

Building miniature crime scenes offers a cumulative, content-rich, project-based learning experience for introductory forensic science students.

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Abstract: This paper presents a cumulative, content-rich, project-based learning experience for a college-level introductory forensic science course. The project was inspired by the Nutshell Studies of Unexplained Death created by Frances Glessner Lee in the 1930s. Students were required to create their own miniature crime scenes at a scale of one inch to one foot. They conducted research over extended periods of time, designed their scene using CAD or Revvit, wrote supporting documents based on their case scenario, gave Google Slides presentations, and constructed three-dimensional work products in the school's makerspace. This project emphasized the essential "4 C's" of 21st century global skills: communication, collaboration, critical thinking, and creativity; and culminated in a Science and Technology Showcase at the end of the school year. Caveats included time limitations due to short class periods and the use of a shared makerspace. The students gained in-depth knowledge of crime scene analysis and death investigation, and were highly engaged throughout the process.

Keywords: Active learning, Nutshell Studies of Unexplained Death, Death investigation, Crime scene, Project-based learning

Introduction

The Nutshell Studies of Unexplained Death, miniature dollhouses depicting death scenes at a scale of 1 inch to 1 foot, are the work of a Chicago heiress and grandmother named Frances Glessner Lee (1878-1962) who became known as the "mother of forensic science" (1). Though Lee was very wealthy and was educated at home by private tutors, she was not allowed to attend college or pursue a career since her traditional parents believed "a lady didn't go to school" (2).

Lee took an interest in forensic medicine through her friendship with Dr. Burgess Magrath. Lee strongly believed that death investigation should be more scientifically sound and that the medical examiner system should replace the coroner system (2). In 1931, Lee provided funds to Harvard University to hire a Professor of Legal Medicine to train doctors to become medical examiners (2). In the 1940s, Lee built her now famous miniature death scenes as a training tool for law enforcement officers so they would "recognize and preserve evidence critical to solving the case" (2). These models became essential training tools used at the twice yearly Frances Glessner Lee Seminars on Legal Medicine at Harvard University, attended by police officers from around the country (2). She named them after a police saying: "Convict the guilty, clear the innocent, and find the

truth in a nutshell" (2). All of the nutshells are based on actual cases investigated by Lee, Magrath, and other police colleagues of theirs, and the models are extremely accurate and detailed. Since it is not possible to solve the cases based only on the visual evidence at the scene, the nutshells are not meant to be "whodunits," but to give the investigators an opportunity to observe and evaluate potentially valuable evidence and to underscore the importance of communication between the police, medical examiners, and forensic scientists at the scene and at the lab (2).

At the training seminars, police officers were given a few relevant facts and, based on these facts and their own observations, were asked to determine whether the manner of death was homicide, suicide, or accident (2). In contrast with the traditional use of miniatures as a feminine undertaking, Lee's scenes "challenge the association of femininity with domestic bliss...[She] featured victims such as women, the poor, and people living on the fringes of society whose cases might be overlooked or tainted with prejudice on the part of the investigator" (1). After the exhibit at the Renwick Gallery, the models were returned to their permanent home at Baltimore's Office of Chief Medical Examiner (answer keys safely locked away), where they are still used as training tools for homicide investigators (3).

In January 2018, the Nutshell Studies were put on exhibit at the Smithsonian's Renwick Gallery (3), and the exhibit was the subject of a news report on CBS This Morning (4). These reports were the impetus for the project presented in this paper. Staten Island Technical High School has offered an introductory course in Forensic Science since 2007. Staten Island Technical High School is one of New York City's specialized high schools. The students are generally high-achieving and must take an entrance exam (the Specialized High School Admissions Test or SHSAT) in order to gain admission. The environment at the school is highly competitive. Forensic science is a full year, college-level elective course that serves as a laboratory- and case study-based overview of forensic science. Students are required to complete approximately 10 laboratory activities, analyze case studies, maintain a laboratory notebook, and to conduct research over extended periods of time and integrate and evaluate multiple sources of information.

Prior to 2018, the final exam for the forensic science class was a full-scale crime scene that students had to analyze as a class. The students taking the crime scene final were broken into several teams, with each team responsible for a particular task (fingerprints, hair analysis, etc.), and they spent an entire school day analyzing the crime scene and presenting their collective results. In 2017-2018, with three classes totaling over 100 students, a single crime scene would not suffice, so an alternative final project was needed.

