Pseudo-clandestine grave identification and excavation laboratory project

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Abstract: When students envision crime scenes and forensic science, they immediately want to find a body and catch a murderer. This laboratory activity goes over how to prepare and execute a mock skeletal excavation that can be applied to most forensic science courses at the university or high school level. Throughout this multi-day, multi-part project, students completed a basic ground survey to locate a clandestine grave, secured a crime scene, excavated a burial, and analyzed a set of skeletal remains. This activity aims to give students hands-on experience using real forensic field and lab techniques. The materials and setup for this activity are usually readily available in any science lab. The project is relatively easy to set up and adjust for difficulty. Students who participated in this activity enjoyed the hands-on aspect of the project and felt more confident in their ability to find and excavate a clandestine grave.

Keywords: mock burial, clandestine grave, forensic anthropology, taphonomy, laboratory activity, bioarchaeology

Introduction

This paper introduces a multi-component forensics laboratory activity/final project in which students locate and excavate a clandestine grave. Detailed instruction and student feedback offered herein will help other forensic science educators implement this hands-on activity in their forensic courses.

When searching Google Scholar and our university's library database for undergraduate forensic laboratory activities, phrases such as "mock burial for taphonomy," "forensic anthropology," or "bioarchaeology" yielded no teaching materials. Likewise, "skeletal excavation" or "clandestine grave laboratory activity" provided no relevant results. There are a few newspaper or university articles highlighting courses that discuss mock graves (1), but no instruction or information for educators is provided. This does not mean that universities do not offer such an activity; instead, there is a need to share such laboratory experiences or instructions so that they are available for educators to use. Genuine, hands-on historical bioarchaeology and archaeology excavation experiences through national and international field schools (2) are available but these opportunities are not accessible to all students for myriad reasons. For example, students from lower socioeconomic backgrounds are less likely to obtain these experiences because excavations are expensive and tend to be outside of the normal academic year when student aid is unavailable (3).

This activity can be adjusted from a high school to a college audience, depending on the course level and student experience needed. This excavation activity can be used in introduction to forensics, forensic biology, forensic anthropology, forensic taphonomy, or any other relevant courses. The course in which we incorporated this project was FORS 3225 Forensic Taphonomy, a junior/senior-level course with prerequisites of introduction to forensic science and forensic biology. We have also used this laboratory activity in forensic anthropology as well as during a high-school forensics summer camp.

Materials and Methods

You will need access to an outdoor space with little to no foot traffic. This outdoor space should allow you to be able to dig and destroy the grass/vegetation during this project. Our university has access to 9 acres of woods and open green space with a small hiking trail. We contacted our security and physical plant before carrying out this project. We were given free rein regarding the space because no one was maintaining the space during that semester.

After receiving permission from the university, we went to a random location off of the hiking trail and buried a disarticulated plastic teaching skeleton one month before the final project. The location was marked using Google Maps by pulling up the current location on the GPS location on my phone. This GPS information was submitted to our campus police and the physical plant.

This project was a multi-day activity (two days in the field and one day in the lab) because our labs are only four hours long and more time is needed to complete the full project. This was a rain or shine activity, increasing the realism of the final project. This final project was treated like an actual body search.

Day 1

Each group was given a field kit. The students signed out the field kit and were responsible for seeing that their field kit returned to the lab with all of the equipment inside. We also brought a standard archaeological sifting screen (1/4" wire screen), three plastic 5-gal buckets, a rake, a shovel, four fence stakes, and flags. Field kits contained the following:

1. Trowels x 2
2. Gloves x 2 (nitrile and leather)
3. Handheld broom
4. Tape measure (100m)
5. North arrow
6. Scale
7. Dust pan
8. String, scissors, tape
9. Small brushes
10. Sharpie
11. Collection bags
12. Soil bags
13. Crime scene tape
14. Small stakes
15. Composition notebook
16. Camera

Students received an aerial map of the trail with marked quadrants (**FIGURE 1**). Students were split into groups of two and assigned a quadrant. The students used basic ground surveying techniques to identify potential evidence and note changes in the soil to identify potential clandestine graves. Evidence and potential graves were marked using marker flags. Students were responsible for keeping all logs/notes, rough sketches, and photographs in their lab notebooks which were collected at the end of the project.

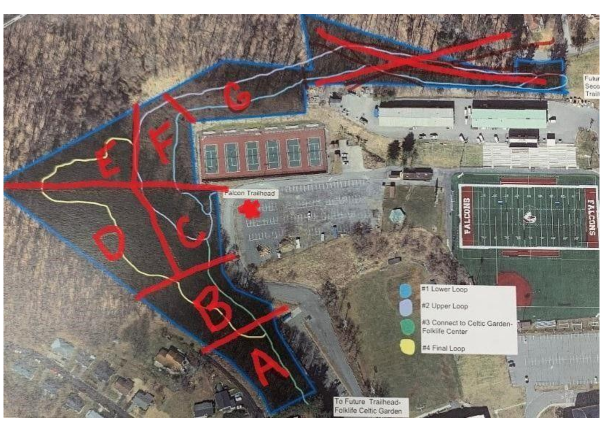

FIGURE 1 Area map students received with the quadrants marked.

