Abstract

By its very methods, be they desk-based research or practical field approaches, archaeology is, by nature, an active discipline. Therefore, the effective teaching of archaeological skills requires a dynamic approach. Most students have to rely on field schools for their training in practical archaeology. However, many of these are prohibitive in cost, accessibility, and inclusivity. This paper describes a newly developed tactic (the Micro-Site Simulation Research Project) utilizing experimental, hands-on, interactive, and experiential pedagogical approaches to overcome these issues, encouraging increased student engagement and the effective teaching of practical archaeological skills in the classroom.

Introduction

Archaeology is a dynamic subject incorporating traditional archaeological excavation, ethnography, and environmental science to explore past cultures. As a discipline, it strives to build a critical understanding of the theoretical and methodological techniques required to understand how past peoples lived, worked, traded, traveled, and interacted with their landscapes and each other.

Field training in these areas can be expensive and present accessibility issues for many students, creating problematic pedagogical dynamics for students unsure if they will pursue further training or a career in archaeology. This article will describe the Micro-site Simulation Research Project, a new pedagogical approach developed at Brandeis University to introduce students to archaeological methods more broadly as well as maritime archaeology more specifically. In producing new avenues by which to introduce students to archaeological training, the Micro-site Project works to increase diversity, equity, and inclusion in the field, essential goals within the discipline.

The number of in-the-field archaeological training programs available to students is woefully few and, particularly within maritime archaeology, often prohibitively expensive, ultimately meaning that many students exhibiting an interest in and drive toward becoming terrestrial and underwater archaeologists cannot gain experience or learn the necessary skills required to access careers in archaeology. This issue was exacerbated by the COVID-19 pandemic, during which many terrestrial and maritime projects were paused, and since then many projects have been thoroughly overbooked. Consequently, building innovative strategies with which to deliver functional proficiency in archaeological methods and maritime archaeology has become imperative not only to combat the effects of the epidemic but also to increase equity and accessibility for student training.

In response to this crisis, the Brandeis historical archaeology laboratory has been expanding and designing pioneering techniques intended to instruct applied archaeological methods to students *on campus*. New teaching practices have led to novel pedagogical methods intended to establish hands-on learning strategies using practical techniques and experimental/experiential archaeology in the lab. This approach ensures that, at the very least, students are introduced to the major concepts of excavation and develop a basic understanding of practical approaches before deciding whether they will continue to engage in further training and, ultimately, have to pay for expensive field schools. This article does not propose that the micro-site approach provides an alternative to in-person training; indeed, this is far from the case. While it is a very effective teaching tool, the micro-site can never replace a full-scale archaeological project due to its fairly apparent limitations (e.g., the absence of diving/underwater elements or experience using full-scale tools). However, the micro-site approach does provide an exceptional pre-field experience and some initial training in specific areas which can afford students of varying backgrounds the opportunity to engage with archaeology in a meaningful way. It can also create new interest even among those who have not considered archaeology as a potential career and allow students the opportunity to "dip their toes" into archaeology with a view to deciding their next educational step, both reducing risk and increasing the number of students able to experience practical methodologies.

In class, the micro-site acts as a scale replica of an imagined archaeological site, complete with stratigraphy and artifacts on which students can develop new skills and pragmatically practice their newly learned proficiencies. These types of hands-on educational activities, or Experiential Learning (ExL), afford a medium through which students can embark on their own excavations, research, and "publication" for themselves. The ExL approach teaches fundamental skills and empowers students to obtain personal knowledge and experience in project management, data analysis, and output development. Furthermore, by focusing on understanding through experience, the ExL approach aids concept retention and skill creation by "learning through reflection on doing" (Patrick 2011:1003), ensuring extended development beyond completing a particular activity or class.

In connecting current archaeological methods, debates, and questions with the "archaeological record" developed within the two major courses run in the Brandeis historical archaeology laboratory, practical pedagogical approaches encouraged students to develop their own research strategies, test hypotheses, and develop independent inferences, a necessary component of any undergraduate or graduate archaeology program. However, far from playing around with an archaeological dataset simply for its own sake, this article argues that learning via experience and reflection—especially in the form of data analysis, scientific hypothesis development, and testing—

drives student development further toward increased analytical potency and out-of-the-box thinking, ultimately amplifying cognitive flexibility.

This article first describes why a hands-on approach is significant before providing a survey of literature reviewing comparable approaches used elsewhere in teaching maritime archaeology to isolate significant recurring elements, principles, and skills. Furthermore, to ensure replicability, this narrative describes the execution of the approach, details site construction and assignments, and discusses student evaluations and feedback. Finally, the article offers recommendations for using this model to teach archaeology students and discusses areas for improvement or advancement.

Cultivating Curiosity: Experimenting with Experiential Teaching in Archaeology

Experiential learning and interactive participation are far from new pedagogical approaches. However, they are sadly underutilized in academic education in the arts and social sciences.

First and foremost, to ensure clarity, it is necessary to review the terminological distinctions and confusions extant amid archaeological pedagogies. The term "experimental" in archaeology generally refers to the field of study that tests archaeological hypotheses, typically by reproducing or approximating ancient technologies. "Hands-on" learning is the practice of learning by doing, whereas "experiential" describes the educational approach designed to emphasize an individual's learning progression, predominantly employing engaged activity and *observation,* rather than rote or didactic learning (such as lecturing) during which student participation is relatively passive. While hands-on techniques can be a tool for experiential learning, they do not incorporate the aspect of reflection that makes experiential techniques so powerful.