Project-based learning uses projects as a means to teach content, rather than a demonstration of knowledge or skills previously learned. A project does not necessarily have to come at the end of a unit--an entire unit can be built around a project type assessment, or the project can be used as a culminating task incorporating several topics or units, which is the approach taken with the SI Tech Nutshell Studies. As a frame of reference, the students had already learned the following units by the time the Nutshell project was assigned: introduction to investigation, eyewitness reliability, crime scene processing and evidence examination, physical matching, evidence admissibility, impressions (including fingerprints, shoe prints, tool marks, firearms), and trace evidence analysis (including glass, paint, hairs, and fibers). During the course of the project, units on serology, bloodstain pattern analysis, DNA analysis, and death investigation were also completed.

One of the major benefits of project-based learning is the opportunity to build the students' higher order thinking skills. The tasks that students complete in class can be categorized into the following levels according to the revised (2001) Bloom's Taxonomy: Remember, Understand, Apply, Analyze, Evaluate, or Create. While students should complete tasks at all levels, most tasks in school are centered around the first three levels, and it is challenging to design lessons in which students complete

tasks at the higher levels of analyze, evaluate, and create (5). Collecting evidence and analyzing the final crime scene, for example, would be at the apply and analyze levels, but does not reach the levels of evaluate or create. In addition, many projects that teachers assign may seem creative or look like project-based instruction but in fact lack substantial learning for students (6). The key to effective project-based learning is to avoid using an "activity-oriented design. Instead of focusing on the desired learning outcomes, this approach merely seeks out tasks that might be fun or at least keep kids busy. The activities, though fun and engaging, don't lead anywhere intellectually [and] lack an explicit focus on important ideas and appropriate evidence of learning" (6).

The goal of the project presented here was twofold. First, the students had to conduct research on an actual case, with a focus on death investigation and crime scene analysis. Building a nutshell required in-depth background knowledge as well as critical thinking and creativity on the part of the students, similar to the knowledge and creativity required to set up a realistic crime scene. The difference is that the students would be the ones exercising these higher order thinking skills, rather than the instructor. Second, the nutshells that the students built had to be sufficient quality to be used as teaching tools the following year, so that future students could analyze them in the same way as investigators at Lee's biannual seminars (and now at the Baltimore OCME) have done.

Learning by doing, and practicing skills and applying knowledge in a real-world setting has gained much attention in recent years, though traditional classroom learning with the teacher as dispenser of knowledge does not incorporate this idea. Shifting the role of the teacher so that it more closely resembles that of a coach "puts the ownership of the learning process in the right place, squarely on the shoulders of the learners" (7). "The deepest learning often occurs when the context is meaningful and not just when the content is memorized to achieve an external award" (8).

Students who are members of "Generation Z," born after the year 2000, pose a unique set of challenges for teachers. These students have spent their lives using cell phones, touchscreens, computers, games, and social media: they are used to the instant gratification that naturally follows from using this type of technology for information and entertainment purposes (8). Because they are so entrenched in the use of social media, they are used to interacting in small groups and value building relationships with their peers and teachers. They do not value memorization and will only memorize in order to achieve a grade, because they will always use google to find information outside of school (8). In addition to the challenges regarding how students now learn, our students are entering a workplace where they will need universal skills such as the use of technology, the ability to

effectively communicate and function on a team, and the ability to work independently. It is important for students to effectively utilize the “4 C’s” of global skills: collaboration, communication, creativity, and critical thinking (8). The Common Core State Standards, while often a source of controversy, are an excellent “vehicle through which to teach global skills” (8). Higher level thinking, project- and inquiry-based learning, and authentic real-world work have been cited as important building blocks for schools of the future (9).

Research has shown that students retain more information when they are actively engaged and construct their own learning (10). Project- and inquiry-based learning gives students the opportunity to “single out salient concepts from the less important information they encounter in new material [and] link these key ideas into a mental structure” (10).

This line of thinking has aligned well with the increased popularity of makerspaces as a means of supporting student creativity. A makerspace is a space that allows students to create an original digital or physical product with a real-world connection or application while engaging in research. This “maker mindset” can be applied to any subject area at any grade level, and may incorporate use of robotics, digital technology, a 3D printer, or traditional arts and craft activities (11). The makerspace at Staten Island Technical High School incorporates all of these aspects and is available to all staff and students. The use of woodworking and crafting materials for building the Staten Island Tech Nutshells was particularly attractive, since the students had the opportunity to create a story and a three-dimensional, physical product. According to Nora Atkinson, curator of the Smithsonian exhibit of the original Nutshell Studies of Unexplained Death, “So much of our culture has gone digital, and that’s where craft shines, because it’s three-dimensional” (1).

