

Authentic Assessment:

Using Authentic Assessment to Foster and Improve Learning Through a Mock Crime Scene Final Exam in a High School and College Level Forensic Science Course

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ABSTRACT: This article demonstrates how authentic assessment has a positive effect on student learning in a high school and college level forensic science course and fosters learning through a mock crime scene final exam. After completing multiple units throughout the course, including crime scene analysis, recognition and preservation of evidence, physical and trace evidence, DNA, fingerprints, firearms, fire investigation, photography, death investigation, documentation and the concept of teamwork, the students have gained a thorough understanding for successfully completing the crime scene final exam. For the students' final exam, multiple mock crime scenes (one per student group, there can be 5-8 groups depending on the number of students per year), based upon real crimes, are set up in a wooded area (**FIGURE 1**) in close proximity to campus and students are provided with the necessary equipment to process the scene they are assigned. Each scene is supervised and evaluated by a uniformed member of the New Rochelle Police Department. After processing the crime scene, students work in the "lab" (the classroom) to evaluate their evidence. Approximately five days later, students present their cases in the mock "courtroom" (the classroom) including photos, rationale for how the scene was processed, any work requested from the lab and any subsequent findings. Police officers who evaluated the students during the crime scene processing also attended the "courtroom" part of the final. Each student presentation is evaluated for accuracy, proper procedure, integrity of the crime scene and the evidence collected as well as the students' overall understanding of what they have learned throughout the year.

Keywords: authentic assessment, mock crime scene, experiential learning, forensic science, high school.

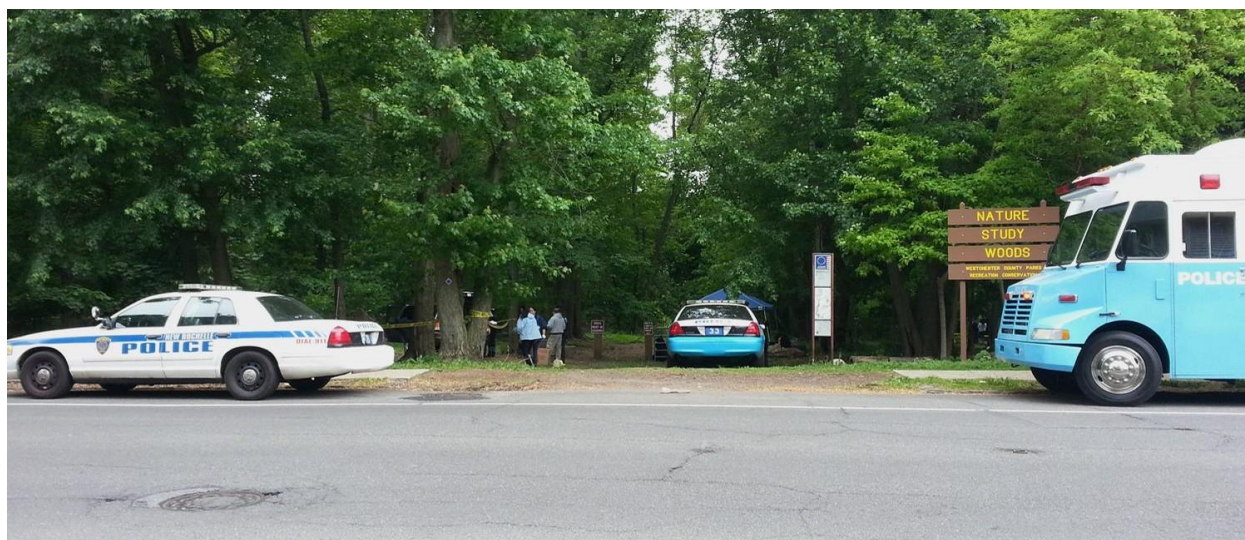


FIGURE 1 The Nature Study Woods, where the "crime scene section" of the final exam takes place. A command post is established just inside the entrance where multiple police officers and almost 200 students take part annually. The New Rochelle Police Department's mobile command post is seen on the right.