David Kolb (1984), utilizing previous works on the topic, developed the formative concept of experiential learning in his book *Experiential Learning: Experience as the Source of Learning and Development*. Drawing on several famous historic and modern authors, Kolb described experiential learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (Kolb 1984:41). Since their introduction, Kolb's theories have dramatically impacted learning-model design and development. Various experiential learning models have been developed, redeveloped, and revised (e.g., Honey and Mumford 1982) and contested (most famously by Hamilton 1980). Many have argued that, rather than a single policy, a genuinely effective teaching approach would, instead, utilize a combination of pedagogical elements, merging traditional didactic classroom learning techniques with experiential methods. This integrated approach has demonstrated benefits, especially when combined with providing students with the opportunity to study or learn according to their preferred learning styles (see Honey and Mumford 1982). Indeed, examples that combine experiential approaches, interactive participation, and gamification have diverse, demonstrated benefits for augmenting learning via kinesthetic activities (Bakas 2013; Griss 1998) and increased recall of newly learned information (Howard-Jones et al. 2011). Additional approaches to pedagogical development, such as Murdoch's Inquiry Cycle (Murdoch 2015), while not specifically engaged with at the time of this micro-site development, also provide an interesting angle when considering the implications of student thinking and group conversation and will be considered in future pedagogical and project development.

Furthermore, recent research from neuroscience has suggested that actively stimulating the brain using varied sensory experiences (e.g., action and speech) can generate increased brain function, yielding more profound comprehension of novel concepts (Watson 2005:16). Utilizing this new knowledge, the instructor can become a facilitator, rather than just a source of information, who directs, prompts, and motivates students to learn (Silberman 1971). This method allows students the freedom to develop and use their own learning style to engage most effectively with the class materials, gain a deeper understanding of the topic, develop valuable Executive Function (EF) skills, and encourage critical thinking and cognitive flexibility (Diamond 2020; Karimi et al. 2010).

Integrative Learning Approaches in Archaeology

The teaching of archaeological methods already often includes an integrated practical approach, such as requiring field school participation before graduation can occur. However, the vast number of courses offered to students comprise a predominantly lecture-based approach. Most practical activities developed to teach archaeology tend to focus on younger students (e.g., K–12 activities offered by the Society for American Archaeology [n.d.-a; SAA], amongst others) and not those at the university level. On their website, the SAA does offer a number of post-secondary-school-level activities (Society for American Archaeology n.d.-b); they are, however, somewhat difficult to find. These activities and integrated approaches have a beneficial impact and can be used to attract student interest, a particularly useful tool in times of dropping enrollment within higher education programs (Knox 2023)

In maritime archaeology specifically, many degree programs (e.g., University of Southampton [UK]; University of West Florida, East Carolina University, and Texas A&M [USA]; Flinders University [Australia]; Alexandria University [Egypt]; and University of Southern Denmark [Denmark], amongst other institutions who offer a maritime archaeology module or class within archaeology/anthropology programs) have already combined lecture, discussion, and practical sessions with training the next generation of maritime archaeologists. Additional topics taught within the field, but with different data and goals, also include submerged prehistoric (precontact) maritime archaeology and geoarchaeology, though programs with these foci are rare.

The term maritime archaeology is used here to cover all aspects of the changing relationship people have and have had with the world's oceans and seas. More accurately, these areas should be referred to as separate subdisciplines of maritime archaeology which all-inclusively covers the study of human/water resource interaction, including oceans, rivers, lakes, and and the adjacent terrestrial, maritime activity sites (e.g., ports). Specifically, there is underwater archaeology (human/water resource interactions using any underwater data from rivers and lakes), marine archaeology (human/sea interactions using submerged marine/saltwater artifacts and sites, including watercraft, settlements, and aircraft lost at sea), and nautical archaeology (archaeological study of shipbuilding and ships, both submerged and terrestrial). However, while the differences are explained to students during class, this article uses "maritime" as a simple catch-all term.

Archaeological Field Schools

A field school is an essential and arguably irreplaceable educational element for students pursuing an archaeology career. However, field schools are becoming increasingly inaccessible. Students aiming to engage in fieldwork face manifold obstacles, particularly in expense, availability, demographic imbalances, and personal safety.

In 2020, Laura Heath-Stout and Elizabeth Hannigan published a survey of 208 field schools available in 2019 detailing the costs incurred by tuition, room and board, and airfare. These costs—along with the loss of wages students would sustain by joining a field project rather than working—presented an expensive picture. While their analysis primarily covered terrestrial field schools rather than underwater, Heath-Stout and Hannigan's data demonstrate the alarming expense of enrolling in archaeological field training and the unfortunate decrease in academic credits offered.

Since 2020 and the impact of the Covid-19 epidemic, these issues have only intensified. Terrestrial projects are generally more common than maritime ones and far easier to find. Heath-Stout and Hannigan's 2019 survey, based on fieldwork opportunities sent to the authors or listed on the Archaeological Institute of America's *Archaeological Fieldwork Opportunities Bulletin* (AFOB), calculated a standardized average cost for a credit-bearing, month-long field school at $4,065, with an average expense of $702 per credit. (Heath-Stout and Hannigan 2020:124). At the time of writing this article (2023), a further survey of non-credit-offering, student-focused field training projects listed on the Archaeological Institute of America's website averages to $3,400.02 per four-week program.