Methods

Students were given an overview of the expectations for the SI Tech Nutshell Studies project and a grading rubric in January. They were told they had the option to complete a different type of final project (such as a written case study) if they were not interested in participating in the nutshells. In 2019, twenty-nine out of thirty-three students elected to complete a nutshell. The students in this particular class had used the nutshells built the previous year to make crime scene sketches for the Crime Scene Processing laboratory activity in the fall (see Figure 1), so they were familiar with the concept of a nutshell and were enthusiastic about making their own.



Figure 1 Students measure and observe miniature crime scenes during the crime scene processing laboratory activity (Fall 2018) at Staten Island Technical High School.

Students formed teams of no more than ten people and chose a team name. They were allowed to choose who they would work with since there would be a significant time commitment outside of school hours. Each team selected a team leader, research/writing leader, and a design/building leader. They began conducting research almost immediately. The first major assignment due was an annotated bibliography (see Figure 5). Students were asked to list each source in MLA or APA format and to take notes on the information in each source. Most students opted to create a digital version of this in a shared google doc, rather than using hand-written notes. Following this assignment, the students turned in a list of materials they wanted to use for building and decorating their nutshells along with an AutoCAD design. At this point in the design process, an interior designer from Brooklyn, NY consulted with the students in our makerspace to determine the best materials and design for their projects (see Figure 2). The research



Figure 2 Forensic Science students consult with interior designer Camille Casaretti regarding the design and construction of their nutshells.

and design phase took place throughout February and March 2019.

Many of the basic building and crafting materials (such as plywood, nails/screws, craft wood, adhesives, paint, and miniature tiles) were made available by the school's makerspace personnel while others (mostly dollhouse furniture and accessories) were requested through a Donors Choose grant. Once all of the materials

arrived, students began building and decorating their nutshells. This work took place during the forensic science class whenever the maker space was available for use. The nutshells were constructed of $\frac{1}{2}$ " plywood (for the base and support structures) and craft wood (for internal walls separating the rooms if needed). The wood was cut, sanded, and painted in the makerspace. The makerspace teacher, Mr. Dazzo, supervised and assisted students while using heavy machinery such as table saws, drills, and sanders.

Since it was challenging to schedule use of a shared space during the school day, the students transported their materials to the classroom once the initial structures had been built so that they could spend more class time painting and decorating. During the course of the project, we continued our regularly scheduled lab activities and case discussions, interspersed with project work periods whenever possible. Many students worked before and after school and during their lunch periods in order to complete the projects. The building and decorating took place from April through the end of May 2019 (see Figure 3). This was a tight timeline given the difficulty of scheduling use of a shared space and will have to be improved on next year.

The next major assignment, due in early May, was a formal presentation to the class regarding the progress of their nutshell. Each team member was allowed to use note cards during the presentation, but slides were limited to images and titles with no additional text (except references). The presentations included background information about the case, design and building progress (see Figure 4), and drafts of written documentation such as a description of the first responder's report and witness statements (for future investigators to analyze the nutshell), autopsy reports, and any other laboratory reports (ballistics, DNA, toxicology) required depending on the specifics of their case. See Figure 5 for samples of student-generated documents. Throughout the entire process (after they handed in their annotated bibliography, during their work periods, after the presentations, and in regularly-scheduled small group meetings) students received continual feedback on their work and made suggestions from the instructor and their peers regarding how to proceed. This was crucial in ensuring that each team made a high-quality work product. In general, the teams convened to distribute tasks or discuss issues on their own, then the team leaders reported back to the instructor about their progress and next steps. Not only did this constant feedback loop improve the quality of their work, it helped the students to build essential communication skills and learn to work on a team.

In addition to feedback from the instructor, all of the teams contacted at least one expert to assist with their research, writing, design, and final product. For example, two of the teams were put in email contact with a medical



Figure 3 Forensic Science students building and decorating their nutshells in the classroom and makerspace.