Once students finished the ground surveys we regrouped and walked through each marker as a team. We worked through each piece of potential evidence and the potential graves. Students worked as a group and eliminated all spots that mimicked a potential grave (e.g., locations with disturbed soil or a different color/texture soil compared to the surrounding soil). This cohort was able to identify the correct placement of the potential grave and then secured the scene. To keep the experience realistic, we never confirmed that this was the placement of the grave, but instead insisted on their ability to combine everything they have learned during their degree to continue or discontinue with the location.

The students placed stakes and crime scene tape in a 20' x 20' area noting the location of the potential grave and crime scene. After taping off the scene the students completed a ground survey, took photographs, marked evidence, sketched the location, and bagged evidence. This was all we had time for during the designated lab time. We kept the crime scene tape up and returned to the scene during our next meeting.

Day 2

We returned to the site with the field kits, sifting screen, plastic 5-gal buckets, rake, shovel, and footprint impression kits. Students recorded any changes that occurred during the 48 hours they were away, and then they marked the outline of the potential grave with string and began excavation. Students first removed the topsoil and sod, taking their time to identify and find the ground surface (paleosurface in archaeological context) in which the skeleton was placed. After the top soil was removed, impressions were taken (footprints, shovel, etc).

Student teams rotated through the various excavation tasks. One group shoveled, one group troweled, one group sieved, and the third group was on bucket duty moving the soil from the excavation to the sieving group. Students tend to want only to trowel, so it is always important to have students complete all of the excavation activities to gain broader experience.

When major landmarks were met, we stopped the group and quizzed them on the next steps. When the vegetation was removed yielding no physical evidence, we paused the activity and asked the students to point out what they observed. This brought in concepts of the Harris Matrix (stratigraphic layers) (5), Munsell soil charts (6), insect presence, color/texture of the soil, and the outline of the potential grave. Once this was completed, students recorded their rough sketches, photographs, and notes (**FIGURE 2**).

FIGURE 2 Students record the site after removing the vegetation and exposing the soil. The yellow arrow indicates north.

Students were instructed to excavate the grave only and expose the skeleton in situ while maintaining consistent layers and avoiding deep penetration of the soil so they did not lose evidence. Once the bone was visible, students ceased using trowels and moved to brushes, picks, and gloved hands to protect the integrity of the skeleton. Once the skeleton was fully exposed in situ, students completed measurements (depth and grave size), sketched, and photographed. The skeleton was then extracted. Students packaged the skeleton in paper evidence bags and all other visible evidence was collected, including soil samples. Soil samples were taken of the grave cut, at the abdominopelvic region, and outside of the grave. Soil samples can be used to determine the chemical properties of the soil, pathogen presence, soil microbe presence, and finally as class evidence. Once the skeleton and all evidence were removed, students continued excavating to identify the grave cut and looked for remaining pieces of evidence. The grave cut shows potential shovel imprints, how deep the grave initially was, and any evidence that may be placed under the individual. Students photographed and recorded the data.

When finished we filled in the hole and cleaned up the scene. All evidence and materials were returned to the lab for the third part of this activity.

Day 3

The final part of this project was processing the evidence and attempting to identify the individual. This lab component consisted of the following:

- Performing a complete skeletal inventory
- Recording basic osteometric and demographic information on the skeleton (7)
- Sorting through evidence and sending it to the appropriate lab section
- Determining if the skeletal information 'matched' any of the missing person's details

Once the project was complete the students submitted a case report analysis of their fieldwork and lab results along with their rough sketches, photographs, and notes from the crime scene.

We used a simple rubric to grade the students at the end of the semester (**TABLE 1**).

TABLE 1 *A very simple grading rubric that can easily be adapted and expanded to grade this project.*

Item	**Points possible**	**100%**	**50%**	**0%**
Participation	20	Punctual, patient, active in all activities	Late to the field, had to be told to be engage in activities	Skipped class, did not participate
Rough sketches	20	Completed measurements and drawings in the field, sketched relevant materials, measurements and legends present	Did not complete sketches in the field, missing some measurements, missing some legends	Did not complete any sketches
Photos with figure legends	20	North arrow present, descriptive legend, photos make sense	Missing north arrow, missing some description, photos are cut or unusable	Did not take own photos or did not submit photos
Case report	40	Detailed descriptions of the activity, no errors, logical, easy to follow	Some grammatical errors, report is not easy to read, poorly described	Did not submit or only a few sentences long

The students were given a short five question survey on their experience one year after the project.