Introduction

While the concept of a mock crime scene final exam is not new, nor is authentic assessment, which first appeared in 1988 (1). Authentic assessment is a student-centered learning experience that evaluates a student's ability to apply knowledge and skills in real-world situations.

Authentic assessments

- require students to be effective performers with acquired knowledge.
- present the student with the full array of tasks that mirror the priorities and challenges found in the best instructional activities.
- attend to whether the student can craft polished, thorough and justifiable answers, performances or products.
- should depend in part upon whether the test simulates real-world tests of ability.
- [use] authentic tasks [involving] "ill-structured" challenges and roles that help students rehearse for the complex ambiguities of the "game" of adult and professional life. (2)

This article will discuss the merits of using a mock crime scene not only as an assessment tool but as a way to foster critical skill development through problem solving, critical thinking, troubleshooting and to prepare them for their future (3).

The overall objective of the forensic science class is to teach the students to think critically, process information, be able to apply what they have learned and take them out of their comfort zone. The course is inherently designed to fulfill a science requirement for those enrolled; however, there are students who develop a familiarity with forensic science that may apply to other aspects of their lives in the future. There are a number of students who go into law enforcement and are doing investigative or forensic work in their departments. Over a dozen former students are now members of the New Rochelle Police Department. And there are even students who attend colleges for a career in forensic science and are now working in forensic labs.

Students read from and use many texts within the course curriculum, are required to read from and utilize many texts in order to establish a strong foundational understanding of the concepts as well as learn about new and innovative technologies employed in the field (4-8). The students also watch videos and listen to podcasts. Also included are

scientific journals and articles written by forensic professionals, many of whom are willing to correspond with students and answer questions. Curriculum units are structured so that the students read relevant content prior to formal instruction by the teacher in the classroom. The students then meet in small groups before joining a full class discussion guided by the teacher. After that, there are interactive PowerPoints and then lab activities reinforcing what they have learned, providing each student the opportunity to delve into the work of crime scene investigation and criminalistics.

In a school district that encompasses a diverse student body, it is necessary to accommodate the needs of all learners to the best of our ability. According to Us News & World Report "this type of course at New Rochelle High School, is appealing to this diverse population of which is made up of 53% male, 47% female, 50.2 % Hispanic, 21.6% African American, 23% Caucasian, 4.5% Asian, and .7% other with 52% eligible for free or reduced lunch (9)." Within the diverse classroom setting, some minority students are at a disadvantage due to language and cultural differences. This helps to neutralize the playing field (10). It gives students the opportunity to show in multiple modalities their understanding of material and concept. It pushes them to think beyond what is in front of them and sometimes it creates a productive struggle for the students. When students work outside their comfort zone, learning takes place (11). They become more analytical, more inquisitive and more thoughtful. They are constructing knowledge for themselves, driving them to look for answers where they may not have looked before, allowing them to constantly go back and evaluate themselves as they work (12). This is the cornerstone of this forensic science course as well as the crime scene final exam.

Authentic assessment, in order to be effective, needs to have components that students will still need and use when they are out of school and in the working world (8) and what takes place during the crime scene final fosters just that. These components include the ability to make inferences, think and process, ask higher order questions, be able to find the answers, be able to successfully work with others and understand, similar to a crime scene, there are multiple components to problem solving. This model is used in multiple class and laboratory activities throughout the years with great success, always tweaking the process to make it more effective.

A former student, now a law school graduate, described his experience while being interviewed for a school district documentary during his crime scene final in 2014. "Mr. Rubins (and this course) taught us to think about things differently and I want to go

into law later in life. So, thinking outside the box is going to be helpful and this crime scene final allows us to do that in a different way than a written test (13).”