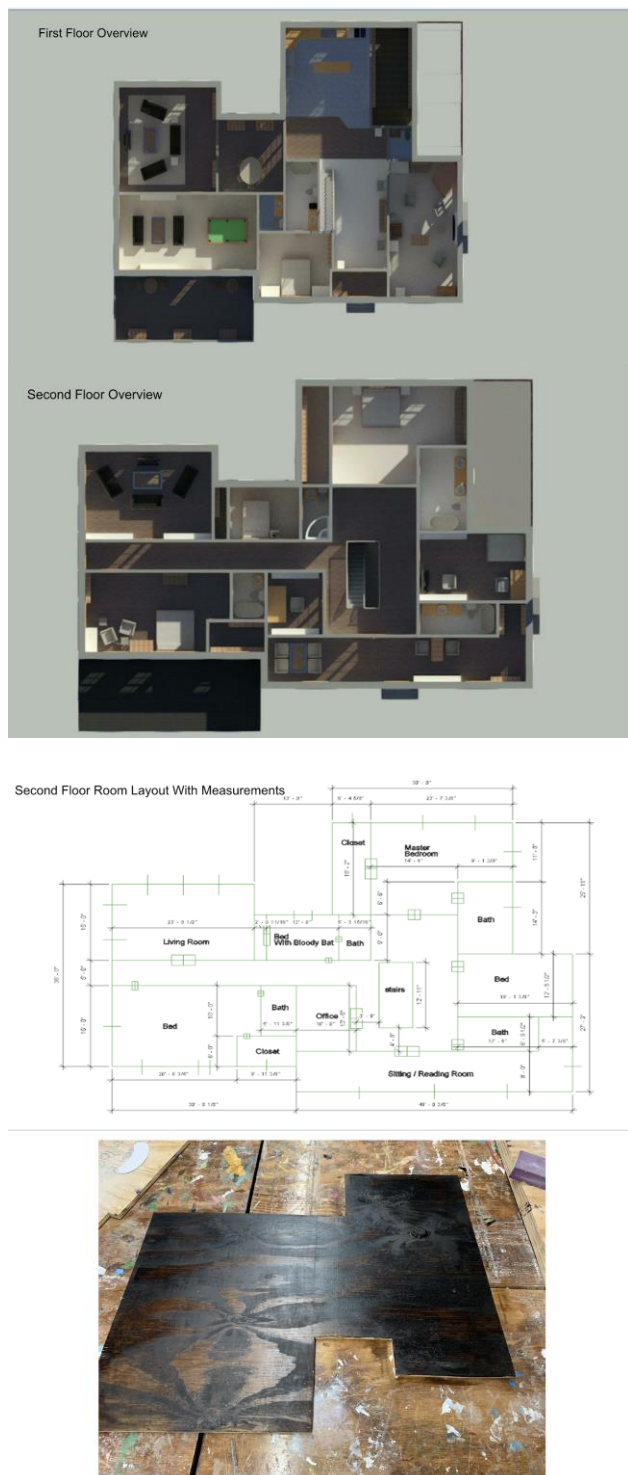


Figure 4 Screen shots of student presentations in google slides depicting the initial floor plan (Revvit), CAD drawing, and structure of the base for their one floor of the nutshell.

examiner who assisted them in writing their autopsy reports. One team discussed burn patterns with a fire marshal, another blood spatter patterns with a crime scene reconstruction expert. One team leader spoke directly with an expert from the Kansas City Public Library about the subject of their nutshell, a murder that took place in the 1930s (12).

These were all excellent opportunities for students to use primary sources and to hone their skills in professional communication and research. Students gained much greater depth of knowledge because of the expertise of these professionals, and their nutshells were that much more authentic as a result. Once the final products and their work binder (with all prior documentation, written reports, and an answer key) were completed, the students presented their nutshells at the first annual Staten Island Tech Science and Technology Showcase on June 7, 2019 (see Figure 6). Guests used miniature flashlights and magnifying glasses to identify important clues, and students presented information about their case and circulated to learn about other projects.

Health and Safety Precautions

All students and staff were required to wear appropriate personal protective equipment while working with tools, paints, or adhesives in the maker space. Staff members supervising the use of tools in the makerspace were required to attend OSHA training and directly supervised any student using heavy machinery such as table saws, drills, or sanders. By far the most common injury observed was burning the fingers while using a hot glue gun. This can be avoided by taking more care while using the hot glue gun and by unplugging the glue gun, placing it out of the way, and leaving a warning sign when not in use.

Interview Transcripts

Sally Davis: I visited her at around nine this morning. I came as soon as I learned of the horrible misunderstanding that took place. I'm telling you, that prison was sketchy and I don't trust those guards one bit. The poor girl was so upset when I saw her. She was treated so poorly by all those horrible thugs. I don't know exactly what goes on around here, but I know one thing for sure; Evelyn would never kill herself.