Additionally, while a few projects (9%) included accommodation, board, equipment, and other sundries such as airport transfers and educational trips within their tuition costs, most did not. None included the airfare required to get to the field site. For maritime archaeology, an online search during the Fall of 2022 presented only eighteen separate underwater pre-COVID-19 field school opportunities, which were surprisingly hard to find, and only five of which have continued since the lifting of epidemic restrictions, drastically reducing opportunities for students to engage in the required training. Of the 18 pre-COVID-19 field schools listed online, just under half included accommodation and sundries (including diving kit) within the fees charged, for an average enrollment cost of $3,878.55. Once again, the airfare would cost extra. When averaged over the variable duration of each field project (7 to 70 days), the median cost of participation in a maritime archaeology field school came to $208.02 per day.

When identified against the myriad of other costs an average student must cover each year, the financial burden incurred by this type of training often becomes insurmountable. For many students, the length of any field school (often between 1–8 weeks) might also cause issues, as it can be imperative that they earn a wage during the summer months to help support them during the school year. Others might be caring for family members or otherwise be unable to travel long distances. Furthermore, demographic imbalances and student personal safety further amplify field project inaccessibility, especially considering "race and ethnicity, sexual orientation, class, and disability" (Heath-Stout and Hannigan 2020:124). For these reasons, both terrestrial and maritime field schools become unreachable goals for many and impossible if students are unsure whether they will enjoy it or wish to pursue the discipline further.

The nature of the field school system reproduces and magnifies inequalities by enabling only students with the requisite financial resources to enroll in these projects and access onsite training, making it easier for only them to enter archaeological careers. Ultimately, this approach does a great disservice to archaeology as a discipline, as well as to the potential students it alienates and excludes. Limiting the number and diversity of students with access to archaeological learning, the current status quo of archaeological training reinforces institutionalized structures of inequality and exclusivity, and also drastically limits the breadth of perspective we may call on as researchers of the human past. By changing how we teach archaeology and archaeological field methods, instructors can develop new, exciting, engaging pedagogical practices *and* help create an increasingly just, inclusive, and well-grounded discipline.

Archaeology in Higher Education

The teaching of archaeology in higher education classrooms primarily focuses on theoretical, technical, ethical, and legislative questions relating to archaeological history. However, as previously noted, much of the ongoing general archaeological training in universities relies on didactic, lecture-based methods: a surprise given archaeology's inherently practical and active nature. Hands-on approaches can become highly effective devices to encourage intricate problem-solving in student-centered archaeology classrooms. However, original activities can be challenging to develop, necessitating considerable time commitments and, often, numerous efforts before becoming a fruitful and dynamic learning instrument. In addition, effective methods frequently remain unshared. Ideally, however, teaching ideas and resources would be shared with as large an audience as possible for them to be adapted and revised to fit diverse academic situations and instructors.

Educators of maritime archaeology in higher education classrooms have developed a number of teaching approaches, many of which promote engaged, hands-on learning and are often available online, for no additional cost to their degree. While there is still a strong primary focus on the ethical, legal, and methodological aspects of the field that affect research on underwater and/or coastal sites, teaching objectives often emphasize the historic and cultural implications of humanity's relationship with the sea, frequently touching on the practical elements of search and survey practices as well as logistics and excavation strategy. These aims require students to grasp a wide variety of terrestrial and underwater methods like archival research, traditional hand surveys (such as tapes and offsets), photogrammetry and other 3D recording methods, and excavation, all of which are vastly improved by utilizing the integrative method described here. Instances of these forms of teaching are relatively commonplace. For example, the Maritime Archaeology Trust (MAT) provides many 3D photogrammetry models (n.d.) with which students of all levels can engage. The Global Foundation for Ocean Exploration (n.d.), in conjunction with the National Oceanic and Atmospheric Administration (NOAA), has also created a selection of hands-on digital activities (primarily offered for K–12 students) that can be easily modifed to provide engaging, experiential approaches introducing university-level students to practical maritime archaeology methods, such as photogrammetry. Kinesthetic activities for maritime archaeology classrooms have also become more accessible, with highly effective approaches such as MAT's "Make Your Own Coracle" (Maritime Archaeology Trust 2020) and NOAA's "Mock Shipwreck" (Thompson n.d.) allowing students to actively experience the discipline's sensory nature without engaging in an underwater field school.

The Micro-Site Pedagogical Approach

In the Fall 2021 semester, the class "Maritime Archaeology: The Salty Relationship Between Society and the Sea" ran in the Brandeis historical archaeology laboratory. It introduced students to the concepts, principles, methods, legislation, and ethics relevant to maritime archaeology. As such, it utilized an integrative pedagogical method to engage students to build their own research project focusing on data provided for their study. Concept development for the Micro-site Simulation Research Project program began in the summer of 2021 with the construction of three micro-sites (with a fourth constructed in Spring 2023) funded by the Brandeis University Center for Teaching and Learning. The project was later developed into a smaller, simplified terrestrial version of the micro-sites project during the lab-based class ANTH 60b: "Archaeological Analysis." The terrestrial version of the approach (Figure 1), designed to introduce students to basic archaeological methods and approaches, consisted of four weeks of teaching time rather than an entire semester. In order to preserve confidentiality and allow for continued use of micro-sites within future teaching, further details regarding site construction and teaching approaches have not been included here. However, a teaching blueprint, including all details relating to site construction, artifact acquisition, class scheduling, and assignments, will be made available to instructors via email correspondence with the author, who would be delighted to share.