Methods/application

During the crime scene part of the final exam, the students properly and effectively processed their crime scene in teams of 4 or 5 by: gathering information from the first responding officer, surveying the scene and maintaining proper scene safety, identifying proper ingress/egress, taking overview photographs, doing a walk through, taking proper evidence and crime scene photographs, identifying evidence and placing markers, packaging evidence, maintaining chain of custody, properly completing all necessary documentation and then performing 111 analysis in the “lab” by properly processing the evidence and ultimately presenting the case in the “courtroom.” The crime scene part of the exam is worth 70% of the grade and the lab and presentation share the other 30%. Each student on the team takes on one of four self-selected roles: Administrator, Investigator, Photographer and either 1 or 2 Evidence Technicians depending on the size of the team. Each team processes only one scene (photos, identified, packaged and collected evidence, etc.) and are given 55 minutes to complete their tasks. The 55-minute time limitation is an unfortunate consequence of the school day, the number of students, the availability of the Nature Study Woods, the availability of members of the police department and student schedules.

Each crime scene is described below, including the relevant information associated with each case and the first responding police officer provided to each student crime scene team.

The crime scenes

Abandoned vehicle (FIGURE 2)

First responding officer statement to crime scene team: “I found this car on regular patrol at 0500. The trunk was slightly open, and I observed an obviously dead body inside. The driver door was open, and the other doors unlocked. Upon looking I saw some personal items in the car. There are what appears to be reddish brown stains on the driver side window, an address/date book found in the front seat and a bag of unknown substance on the floor. License plate: NY (read plate on car) Reported Stolen, 5/21/24. The Registered Owner is **Johnny PH**, 123-01 Roosevelt Ave, New York, NY 11368.”



FIGURE 2 Crime scene photo of mock abandoned vehicle scenario.

Final statement for ALL crime scenes by officer:

“I have secured the scene. I did not touch anything including the body and no one has been in or out. The Medical Examiner is on the way and will provide you with important information about the body upon arrival.”

NB: The address provided corresponds to Citi Field, home of the NY Mets. This address is used to ensure students are following up on the clues/evidence, and to ask subsequent questions, which is part of the authentic assessment.

Body on the hill

First responding officer statement to crime scene team: “A 30 - 40-year-old female was found by a jogger approximately 1hr ago on the hill. There are what appear to be defensive wounds on the right hand, at least one gunshot wound and reddish-brown stains on the body. Her shirt is slightly raised and there is what appears to be lividity in the lower back on both sides. The jogger is still at the scene if you need to speak with her. She says that she runs through here every day at approximately the same time and the body was **not** here yesterday.”

Body in drain (FIGURE 3)

First responding officer statement to crime scene team: “A body was found in the storm drain by a man walking his dog. The legs are sticking out of the drain. There seems to be some reddish-brown stains on the feet and I saw some flies near the body. The man walks here **every** day at approximately 5 AM however he did not walk here yesterday because he overslept. He did not see the body on Monday. The

man is still at the scene if you need to speak with him.”



FIGURE 3 Crime scene photo of body in the drain scenario.

NB: The students in all scenes have the opportunity to interview the witnesses.

Robbery/homicide

First responding officer statement to crime scene team: *Upon arrival I found a 25 year old who was robbed at the corner of Eastchester Rd. and Webster Avenue. The suspect stole a bag with many personal items. The items seem scattered throughout the wooded area near the gravel pile. Upon walking around the back side of the pile, I noticed a body in the wooded area with obvious signs of death including dependent lividity and what appears to be full rigor. I do not think this is related to the robbery. The victim is here at the scene and available for an interview*

Attempted abduction/homicide

First responding officer statement to crime scene team: *“Upon arrival I found a woman (witness) who was doing her yoga in the woods and heard a scream. She saw a woman who was jogging through the Nature Study Woods attacked and then a gunshot. The woman fell to the ground, and she heard a car “screech off” up Webster Avenue toward Eastchester Road. EMS was called and pronounced the woman dead at the scene.”*

Suspect: *20-30 YO white female, brown hair, 6 feet tall, white shirt, black pants. The assault took place approximately 40 minutes ago. The car is a blue four door, New York plates, first three letters of plate*

DUH. Victim was not transported to hospital due to obvious signs of death.