Prisoner 1: She was in the cell next to mine for two days, and I never heard nothing but non-stop whining from that one. I don't think that woman had a kind bone in her body. Always talking about how she was better than us because she spent more on lawyers. I'll tell you this though, I don't think anyone around here misses her. But I heard her tell her friend she would rather die than stay in that cell another day.

Prisoner 2: Well, other than whining all the time, all she did was talk about getting out of here. How her lawyers were the best in the country and would get her charges dropped and such. I didn't kill her—I was at lunch when they found her—but I'm just saying, it could be murder. She was ready to leave and didn't look like she was going to give up.

Marco Rojas (Guard): I was often given shifts in the section of the prison where Evelyn's cell was. Multiple times she refused to comply with basic procedures and over and over again she threatened me with lawsuits. We had to crack down on her behavior at times when she refused to cooperate. I found her body when the local police asked to speak with her before the trial. Her suicide was unexpected, but not a total shock.

Frank Williams (Guard): I was her escort from her cell to the visitation room and then back to her cell. I didn't see her displaying any signs of suicidal ideation, but she clearly had problems with authority and was not happy here, and was afraid of trial. I'm not all too chuffed about it—maybe she was just feeling guilty about the things she'd done. Drugs kill people, you know; my daughter died when she OD'd on cocaine. It's a damn shame.

**OFFICE OF CHIEF MEDICAL EXAMINER
CITY OF NEW YORK**

REPORT OF AUTOPSY

Name of Decedent: Steven Sullivan M.E. #: 0010
Autopsy Performed by: Hanna Yeum Date of Autopsy: May 15, 2015

FINAL DIAGNOSES

- I. **Stab Wound**
 - A. 3 inches on the left of the heart, there is an incision wound 4 inches deep. Left lung was filled with blood.
- II. **Blunt Force Trauma**
 - A. On the right side of the forehead above the eyebrow is one irregular, red abrasions measuring 1/4 x 1".
- III. **Burn Injuries**
 - A. On the front side of the body, the epidermis and dermis has been damaged and appears white. No soot was found in trachea, indicating that the decedent passed before the fire.

CAUSE OF DEATH: Choking
CONTRIBUTING CAUSE OF DEATH: Blunt force trauma and burn injuries
MANNER OF DEATH: Homicide

Autopsy

Case No. 16168

**OFFICE OF THE NEW YORK CITY MEDICAL EXAMINER
88 Washington Street
BROOKLYN, NEW YORK 01970**

REPORT OF INVESTIGATION BY COUNTY MEDICAL EXAMINER

DECEDENT: EVELYN RICHARDSON RACE: WHITE SEX: F AGE: 27
HOME ADDRESS: 37 KINGS AVE. City: BROOKLYN M.D. OCCUPATION: TAX CONSULTANT
TYPE OF DEATH: Violent Unnatural Suicide Suddenly while in apparent health Found Dead
Is Prison Suspicious, unusual or unnatural Circumstances Found dead in holding cell, brought from bedchamber
If Motor Vehicle Accident Check One: Driver Passenger Pedestrian Unknown
Notification by: Coroner's Facility Address: 37 Kings Ave, Brooklyn, NY, 10386
Investigating Agency: New York Police Department

Description of Body: Clothed Unclothed Partly Clothed
Eyes: GREEN Hair: RED Mole(s): No Beard: No
Weight: 130 Pounds Length: 65 Body Temp: 94.1 Date and Time: 6-15-08, 3pm
Rigor: Yes No Lymph: No Liver Color: Normal Pleura: Non-Fused

Marks and Wounds:

- Black ink tattoo on the inside of the left wrist
- "charm bracelet" tattoo on the left ankle
- 1.5 inch ligature mark present constant along the front and sides of the neck
- From left hand, fingernails on the pointer and middle fingers are broken and red nail polish is chipped
- From right hand, fingernail on ring finger is chipped
- Nothing is apparent in the shoes
- inconsistent ligature mark directly under jawbone

PROBABLE CAUSE OF DEATH: Asphyxiation
MANNER OF DEATH: (check one only) Accidental Natural Suicide Unnatural Homicide Poisoning Psychological Dr. Whitty Lodge
DISPOSITION OR CARE: 1. Not a medical examiner case 2. Autopsy requested Yes No 3. Autopsy ordered Yes No 4. Pathologist: Dr. Whitty Lodge

I hereby declare that after receiving notice of the death described herein I took charge of the body and made inquiry regarding the cause of death in accordance with Section 21-800.33-6(b) Massachusetts Code Annotated and that the information contained herein regarding said death is true and correct to the best of my knowledge and belief.