Figure 1. the three four-week-long, terrestrial micro-site projects.

Each of the micro-sites consists of self-contained scale models of an excavation locale demonstrating relevant archaeological materials. Additional information on the semester-long projects, such as the site scale, datum points, and their imagined geographic coordinates, were also provided to students in a "Site Narrative" information pack.

Four-Week-Long Micro-Sites; ANTH 60b: "Archaeological Analysis"

Brandeis' ANTH 60b: "Archaeological Analysis" is a lab-based course that introduces students to the basics of archaeological laboratory analysis using authentic historical artifacts from an archaeological site. As many of the students who enroll in the class have never taken any archaeology classes before, it is imperative that they understand archaeological recovery procedures and stratigraphic theory in detail before being allowed access to artifact collections. Therefore, the motivation behind micro-site construction for this class was to provide a (relatively) quick, engaged learning experience to ensure students gain a thorough understanding of the importance of provenience and context. With this in mind, rather than employ didactic learning, which can have varied information absorption rates, three micro-sites were constructed using easily accessible materials modeling varying locations, stratigraphy, and artifacts.

After two introductory lectures on survey and excavation methods, students in groups of 3 or 4 began surveying their sites using photographic recording methods and hand-drawn mapping techniques. Once this stage was complete, they were able to begin excavation using “shovels” (in actuality, long-handled ice-cream spoons sourced online) and sifters (stainless steel, double-sieve honey strainers), then map the found artifacts (again sourced online from brands such as Lego and Playmobil) using miniature plumb bobs, mason lines, and small hand tapes as well as fabric tape measures. Each group was responsible for collecting, photographing, cataloging, and recording artifacts; developing their own site catalog; and drawing excavation plans and profiles. Documenting all the information they gathered allowed them to solidify their learning, ensuring each student absorbed vital information and developed skills they may not have gained in lecture-based classes, and ensured their careful treatment of artifact provenience when allowed to access the teaching collection.

Semester-Long Micro-Sites; ANTH 124a: “Maritime Archaeology: The Salty Relationship Between Society and the Sea”

The maritime micro-sites each consist of confined, scaled shipwreck models sunk in transparent acrylic tanks and held in place with a clear resin. The tanks were filled with sand, and a nail was placed near the wreck and in each corner of the tank, demarcating the site’s datum points. The model shipwrecks (Figure 2) were built to represent three historically accurate (as much as was possible) ship designs and given code names to hide their identities from the students: (1) Datum, (2) Scuba, and (3) Compass.

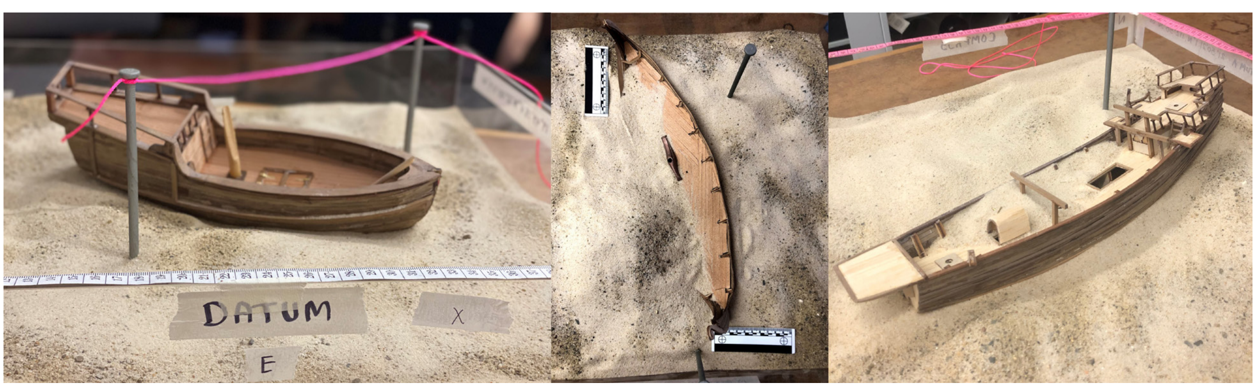

Figure 2. Three of the semester-long, marine micro-sites; (left to right) Datum, Scuba, and Compass.

Additional information on the semester-long projects, such as the site scale, datum points, and their imagined geographic coordinates, were also provided to students in the aforementioned "Site Narrative" information pack, which described site information and hints. The pack included material such as site orientation, location (coordinates for each datum point), and radiocarbon dating results, all of which were crafted to drip-feed information to the student "investigators" as they collected data via survey, excavation, research, and visualization. Additionally, artifacts (Figure 3) were chosen to fit within the narrative of each micro-site and hidden within the sand. The artifacts, many of which were easily obtained from popular toy brands, were carefully placed within the imagined soil "matrix" to represent unique underwater site formation and deposition processes (Muckelroy 1976), creating an opportunity for students to examine and discuss ship use, taphonomy, and wreck degradation in maritime environments. For more information concerning procurement (e.g., ships and artifacts) and site narratives, readers are encouraged to contact the author for access. As of Spring 2023, the instructor was still attempting to develop effective, comprehensive techniques for demonstrating underwater environments, site formation, and environmental effects.