FIGURE 4 Student (crime scene administrator) documenting evidence and managing crime scene log.

Hunting “Accident”

First responding officer statement to crime scene team: *“Upon arrival, approximately 45 min ago, I found a 28 YO male dead from a gunshot wound confirmed by EMS. His friend (here at scene) states he was up in the tree hunting for deer when he accidentally dropped his rifle. Upon hitting the ground, the rifle went off and shot his friend in the chest who was standing by a tree. The hunter legally owns the rifle and has no known criminal record. There is only one weapon at the scene.*

Students are provided with a 15-page “crime scene” packet one month prior to the exam with documents to compile the necessary data from their crime scenes (**FIGURE 4**). The documents are to be included digitally in the subsequent courtroom presentations. The packet typically contains each of the following: crime scene steps checklist, crime scene jobs and descriptions, crime scene personnel log, general crime scene information, sketch and evidence measurements (**FIGURE 5**), photo and evidence logs, lab analysis request, and crime scene forms for all possible scenes (i.e., vehicle, body, wound, or weapon). Each document is designed to reinforce student learning throughout the year and facilitate the gathering of information, thus guiding each student to use the scientific method in approaching their crime scene. A full month of preparation is necessary because of the complexity of

the exam, which is interwoven within the regular curriculum.

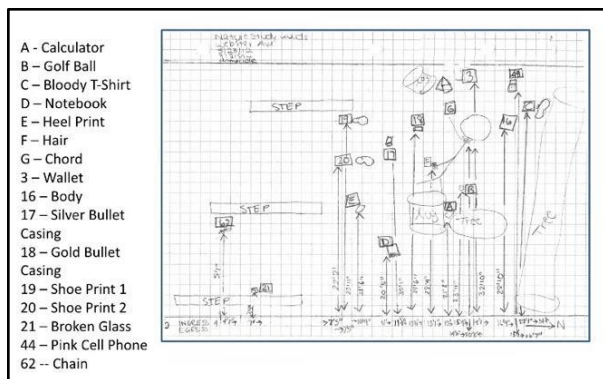


FIGURE 5 An example sketch made by a student for the “body on the hill” crime scene using baseline measurement.

Each scene is set up to ensure a diverse set of conditions and problems for the students to work through while processing their scenes, a product of both the teacher and the surrounding environment. This creates an ideal setting for authentic assessment. While there is not one specific “thing” in each crime scene that is useful to the assessment, it is the sum of all the parts, from not contaminating the scene to locating the evidence and managing it correctly. This can be correlated to the innate understanding that an experienced crime scene investigator would have. Clearly students are not expected to have the understanding of a 20-year veteran. As this is a culminating event, the students have accrued knowledge over time enabling them to rise to the occasion and adequately analyze the scene.

Unlike some crime scene final exams, students do not have to solve the case at their crime scene. This is so their primary focus is on processing and critical thinking. As each crime scene is different, it affords the students the opportunity to work out of the sterile environment of the classroom, allowing them to take a more analytical approach to the detail and the critical thinking required to complete such a task. While each crime scene is different, the core competencies and skills are consistent for each one.

When observing a team of students in the woods at their “crime scene”, you see motivated, excited and inspired students deeply focused on the task at hand. You see them doing the work of crime scene investigators and forensic scientists, processing the scene and working in the lab. You see them figuring out what they thought they could not. You see them applying what they have learned and you see them with a plan that has gone astray due to circumstances beyond their control and watch them rework that plan in real time with the knowledge and understanding

they have built all year. “Authentic assessment involves observing students ‘doing’ experiences in meaningful contexts” and constructing their own knowledge using a multifaceted cognitive approach (12). That is authentic assessment in action!