Hazards and Safety Precautions

Students should wear appropriate field clothing (long pants. shirts, hats, and closed-toed shoes). Depending on the location and time of year, students should be encouraged to use insect repellent and sunscreen, and to inspect one another for ticks. Also, ensure students pay attention when walking through high grasses and on uneven terrain as they can be bitten by animals or fall and get injured.

Also, it is ill advised to use real human skeletal material to carry out this project for ethical reasons. Bury a plastic skeleton or animal bones and swap out the bones for real human skeletal material during the laboratory analysis if necessary. We continued using the fake skeleton during the laboratory section.

Results

This activity allowed students to apply all of the information they learned throughout the semester and call on materials learned in their previous courses (e.g., forensic biology, trace analysis, and introduction to forensic science). The average grade for this project was 90.25% (n = 8). Full grade distribution in **TABLE 2**. Points were commonly deducted for photos without the north arrow present, completing partial rough sketches in the field, and case reports had some grammatical errors. Participation was high and inflated the scores, decreasing the score for the student who received a D. Due to these observations we adjusted the rubric in **TABLE 1**.

TABLE 2 *Grade distribution of the final project.*

Item	Grade
Max value	100
Min value	65
Average	90.25
St. deviation	11
Letter distribution	A 90-100%: 5 B 80-89%: 2 C 70-79%: 0 D 60-69%: 1 F 0-59%: 0

Students were asked five open-ended questions about their experience with the final project. Six out of eight (75%) students responded. All of the students who responded remembered the final class project with one student replying "Yes, I remember the final project! I talk about it all the time."

Students were also asked about their favorite and least favorite parts of the excavation project. Overall, 100% of the students that responded stated that their favorite part was finding the body and excavating. The least favorite part varied, with 50% of the students stating that it was navigating the terrain, 33.3% stated it was the instructor not confirming the location of the body, and 16.7% said it was doing the ground search but they stated "I understand that it was to simulate a real-life scenario."

The final questions in the survey asked if students 1) felt the activity increased their confidence in locating and excavating a clandestine grave and 2) increased their confidence in forensic taphonomy. One hundred percent of students stated they felt this activity increased their confidence in locating and finding a clandestine grave. One student commented, "I feel like this class as a whole helped my confidence to excavate graves. Overall, by being able to be hands-on helped me learn what to look for and made me feel better as a whole about the topic." One hundred percent of students also stated they felt more confident in forensic taphonomy. Students stated the following: "It increased my confidence because I wasn't just cramming and forgetting knowledge like I usually do for classes;" "Being able to work as a team made us all more alert and aware of what to look for. I really enjoyed the project and feel like it helped pull the whole class and everything we learned during the semester together." Based on grades and survey results I believe students enjoyed the hands-on aspect of this project and felt it was relevant.

Discussion and Conclusion

This final project consisted of three days of hands-on, real-life experience finding and excavating a clandestine grave through simulation. Overall, students excelled on this project with the average grade being an A. Students enjoyed the immersive and applied feeling of this activity.

Set up and preparation for the project should be done in advance as it takes a few hours out of your day to hike and bury a skeleton. Depending upon terrain and soil type (e.g., dense clay) with respect to the physical capabilities of the instructor, the burial may require assistance or delegation. This paper reports upon a small class (n = 8); a larger class or multiple sections will require multiple burials to give all students the same experience.

This project can easily be adjusted to be more or less advanced. For example, we have scaled down this activity to use it during a middle school summer camp within a 1.5-hour time block and reused the same hole for each group. In this instance, we used a flat, grassy area beside a parking lot to improve accessibility and time efficiency. Moreover, the activity can be tailored in difficulty based upon the amount of struggle the students are permitted to encounter before rendering assistance with instructor guidance.

Students can get professional training from various institutions such as the University of Tennessee Knoxville, DITA Academy, and Western Carolina University, but again this leads us back to the feasibility of students being able to afford these courses (3) and receive college credit. The mock grave excavation activity is practically free of cost if you have access to a fake skeleton. The excavation kits can become expensive but are not required. Small gardening tools and paper lunch bags can easily be substituted for excavation trowels and paper evidence bags.

Limitations for this project include set-up time and if students are unable to participate due to the terrain. Philips and Gilchrist (7) mention protocols and inclusion activities for persons with disabilities. The activity can also be adjusted for difficulty by assigning groups to the field or lab. This project lacked a control group, thus there is no comparison of learning outcomes with an alternative activity. Nevertheless, alternatives to actual excavation are seemingly limited.

According to Larson et al (8), there is a need for more scientific methodology in forensic investigation of clandestine graves. We believe that exposing students to hands-on excavation techniques early in their careers allows for a better-trained graduate and forensic investigator.

Acknowledgments

We would like to thank Dr. Greg Popovich, Fairmont State University, and the students who participated in this course.

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