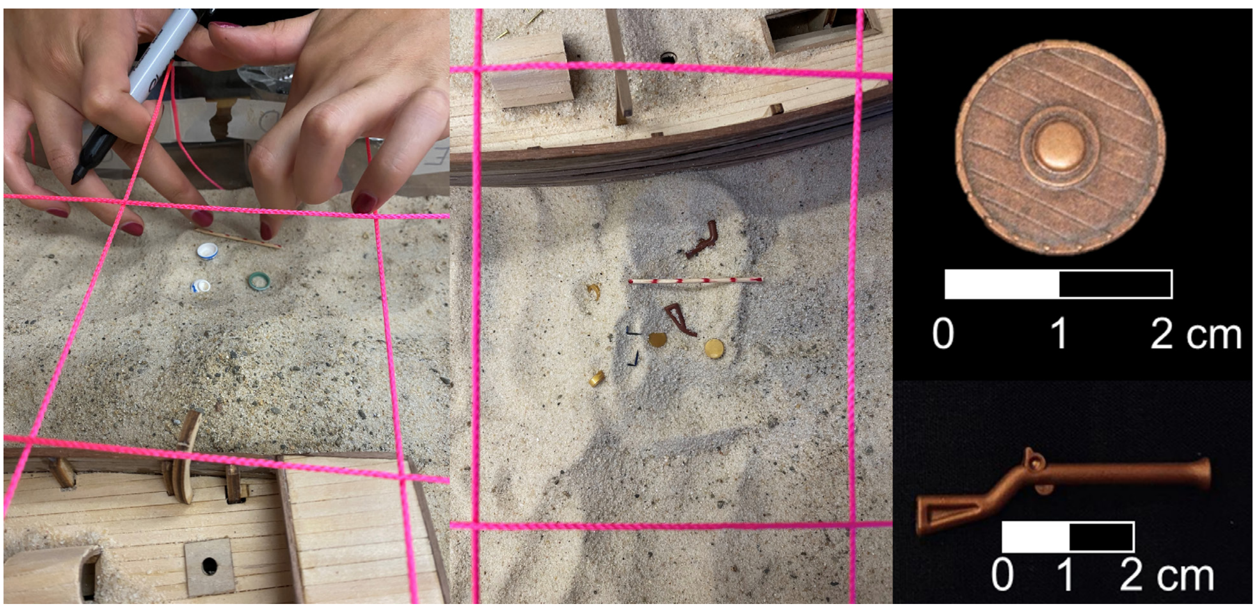

Figure 3. A subassemblage collection of artifacts excavated from the projects.

Successful completion of the semester-long Micro-site Simulation Research Project was comprised of four steps: (1) data collection, (2) research, (3) reflection and data analysis, and (4) tendering a compendium of research to document their work. The class structure involved a series of weekly lectures, workshops, and hands-on laboratory surveys and excavation activities. Assignments were based on practical proceedings, ensuring students could implement their taught skills, thus solidifying skills learned in the classroom/lab. Assessments were further designed to demonstrate their absorption rate as well as to allow the instructor to monitor student progress, ensuring their research was advancing effectively and appropriately.

The assignments/developed skills include documentation of data in a field journal, research, archaeological survey and mapping, generation of outputs using Geographic Information Systems (GIS) and Adobe Illustrator, site photography, photogrammetry, creation of 3D visualizations, development of applications for funding, and community engagement activities in the form of website creation for dissemination.

Class and Assignment Format

Initial testing of the semester-long micro-sites project began during the 2021 Fall semester and has since been offered again in Spring 2023. At the start of each semester, the class format utilized didactic lecturing to give students background information on the discipline and situate them within the topic. These introductory lectures focused on examining the history of archaeology and maritime archaeology, the methods and techniques used, and the ethical considerations involved in conducting archaeological and underwater archaeological work. In addition, activities ran concurrently allowing students to test these approaches in class. For example, in the “Find a Shipwreck” activity, students used Google Earth to discover and explore extant shipwrecks around the world, researched them and their local environments, and then returned to the class to report and discuss their discoveries.

One of the significant drawbacks to this approach in teaching maritime archaeology lies in its inability to simulate the experience of underwater archaeology and, in particular, scuba diving. While it would ultimately be wonderful to take students to a pool and perhaps simulate underwater excavation in that way, an alternative option was developed using the “Mock Shipwreck” activity mentioned earlier as a guide to help students imagine an “underwater” survey. Students were instructed to survey a created “site” (a number of random items placed on the floor). In groups, they were given the “depth” of their imagined excavation and a time limit to which they had to adhere in an attempt to replicate some issues that arise while diving at depth. Furthermore, groups could not communicate verbally, but only by using diving sign language. As a consequence, extreme dismay resulted from anyone accidentally using the “thumbs up” sign to mean “OK,” as it necessitated both the diver and their buddy diver having to come to the surface and wait the allotted time before they could “submerge” again. These early classes and the scuba simulation activity described above create opportunities to discuss the impact of underwater environments on practical survey and excavation methodologies and provide critical moments to introduce the significant activities and assignments undertaken during the semester (both during class and in their personal study time).