6-15-08 Brooklyn Morgan *Whitty Lodge*

**Annotated Bibliography
Team 1046**

1. Bergara, Ryan, et al. "The 'Ogletree Murder' Is One Of The Creepiest Unsolved Cases In American History." *BuzzFeed, BuzzFeed*, 1 Sept. 2017. www.buzzfeed.com/ryanbergara/the-ogletree-murder-is-one-of-the-creepiest-unsolved-cases.
- Roland Owen checked into a hotel in Kansas City on January 2, 1935
- He was described as being 25 to 30 years old, and he had brown hair with a scar on his head
- Bellboy reports that Owen had only seemed to pack a brush, comb, and toothpaste
- Maid was allowed to clean while he was in the room, but asked her to leave the door unlocked because his friend was about to visit
- He kept the shades tightly drawn and only had a dim lamp on
- He appeared to be worried or afraid
- When the maid returned, she found Owen dressed in nice clothes in his bed
- The next day, the door was locked from the outside, but Owen was in the room
- When the maid was in the room, Owen received a phone call
- Maid returned later and heard two male voices that said they didn't need towels, even though there were no towels in the room
- A hotel guest heard loud female and male voices that night, but it could have been from a party in another hotel room
- On January 4, the hotel noticed that Owen's phone had been off the hook for a while
- Bellboy Propst came to his room to tell him to put the phone back on the hook
- Owen told him to come in, but the door was locked and no one let Propst in
- When another bellboy came to check on the phone that was still off the hook, he let himself into the room
- He saw Owen on the bed, naked, with a dark stain around him
- The phone stand was kicked over, so he fixed it and left
- Bellboy assumed Owen was drunk

Figure 5 Student-generated documents and reports for the nutshells, including annotated bibliography, witness statements, and autopsy reports.



Figure 6 Students, staff, and parents at the Science and Technology Showcase June 7, 2019 at Staten Island Technical High School.



Results

The following figures (Figures 7-11) are photos of several Staten Island Tech Nutshell Studies with brief descriptions of each case.



Figure 7 “The Death of Evelyn Richardson” (2018)

This case scenario involved the death of Evelyn Richardson, who had been pulled over for speeding then given a desk appearance ticket because a large quantity of cocaine was found in her car. She was ordered to appear in court, but was arrested when she failed to appear the next day. She was found dead in her cell of an apparent suicide. Investigators were required to evaluate the physical injuries on the body, witness statements, autopsy findings, and psychological autopsy report in order to determine the manner of death. The structure was constructed from ½”



Figure 8 “The Mystery of Room 1046” (2019)

This nutshell study was based on a historical case, the murder of Roland T. Owen at the Hotel President in Kansas City 1935. His body was discovered by a bell boy (top left) after hotel staff noticed that his room phone had been left off the hook for hours. Owen had ligature marks on his neck, ankles, and waist and extensive blunt force injuries but insisted that he “fell in the tub” when a responding police officer asked who had beaten him. The case remains unsolved. The structure was built from ½” plywood, the room partitions were constructed from balsa wood, and a metal track was used to create a “shelf” for the tenth floor hotel room. To represent the floors beneath the hotel room, the space was filled with newspaper clippings about the case from the 1930s and lit with a battery-operated LED dollhouse light (bottom right).



Figure 9 “The Sloppy Mob” (2018)

This nutshell study was loosely based on a historical case, an infamous murder that took place in Staten Island, NY. The base was constructed from ½” plywood, the walls from balsa wood. The basement, first floor, and part of the exterior of the mansion are shown in the photos above, with bloodstains visible in each of these areas. The first floor and basement were attached using a hinge (middle left photo) so that both floors are viewable. Weapons and blood stains were visible in the basement, and evidence of the victim’s remains were seen in the basement furnace. These bone fragments were created using CAD software and printed using a 3D printer in the Staten Island Tech CAD room.



Figure 10 “Another One Burns to Dust” (2019)

This nutshell was also based on a true story, a quadruple homicide/arson that took place in the D.C. area. Two floors of the mansion where these crimes took place were constructed using ½” plywood. Some of the interior walls were made using craft wood, and the “stairs” are cut popsicle sticks. The second floor was stacked on top of the first, and wooden dowels (one is visible in the bottom right photo) were used to stabilize the top floor. Blood evidence is visible on the first floor, and smoke and fire damage are evident on the second floor.