The “courtroom” PowerPoint presentation, which is 20 minutes long, holds the students accountable for everything they have, documented, collected, analyzed and concluded and is an interactive forum between the crime scene team and the teacher. The presentation format is provided by the teacher for consistency in both presentation and grading but allows the students to add anything they deem necessary to enhance their presentation or explain irregularities. This is the capstone of the entire experience: The opportunity for the students to show the teacher that they have not only learned facts, but that they understand the broad field of crime scenes and forensic science. It is where they make connections from the crime scene to the lab, from the lab to a conclusion and from that conclusion to be able to explain what they have found and what it means in front of a group of their peers and their teacher. The teacher stops the presenters during their presentation asking questions to hold them accountable regarding methodology, protocol, rules, why they did or did not request certain lab analysis or collect certain evidence and if they followed the format provided ensuring all evidence and documents have been included. This forces the students to think on their feet showing whether or not they understand the material. This is often the most stressful part of the exam for the students and is the final step in the authentic assessment. All the students in the group are required to present and the police officers that were at the crime scene final are often in attendance to support the students. Police officers are not responsible for grading this section.

Materials

Students are provided with equipment and materials they have used all year long that they need to process their crime scene and analyze evidence. Some equipment such as gloves and cameras (students use their phones) are brought by the students. They may also choose to bring other materials and equipment including Tyvek suits (**FIGURE 6**), tarps, flashlights, extra clipboards and anything else they might need. Some students have gone as far as to bring tables, tents (to keep materials dry during bad weather), small shovels and even a metal detector! The use of phones allows students to upload all their images and documents to create their presentation. Microscopes, fingerprint equipment, photo scales, black mats for photography, lights and

other lab equipment are provided in class for their analysis of the evidence.



FIGURE 6 Students in their NRHS Forensic Unit shirts and Tyvek suits.



FIGURE 7 Some of the materials provided include evidence markers, measuring tapes, paper bags, ingress/egress markers, swabs and sterile water.

Some of the materials used can be found or provided by the following:

Sirchie: photo scales, crime scene tape, magnetic fingerprint applicators and powder, evidence markers, paper and plastic evidence bags (students have been well educated about collecting biological evidence in paper bags) (**FIGURE 7**).

Home depot: tape measures; (100 ft, 50 ft and 25 ft.) Six “dead bodies” made from old clothing stuffed with newspaper.

“Abandoned” vehicle provided by local towing company courtesy of the New Rochelle Police Department.

Examples of evidence left at the crime scenes for the students

Money (fake), cell phones, notebooks, personal bags, rope, glasses, prescription bottles (with Tic Tacs as fake pills), lip balm, day planners with notes written on the pages, shoes, shoe impressions, synthetic “blood” spatter, bullet casings and bullets provided by the New Rochelle Police Department that have been fired (in relatively good condition with visible grooves and lands) and a training rifle also provided by the New Rochelle Police Department. The rifle is inoperable, always in control of the New Rochelle Police Department and cannot be collected by students. An evidence photo of the rifle serves as the evidence in the presentation. Students must provide proper documentation of packaging and chain of custody (**FIGURE 8**).



FIGURE 8 Student preparing to package evidence.

After the final exam, all the evidence is repackaged by former students in preparation for the following year. There are approximately 400 pieces of evidence that supply all of the crime scenes. Most of them are recycled every year and new pieces of evidence are added in to keep the scenes up to date.

Some of the “day planners” have notes, indicating who may have committed a crime.

Hazards/safety

The Nature Study Woods is a public wooded area for walking and hiking. For safety, students are required to wear long pants, socks and sturdy shoes. They are advised to bring insect repellent due to possible ticks and other insects as in any wooded area. Since this is a rain or shine event, they are also advised to have rain gear and proper footwear as some of the ground may be slippery or muddy. There are no other significant dangers. In case of a medical emergency the police have direct radio contact to EMS and often there is a school nurse on site available. Students are all told to bring water. Permission slips must be signed by parents/guardians as per school district rules.