As the semester progressed, students were divided into groups and assigned a micro-site per group. The lecturing format then gave way to applied workshops and hands-on laboratory activities that detailed practical applications for the various techniques and tools used throughout their projects (e.g., photogrammetry and 3D visualizations, GIS, and Adobe Illustrator). Each of the workshops and activities, as well as various guest instructors, were selected to aid students in completing project assignments. These assessments included several components:

A group field journal: Beyond the more obvious, traditional reasons that archaeologists keep field journals while working in the field, this relatively minor weekly aspect of the assignment schedule became vital to the success of the project as it allowed the instructor to keep abreast of the research, data analysis, and theories that each group of investigators was developing week-to-week. Since students completed the journal online, it also provided opportunities for the instructor to give hints and direct student research approaches, allowing them to refine their theories, discuss methods and tactics, and reach weekly goals. Furthermore, this assignment provided an ideal space for students to reflect on their approach and data regularly.

Archaeological survey and mapping: Having been introduced to traditional survey methods during lectures earlier in the semester, students became engaged in designing a project survey plan, problem-solving issues, and working out how best to map and draw their sites. Ultimately, most groups utilized tapes and offsets to map their sites and fabricated a grid system to triangulate point locations using the datums.

Figure 4. Excavation of a micro-site.

Excavation: Once the site surveys were complete, students further developed their project agenda to include excavation methodologies and, using the grid system, excavated their wreck by quadrants (Figure 4). Generally, students could employ the tools used during authentic excavations (such as tapes, leaf trowels, and brushes).

However, because the excavation was occurring in the lab, some imagination was required to simulate equipment that would not have small-scale equivalents (such as, teaspoons instead of trowels, mini sieves instead of fullscale sifters). During this stage, students uncovered the artifacts hidden within the sand, which they recovered, “curated,” bagged, numbered, and analyzed while inputting the data into a site catalog. As was expected, the practical excavation aspect of the class was extremely popular with the students, with one stating, “I learned a lot about how fieldwork works! The fact that we went through the entire excavation process? Really cool!” (anonymous student, 2021).

Geographic Information Systems (GIS) and Adobe Illustrator: This was potentially the most complex and challenging aspect of the teaching project, as GIS can be notoriously tricky and temperamental. However, after a few false starts with software issues in various computer labs, students spent several sessions learning the basics of GIS and Illustrator software approaches. During this period, students were encouraged to research their sites’ wider natural and historic environments, including any areas or other sites that may be relevant to their site. The following steps involved students employing both platforms first to digitize and geolocate their survey map using the coordinates they received at the beginning of the semester and then mapping the artifacts discovered during excavation.

Site photography, photogrammetry, and 3D visualization: Site photography and photogrammetry are well-established areas of maritime archaeology recording practice (Figure 5). Exploiting Brandeis’ dedicated experts in innovation and technologies at the MakerLab, students received instruction on 3D photogrammetry, enabling them to build a 3D reconstruction of their sites using Reality Capture and Metashape; this aspect of the project built student-directed outputs while under supervision.

Figure 5. *Left*; students photographing the micro-site code-named Scuba for photogrammetry; *right*, an image still taken from a student-developed 3D visualization of the same site.

Research compendium: Students were given the opportunity to decide what form their final research compilation would take. Choosing between completing a written report or creating an online museum website focused on information dissemination designed to showcase their research project and wreck site allowed students to direct their efforts accordingly. Using this approach, two of the three groups chose to complete a dissemination website in which students effectively integrated the outputs they had developed throughout the semester, assimilating research data and visualizations.

Additional items: In 2023, students were permitted to apply to the instructor for "additional funding" to complete further testing. Two of the three groups wrote an application describing their chosen analysis method (radiocarbon dating and dendrochronological analysis) and the potential data that they hoped to access. Both groups "won" additional project funding and were provided radiocarbon and dendrochronological data to further add to their site narratives.

Student Feedback

After the class grades were listed at the close of the 2021 and 2023 semesters, the students were invited to complete an anonymous survey designed to elicit their experiences and feedback after undergoing the teaching methods described above. This aspect of the study has received Brandeis University IRB Protocol Approval (approval number #23110R-E). Students (all over 18 years old) were provided with Informed Consent documentation and asked to participate if they felt comfortable. The response rate after each semester was over 90% (91.67% in 2021 and 90% in 2023). Of these, 27.27% in 2021 and 44.44% in 2023 had previously taken formal coursework in archaeology and none in maritime archaeology, reflecting the department-led program of practical teaching methods designed to increase archaeological student enrollment.

Of the activities and assignments, GIS was commonly distinguished as the most challenging for them. This difficulty was partly due to the complexity of GIS as a platform and, admittedly, partially due to institution-wide technical difficulties encountered during the semester. Most students, however, strongly agreed that the kinesthetic, experiential approaches in which they engaged through the semester (such as the hands-on activities, excavation of the micro-sites, research, and data analysis) allowed them to gain a "much better understanding of archaeology as a science" (anonymous student, 2021). Ultimately, most students (82.6%) stated that this class and the Micro-site Simulation Research Project helped them gain an accessible understanding of archaeological methods and independent research.