Figure 11 “The Case of the Cabin Killer”
A two-story log cabin was constructed using ½” plywood. Interior walls and staircase were built using popsicle sticks, and wooden dowels were adhered to the exterior to give a rustic appearance. This case was a quadruple homicide at an AirBNB, with each victim suffering blunt force trauma at the hands of the cabin owner.

Discussion and Conclusion

This article presented a cumulative project-based learning experience for a college level introductory forensic science class. The work products and presentations by the students were high quality and demonstrated in-depth knowledge of their respective cases. Students also benefited from the work of the other teams, learning from each other, since they had the opportunity to hear all of the presentations and observe the other nutshells at the culminating Science and Technology Showcase. Additionally, the use of the nutshells for the students’ crime scene sketching lab in the fall term not only provided an accurate crime scene to depict in a sketch but also generated enthusiasm for the final project. The majority of the students (29 out of 33 in the class) elected to complete a nutshell even when presented with other options. Many of the students had expressed during the crime scene sketching lab that they were excited to “make their own” nutshells the following semester.

By far the most challenging issue in 2019 were the time constraints (class periods are only 41 minutes) and the use of the shared makerspace for the building and design portion of the project. Several other classes had scheduled use of the makerspace for their own projects, and many students had no choice but to work independently in the makerspace during lunch or free periods. The space was simply not large enough to accommodate the number of students and staff who want to use it during any given class period. The temporary solution to this problem was to move the students’ materials to the classroom so that they could work during class time even when the makerspace was unavailable. The goal for next year is to expand on this, having students do more of the work in the classroom from the start of the project and limiting their time in the makerspace strictly to building the structures. Although students were told from the initial introduction to the project that they were expected to work outside of class time, dedicating a substantial amount of class time for the project was essential for generating enthusiasm, motivating the students to take their project seriously, and ensuring that they had many opportunities to receive continual feedback on their work.

Another challenge was managing large groups of students working on a singular task. In 2018, the first year this project was introduced, there were only two nutshells built per class, so literally half the class was working on a single project. In 2019, the teams were smaller, with a maximum of ten students per nutshell, since the amount of man hours required seemed reasonable for ten students. The teams who had stronger leaders tended to work more efficiently, since a strong leader resulted in team members having a clearer picture of what was expected of them. In 2018, the students were grouped based on students’ responses to a google form they filled out regarding which

elements of the project (design, writing, etc) they were most interested in working on. This was done in order to avoid a whole team of students who like to build but don't like writing, for example. The instructor finalized which groups of students would work together.

In 2019, students were given more freedom in choosing their own teams but the instructor made suggestions based on students' personalities and strengths. Additionally, students were given other options besides building a nutshell (e.g., writing a case study, filming a documentary) in order to ensure that all students were comfortable in their teams and in their respective roles. The major issues (in a limited number of teams) the last two years was student inertia or lack of focus early in the process that led to problems later. One team in particular did not have any students willing to choose a specific direction and get started, so they were behind throughout the entire process due to a lack of decisiveness and initiative. In retrospect, all of the students on that team were quiet and somewhat passive, so that was not a good mix of students. Though they were able to complete the project, they did not meet all of the standards on the rubric and several students complained about the group dynamic. Allowing the students to choose their own teams in 2019 did not eliminate all instances of personality conflicts or lack of effort on the part of some students, but it certainly reduced the number of complaints when the instructor did not have the final say in choosing team members.

One major reason for the success of this project was the fact that students were given details on the project requirements and grading rubric months before it was due, with constant feedback from experts, peers, and from the instructor as they were working. The rubrics (see Figures 12 and 13) includes standards that assess students' research, writing, design, construction, collaboration as a team, and presentation. The final product and presentation were used to determine whether students met these standards, but prior presentations, annotated bibliographies, and CAD designs were evaluated at several points throughout the process using the same standards. In all of these instances, students were given verbal and written feedback from the instructor, their peers and, for some elements of the project, from outside experts. The final grade was based solely on the final evaluation and was weighted as a 500 point assignment. As a basis of comparison, each laboratory activity is weighted at 100 points, and each case discussion is between 50 and 100 points, depending on the length of the discussion and the amount of research required. The letter grades are an approximation based on whether they meet each standard. Generally, "meeting" a standard is considered "A" work, while "approaching" a standard is considered "B" work, while "developing" is a C or D. [For further information on standards based grading, refer to the book *Hacking Assessment* by Starr Sackstein.] For purposes of the nutshells project, if the team was "meeting" all standards

on the rubric, they received an A. If they exceeded at least two standards (and met all others) they received an A+. If students were approaching on 2 or more standards but meeting all others, they received an A- or B+, depending on the number of standards they met. The majority of the teams met all or nearly all of the standards, and the grades were overall very high. This was likely due to the continual feedback students received while working on the project. They were familiar with the rubric and striving to meet those standards from the outset, and they were given guidance while they were working on each element of the project.

