- DIAGRAM: Shows basic elements to identify on 3D scan and on experimental flake student will produce. (Created by M. Peuramaki-Brown, 2017. CC BY).



Intended Curriculum Learning Outcomes

- Students will develop basic artifact identification skills.
- Students will develop basic archaeological visualization skills.
- Students will develop basic experimentation skills.

Instructional Activities **Remember reading, writing, watching, listening, feeling/ manipulating/applied, and talking/discussing*

1. Teacher will *(10 minutes)*
    - Introduce (listening [audio], watching [ppt/video], and reading [text]) the topic, goals, terminology, resources and how to use, assignment.
2. Students will *(66 minutes total)*
    - View video showing flint knapping tools and demonstrating process of flake removal. *(16 min.)*
    - View diagram with characteristic features of a flake. *(15 min.)*
    - Identify [writing] elements, if possible, from video/diagram on a manipulable 3D scan of a flake [tangible].
    - Try to produce [tangible] a flake from piece of glass/porcelain using a rock (the hard hammer percussion technique demonstrated in video). (20 min.) **Disclaimer: you are producing sharp items with sharp bits. Wear some protective goggles and gloves. If possible, do this activity outdoors.*
    - Share results of experimental flake production on the Moodle discussion [talking/writing/visualizing] board in the form of a photo of your achievements and written description or short video. *(15 min.)*
        - Were you successful? Why or why not?
        - How does your resulting flake compare to the diagram and 3D scan? What features can you see? Which can you not?
        - How does it compare to the flint knapper in the video (remember, he is a professional)?
    - Student comments on at least one other existing post (Similar results? Different? Why?)
    - Teacher/tutor to comment on all postings and encourage ongoing discussion through follow-up questions.

Learner Assessment

- Students will demonstrate basic identification, experimentation, and digital manipulation skills.
- Students will engage in self-directed learning.
- Students will engage with teacher and other learners.