Results

The results of this exam are quite interesting. First is the success that the students feel upon completion. Second is seeing these students bring together this massive task in a way that they never expected they could. The buildup for the final exam starts on day one of school and continues throughout the year which adds to the intensity and focus needed to complete their tasks. It is obvious that learning has taken place during the month of planning prior to and during the exam itself. Scores are generally higher than some traditional exams given throughout the year as students have a better understanding of concepts by this time and have had time to process all topics as a whole by the end of the school year. This is due to the authenticity of the exam and the real world circumstances the students’ experience. The students are highly motivated to succeed.

An example of such great success is a former student, a veteran Criminalist who in an email said, *“As a current forensic practitioner, my career interest started with the opportunity to learn forensic coursework in the high school setting, culminating in a practical final examination which coupled real crime scenarios, law enforcement, media and other field applicable professionals to reinforce the material learned throughout the year. Learning in the classroom is the typical expected experience, but having a mock crime scene to reinforce the observation and scientific skills gained throughout the year reinforced the material in a remarkable way. While the overall course guided my path towards forensic science, the mock crime scene final exam provided insight to where my passion and career*

goals could intersect. This blossomed from Mr. Rubins’ class all the way through my master’s and into a job.”

The rubric (**FIGURE 9**) used for the exam has both objective and subjective sections for the crime scene and also includes a section for the presentation and the lab work. Although rubrics can be somewhat limiting, due to the nature of this exam (with multiple teams participating and multiple police officers grading them), an effort has been made in the rubric design to normalize the grading across all students for all activities.

GRADING SCALE	
0 =	Specific task not completed at all
1 =	Minimally completed Lacks basic knowledge or skills
2 =	Somewhat completed Average knowledge or skills
3 =	Thoroughly completed Shows MASTERY
Devise an effective plan to process scene before entering.	
Minimize personnel in crime scene.	
Administrator's attention to detail related to crime scene.	
Effectively supervises group/completes all tasks.	
Maintain Crime Scene Log.	
Maintain overall chain of custody	
Maintain evidence log during collection.	
Identify and locate relevant evidence.	
Packages evidence correctly.	
Manages evidence in an organized logical way.	
Completes proper crime scene walk through.	
Obtain appropriate information from first responder.	
Completes proper crime scene sketch	
Investigator's attention to detail related to crime scene.	
Gathers appropriate scene information and interviews witnesses.	
Overview photographs of crime scene before entering.	
Overview photographs of crime scene with markers.	
Attention to photographic detail / logical work order.	
Photograph evidence with evidence markers .	
Closeup/macro.	
Photo scale is in photo and used properly	
Photographer's attention to detail related to crime scene	

FIGURE 9 A subsection of the of the rubric.

The morning of the exam, prior to the student’s arrival, the author meets with the police officers to

discuss how to effectively grade the students, what is being looked for and why both the subjective and objective parts are important. The author walks around and discusses with each officer how the students are doing while they are processing their scenes. Many of these officers have been assisting with the final for years, as a result, they know what to expect and can help the newer officers to ensure the grading is effective and fair. The students work in teams, but each student receives an individual grade. There is no group grade. The front page of the rubric is for completing specific tasks and how well they are done, 0 = lack of understanding, 1, 2, 3 = mastery of subject matter. The back page of the rubric is the subjective section. The officer has the opportunity to write a narrative about each student describing their actions, understanding and contribution to the team (**FIGURE 10**). The final grade is a combination of the rubric scoring, the narrative written by the police officer, the teacher observations and the courtroom presentation.



FIGURE 10 Former student, now retired detective, evaluating students using the rubric.

Discussion and conclusion

Authentic assessment, in this case, is the connection between what is learned during the school year and the crime scene final exam. It is meaningful, experiential and educational. And while it is an assessment for the students, they do not view this the same way they would a traditional assessment as it has become an integral part of their way of learning. Authentic assessment through a mock crime scene final exam meets the objectives of the forensic science class by fostering and improving learning. This enables the students to do the real work of real crime scene investigators and forensic

scientists making what they do authentic. There are many pieces to this exam, there is a lot going on at one time and always some sort of X factor causing the students to stop and rethink what they are doing. It is messy, not a tidy way of doing things and difficult to tie directly to a score (14). This messy method enables the author to provide sound instruction that meets the high standard this class demands.