Despite the minor caveats discussed above, this type of project is recommended for teaching forensic science, crime scene analysis, and death investigation. The project incorporated student choice to a large extent, and gave students the opportunity to showcase their skills in leadership, design, building, decorating, writing, and research. Several students who were very quiet and reserved in prior class discussions or activities took on a clear leadership role in the final project, with their peers looking to them for direction and advice. All students exercised the 21st century skills of communication, collaboration, critical thinking, and creativity during the completion of this project. They gained greater depth of knowledge of the subjects of crime scene analysis and death investigation, and they genuinely enjoyed watching their work come together into a final finished product. They were especially proud at the Science and Technology Showcase in June, as this offered them the opportunity to present their work to the school and community and motivated them to create an excellent work product.

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Ms. Sheila Estacio-Dennis, John Jay College of Criminal Justice

Dr. Lawrence Quarino, Cedar Crest College

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Mr. Charles Dazzo, Staten Island Technical High School

Dr. Jared Jax, Staten Island Technical High School

Mr. Mark Erlenwein, Principal, Staten Island Technical High School

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Standards: Research and Writing

CCSS.ELA-LITERACY.RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media in order to [create a realistic death investigation case scenario and explanation].

CCSS.ELA-LITERACY.RST.11-12.9 Synthesize information from a range of sources...into a coherent understanding [death investigation and crime scene reconstruction analysis]. **11-12.WHST.8** Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

CCSS.ELA-LITERACY.WHST.11-12.2.B Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples [in order to demonstrate a well-documented and well-supported solution for each of the major issues in the case scenario. The answer key is detailed and accurate and demonstrates knowledge the students have gained through their research.]

CCSS.ELA-LITERACY.WHST.11-12.2.D Use precise language domain-specific vocabulary ... [associated with the concepts addressed in the case, in a manner that indicates conceptual understanding].

CCSS.ELA-LITERACY.WHST.11-12.5 Develop and strengthen writing as needed by planning, revising, editing, revising, or trying a new approach, focusing on what is most significant for a specific purpose and audience.

Figure 12 Screenshots of 2019 Final Project Rubric for the Nutshell Studies, showing the research and writing standards used to evaluate the students' work.

Standards: Team Discussions and Collaboration (Instructor and Peer Review)

CCSS 11-12.SL.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on ...topics, texts, and issues [related to death investigation and crime scene analysis], building on others' ideas [in order to create a coherent project]

CCSS 11-12.SL.1a Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the [project] topic... to stimulate a thoughtful, well reasoned exchange of ideas.

CCSS 11-12.SL.1b Work with peers to promote civil, democratic discussions and decision making, set clear goals and deadlines, and establish individual roles as needed.

Standards: Presentation

CCSS.ELA-LITERACY.WHST.11-12.2.A Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole...[Information is presented in a logical sequence that is easy to follow]

include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.

CCSS.ELA-LITERACY.WHST.11-12.2.B Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples...[The story and design are planned in detail, there is evidence of in-depth

research, and the team has made significant progress in building the structure.]

Engage with the audience by avoiding reading from slides or note cards and making eye contact with audience members.

Project your voice in a volume that is appropriate, and enunciate words clearly.

Standards: Design and Building
Quality of Construction The nutshell shows considerable attention to construction. The structure and objects are neatly trimmed. All items are carefully and securely attached. There are no stray marks, smudges, or glue stains. The nutshell can be moved carefully without fear of any objects falling over or walls/objects coming loose.
Creativity Several of the objects in the nutshell and elements of the storyline and construction reflect an exceptional degree of student creativity.
Style and Appearance The nutshell's appearance is interesting, polished, and professional without any sloppy or distracting elements.
Demonstration of Content Facts and Knowledge The nutshell demonstrates the exemplary knowledge the students have gained from the research and writing. Elements of the case scenario are well represented by the structure and objects in the nutshell. The physical presentation is consistent with the content of the case scenario, answer key, and any supporting documents.
Time and Effort Much time and effort went into the planning, design, and building of the nutshell.

Figure 13 Screenshots of 2019 Final Project Rubric for the Nutshell Studies, showing the team collaboration, presentation, and design and building standards used to evaluate the students' work.

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