Furthermore, over 90% of the 2021 respondents stated that their experiences in this class allowed them to engage successfully and actively with the class materials, gaining a deeper understanding of the topic and advancing their critical thinking and cognitive flexibility. When asked to rate their experience of the class and its impact on knowledge building, the Spring 2023 survey results, which are considered a more accurate diagnostic group due to fewer COVID-19-related disruptions, showed a very positive trend. Further confirmation of this optimistic trend came in the freeform comments from both years;

- "ArcGIS was extremely difficult to learn, but I ended up teaching a lot of people how to place their boats into the site. I found that when I taught something, I felt like I understood it more" (anonymous student, 2021).
- "I learned how to use new technologies that I wouldn't have another chance to learn unless I actually end up going to field school. I really enjoyed working with my group, even if wrangling them was sometimes like herding cats. I learned that I really like sticking my hands in dirt and researching artifacts, so maybe that'll help me figure out what I want to do when I graduate" (anonymous student, 2021).
- "I enjoyed the fact that we did most of the learning ourselves and we were expected to solve our own problems. I think because of this I got more out of the class" (anonymous student, 2023).
- "This class was super fun and fully met my expectations. I had a great time creating our method and excavating and making the website and learning all that goes into running a site, even if it wasn't underwater" (anonymous student, 2023).
- "This class gave me lots of good introductory experience to field concepts and it was a fun and interesting way to learn and use these skills" (anonymous student, 2023).
- "The class was very hands on and much of the learning was done in real time as we excavated the sites. The class was also very dependent on the amount of effort we put into it and we could see the fruits of our efforts" (anonymous student, 2023).

These comments suggest that, while still in its early stages, the micro-site project shows promise and provides, among other things, a guided opportunity for students to develop their skills and confidence.

Discussion

Increasing accessibility to field skills is swiftly becoming vital to terrestrial and maritime archaeology. Engaging diverse groups of students from a range of backgrounds increases the cohort of interested and enthusiastic archaeology students whose diversity of perspectives will help develop scientific archaeology into a more precise, objective, just, and inclusive discipline. The direct, practical benefits of using an integrative approach that employs didactic, Socratic, and facilitative methods to combine lecture, discussion, and experiential/hands-on tactics are clear for students. In addition, developing teaching environments in which learners utilize independent learning strategies—in this case, via *student-driven* groups *guided* by the instructor—

can facilitate the development of essential skills that directly benefit students throughout and beyond their university careers.

During ANTH 124a and their work on the Micro-site Simulation Research Project, students demonstrated tangible improvement in Executive Function (EF) skills. Scaffolding classes, activities, and assignments using equity-minded, transparent teaching styles and facilitated tasks helped guide students toward critical thinking and cognitive flexibility. The long-term applied benefits of the approaches described here promote a practice of professionalism and allow students to become effective project managers: organizing their time, developing resilience to research challenges, designing or redesigning their methodologies to fit their objectives, and analyzing datasets to develop inferences by themselves. In addition, granting students the flexibility and self-directed learning typically developed during fieldwork, but in this case through the kinesthetic, experiential assignments and activities encompassed within the Micro-site Simulation Research Project, helped students acquire representative experience analyzing and visualizing real-world data. Finally, designing methodologies and approaches meant that students were actively working on the research frontier while also provided with the opportunity to develop skills and knowledge they likely would only gain during an expensive or hard-to-find field school.

The challenges of this sort of pedagogical approach are comparable to those confronted by other archaeology classes. Many of the students enrolled in this class had no experience in anthropological or archaeological methods, so some students required more assistance than others. The time necessitated by this increased attention might make replication of this approach unfeasible for larger classes, which have limited contact hours. Additionally, due to the character of the Micro-site Simulation Research Project, the instructor must have the ability to construct the micro-sites themself, as well as detailed knowledge of fieldwork practices in order to aid students in solving methodological and research complications. In the future, classes will include student peer-to-peer reviews to alleviate some of these issues. The use of peer-to-peer assessments will accomplish two aims; firstly, it will delegate some feedback responsibility to students and away from the instructor, and secondly, it will permit students to engage with other groups' research and different micro-sites, as well as to support each other.

Future Aims and Improvements

The future opportunities and aims for this experimental, experiential teaching project are broad, including—but not limited to—the development of new Micro-site Simulation Research Projects, potentially including airplanes and submerged settlements. Further development of the activities and assignments described here are continuously ongoing.

Due to the problematic lack of diving within this teaching method and given additional issues with transferring generic diving skills to the specific requirements of scientific diving, in the future the instructor intends to attempt some additional lessons stressing the importance of diving health and safety during maritime excavations. Discussions in this area could, among other topics, consider safe diving practices at different types of sites in varied depths and environments, possibly engaging with the Occupational Health and Safety Administration (OSHA) Guidelines for Scientific Diving. Further aims for this project include developing added details in the micro-sites to represent the "submerged" local environments, site formation, and environmental effects, which would allow further discussion of underwater and foreshore ecologies, ocean dynamics, and various other topics.

Conclusion

The primary conclusion of this teaching project is that hands-on/kinesthetic learning practices are appreciated and effective. More explicitly, it is feasible to operate small-scale but active and comprehensive research projects designed for and by students to teach fundamental and introductory archaeological field and project skills in the lab. Student feedback signaled that this was a constructive experience, and many felt so stimulated by this experience that they considered taking their archaeological studies further. However, this study is still constrained by its small sample size. This limitation will be corrected over future years when measured with and against the other abundant applications of experiential learning in terrestrial and maritime archaeology (noted above). Looking toward the future, archaeology programs have a duty to prioritize the provision of equal and accessible opportunities for student skill development, allowing participants to gain the experience required to consider a career in archaeology. Active, kinesthetic assignments, activities, and approaches play a significant role in providing accessible, affordable, and engaging archaeological skills training and preparing students to undertake the applied challenges of research in archaeology.