Learning and assessment occur at the same time during this exam in a seamless way in which passersby and people walking through the park do not even know a test is taking place (12) and who often ask the police officers and students (seeing all the crime scene tape and police vehicles), “what is going on, is everything ok?”

While this form of assessment does not always fit into a specific niche nor is practical in every circumstance, when possible, it provides a rich picture of a student's understanding. It takes a significant amount of time to create and a number of iterations for it to become effective. The first two years conducting this exam, there was no grading rubric and the process of collecting accurate data for scoring was chaotic. Every year or two changes are made based upon what happens at the crime scene, input from the police officers and students, my experiences throughout the school year and the final exam grading process. Some examples include how and what students are expected to achieve, exactly what the police officer should look for and what is expected in the courtroom presentation.

“Authentic assessment practices, maintain Darlene Hammond, permit the educator, not only a richer evaluation of students and their capabilities, but they also support and transform the process of teaching and learning (10).” The student learning objectives for this course illustrate this point and support an authentic assessment based class.

Forensic science student learning objectives:

By the end of the school year students will:

- Understand the contribution forensic science makes to the field of criminal justice.
- Understand that there are different disciplines in forensic science that often work in unison.
- Understand the role of the lab, the criminalist and law enforcement and their relationship to each other.
- Be able to correctly process a crime scene by taking on the roles of the crime scene administrator, photographer, investigator and crime scene technician.

- Have the ability to properly take crime scene photographs including overviews, itemized and evidence comparison photographs.
- Be able to apply to a real-life scenario what they have learned in class.
- Have the ability to clearly articulate in a simulated courtroom, what has taken place at a crime scene, the significance of the photographs taken, the evidence collected, the lab results and how they all tie together.

How do we know that the students have achieved the learning objectives? Because the outcomes manifest themselves through the students while they process their crime scenes, work in the “lab” and during their presentations. It is tangible, it is visible and it is palpable.

A former student and current college sophomore said when asked by an administrator about the exam. “This was so much more valuable and a better assessment of what we’d learned than a paper test would have been. Because it made me apply what I’d learned in class to a real life scenario instead of spitting back answers. Everything in this course is all about understanding and application, not memorization.”

The true depth of authentic education and assessment is difficult to measure right away and often takes significant time to see the outcomes (14). The results of an authentic assessment based class are clear and long lasting. The author recently curated, in our own school museum, an exhibit entitled, *27 years of Forensic Science at New Rochelle High School* (FIGURE 11).

Over 65 people attended the opening including friends, teachers, administrators and most importantly former students. Some of them are married with kids, some are in college or graduate school, some are working or own a business and they can still tell you which crime scene they had, who their officer was, the weather that day, who was on their team, their experience during the presentation and their score on the exam. These are two recent video news reports, *The Journal News* (15) and *News 12 Westchester* (16).



FIGURE 11 Panoramic view of museum exhibit.

This is not a course that one might expect to have such an impact on students, but after so many years the implications of a course like this with this type of assessment is clear. “...here at New Rochelle, among the largest and most ethnically and economically diverse high schools in New York if not the nation, one phylum of science class has proved a runaway success (17).” The reason for this success, lies in its authenticity, that jumbled mess that to an outsider may not make sense. But to those students who experience it, it is what drives them and pushes them to be independent learners, preparing them for college, the workforce and life in general.

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My students, who wait almost 180 days to go out in the sun, rain, heat, humidity or cold to enthusiastically and with some trepidation, process crime scenes and show their teacher, police officers and forensic professionals that they can apply what they have learned and that they can play in the very deepest end of the pool.

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