The Brandeis Anthropology Department is actively developing new, practical approaches to teaching archaeological skills and is collaborating with specialist colleagues who work in environmental sciences, GIS, technology, and innovation, amongst others, to create equitable lab- and field-based training. The micro-sites approach has increased interest in archaeology within the student community, acting as a useful point of engagement. And the Micro-sites Project itself has been a valuable gateway into the subject for students. The Anthropology Department now offers credit-bearing methodological training in archaeology during the semester at no extra cost to students (in money or time), allowing inclusive, equitable, and universal semester-long training in archaeological field methods with few to no additional encumbrances.

Ultimately, the Micro-site Simulation Research Project cannot replace the archaeological field school in its entirety, nor be a panacea for the issue of field training in archaeology or maritime archaeology. However, it does effectively support learning in the classroom, providing students with no prior experience in archaeology with a universal, equitable, and active teaser, or entry point, to archaeological field approaches through which they can decide whether to pursue future training.

Replication note: While details of the Micro-site Simulation Research Project narratives were not shared here to allow their continued use in teaching, the corresponding author would be delighted, on request, to share any and all materials developed during this trial.

References Cited

Bakas, Spyridon
2013 Hoplites and Ancient Greek Battle Fair. From Experimental Archaeology to Experiential Learning. An Insight View of Popularization Methods. *Archaeology and Science* 9:135–140.

Diamond, Adele
2020 Executive Functions. In *Neurocognitive Development: Normative Development*, edited by A. Gallagher, C. Bulteau, D. Cohen, and J.L. Michaud, pp. 225–241. Handbook of Clinical Neurology Vol. 173. Elsevier Science, Amsterdam.

Global Foundation for Ocean Exploration
n.d. Teacher Resources. In conjunction with NOAA’s Monitor National Marine Sanctuary. https://engineeringfordiscovery.org/valor-in-the-atlantic/teacher-resources/

Griss, Susan
1998 *Minds in Motion: A Kinesthetic Approach to Teaching Elementary Curriculum*. Heinemann, Portsmouth, New Hampshire.

Hamilton, Stephen F.
1980 Experiential Learning Programs for Youth. *American Journal of Education* 88(2):179–215.

Heath-Stout, Laura E., and Elizabeth M. Hannigan
2020 Affording Archaeology: How Field School Costs Promote Exclusivity. *Advances in Archaeological Practice* 8(2):123–133. https://doi.org/DOI:10.1017/aap.2020.7

Honey, Peter, and Alan Mumford
1982 *The Manual of Learning Styles*. Peter Honey Publications, Maidenhead, England.

Howard-Jones, Paul A., Skevi Demetriou, Rafal Bogacz, Jee H. Yoo, and Ute Leonards
2011 Toward a Science of Learning Games. *Mind, Brain, and Education* 5(1):33–41. https://doi.org/10.1111/j.1751-228X.2011.01108.x

Karimi, Reza, Cassandra Arendt, Pauline Cawley, Amber V. Buhler, Fawzy Elbarbry, and Sigrid C. Roberts
2010 Learning Bridge: Curricular Integration of Didactic and Experiential Education. *American Journal of Pharmaceutical Education* 74(3):48.

Knox, Liam
2023 Grasping for a Foothold on the Enrollment Cliff. *Inside Higher Ed*. May 12. https://www.insidehighered.com/news/business/revenue-strategies/2023/05/12/grasping-foothold-enrollment-cliff

Kolb, David A.
1984 *Experiential Learning: Experience as the Source of Learning and Development*. Prentice-Hall, Englewood Cliffs, New Jersey.

Maritime Archaeology Trust (MAT)
2020 Make Your Own Coracle. https://maritimearchaeologytrust.org/make-your-own-coracle/
n.d. 3D photogrammetry models. https://maritimearchaeologytrust.org/explore-the-past/interactives/

Muckelroy, Keith
1976 The Integration of Historical and Archaeological Data Concerning an Historic Wreck Site: The “Kennemerland.” *World Archaeology* 7(3):280–290. https://doi.org/10.1080/00438243.1976.9979641

Murdoch, Kath
2015 *The Power of Inquiry*. Seastar Education, Northcote, Australia.

Occupational Safety and Health Administration (OSHA)
1985 Guidelines for Scientific Diving. https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910SubpartTAppB

Patrick, Felicia

2011 *Handbook of Research on Improving Learning and Motivation Through Educational Games: Multidisciplinary Approaches*. IGI Global, Hershey, Pennsylvania.

Silberman, Charles E.

1971 *Crisis in the Classroom, The Remaking of American Education*. Vintage, New York.

Society for American Archaeology (SAA)

n.d.-a K–12 Activities and Resources. https://www.saa.org/education-outreach/teaching-archaeology/k-12-activities-resources

n.d.-b Post-secondary Resources. https://www.saa.org/education-outreach/teaching-archaeology/post-secondary-resources

Thompson, Kate

n.d. Mock Shipwreck. NOAA's National Marine Sanctuary Program (additional information at http://sanctuaries.noaa.gov/education/). https://nmssanctuaries.blob.core.windows.net/sanctuaries-prod/media/archive/education/pdfs/finalmwcurr.pdf

Watson, Anne

2005 Dance and Mathematics: Engaging Senses in Learning. *Australian Senior Mathematics Journal* 19(1):16–23.