Learning by Doing: CSI Comes Alive

Enhancing Information Retention of Forensic Science Students: Incorporating A Simulated Crime Scene Practicum into The College Classroom

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Abstract

The purpose of this research was to investigate whether crime scene simulations benefit the learning process in terms of retention of knowledge. By providing a real-word experience via the Applied Learning pedagogy, the comprehension of the basic foundations of forensic science were indeed retained and enhanced through the incorporation of a mock crime scene in the classroom. A total of 50 undergraduate students majoring in criminal justice participated and were evaluated using three different assessment measures employed throughout the practicum: feedback, reflection, and debriefings. This qualitative research uncovered that students' retention of the theories and concepts continued past the midterm examination while the instructor benefited from a multi-assessment approach to gauging student performance. Additionally, this research also found that learners benefited in ways beyond the scope of this study; they also came away with practical realizations relating to the benefits of collaboration and an understanding of how this course prepares them for careers in law enforcement.

Keywords : Applied Learning, Criminal Justice Education, Simulation, Assessment, Evaluation

Introduction

Crime scene simulations offer college students with a unique way to learn the subject matter and develop their critical thinking and problem-solving skills. One college, Farmingdale State College in New York, recently incorporated an applied learning program into its Criminal Justice curriculum to prepare students for careers in law enforcement and is the focus of this research.

Classroom simulations offers instructors the ability "to keep things fresh and exciting" [1] an innovative strategy to keep students engaged despite the distractions [2] especially these days of smartphones and other technical gadgets brought into the classroom. Adding a mock practicum is one way to overcome this dilemma of improving interest, and according to Reese [3], may even be seen as more effective than other approaches of engaging students while enhancing learning, which is probably the reason why they have been met with much success in many disciplines, especially in the field of Criminal Justice.

As more people pursue crime scene investigator type of work, the use of a mock practicum has also increased due primarily to the advantage they offer in learning and their effectiveness in performance.   "A crime scene technology program can only be successful if it provides students with extensive practical experience" [4] (p. 120).   Police departments have been utilizing mock activities in the form of scenario-based training programs to build upon the skills of their officers. By combining knowledge and skills covered in training into a simulated situation helps the officers put what was learned in the classroom into use, which requires more than surface learning to accomplish [5]. Bulen [6] found that involvement in a mock active shooter scenario on a college campus "greatly helped to bridge the gap" (p. 39) of applying what was learned in class to a real-world situation. Here the criminal justice pupils played multiple roles as both victims and as active shooters in a mock campus shooting activity.   In addition to the increasing comprehension of the materials covered in class, they were positively affected by the many different stimuli presented which gave them a better understanding of their reflexes and actions when put to the test during a highly stressful confrontation. Moats, Chermack, & Dooley

[7] also found that simulations of mock emergencies as seen in natural disasters, enables governmental authorities to best plan to avert and handle situations based on scenario-based training methods to best mitigate the consequences of such events.   Overall, college level criminal justice education requires a compliment of a real-world experience such as a mock crime scene practicum to become more effective law enforcement officers.

Similar to moot trial activities, this form of applied learning provides transferable skills to actual courtrooms [8]. The implementation of simulations challenges participants to assume the role of an expert in the field in a way to ensure a high-quality work product which is necessary in the real world.   Sherrin [9] found that mock trials allow law students who, despite having different skill sets, develop their critical thinking and communication abilities. The rigor of preparing for a trial prepares them in ways traditional lecture does not. Mock trials offer a flexible way to increase learning by enabling theory to connect with practice [10]. Shepelak [11] saw in legal education a superior level of learning and "highly analytical as they present defense and counterarguments to the court" (p. 395).

In medical education, scenario-based training is necessary to best to educate future health professionals.   Bray et.al, [12] found that colleges specializing in pharmacy curriculums the learning outcomes were greatly enhanced because role playing allowed for the application of knowledge and skills covered in class to real world scenarios. Textbook knowledge alone is not enough to develop a student thoroughly, mock activities or simulations offer a unique method to best equip individuals for meeting the learning objectives. Lateef [13] also acknowledged the importance of simulation-based learning in the medical field because it provides access to real-life situations without putting patients in jeopardy.   Health professionals require a solid knowledge of medicine and skills in medical procedures however, it is not recommended that students practice on patients as there is no room for error as well as the ethical dilemmas that abound, that is why simulations offer an invaluable method to teach future doctors to administer techniques and use equipment without worry. Simulations enable individuals to become immersed in the activity [14] as if they were actually involved in the real thing. Critical thinking skills are strengthened and competencies in the subject matter are broadened due to individuals being absorbed in the experience. Guptka, Peckler & Schoken [15] identified that physical skills in technique need to be practiced via an activity and simulation comes into play.   In addition to eye-hand coordination, future medical personnel also require self-confidence especially when it comes to handling unexpected events that routinely occur in the treatment of patients.

Mock crime scene practicums fall under the Applied Learning pedagogy as it offers a method to engage learning by providing a hands-on approach to education. Instead of merely sitting in on a lecture, viewing a video or reading about a case study of descriptions of actions, students who take part in a practicum pick up much more than domain specific information. The central focus is to move away from the more traditional teaching methods of one-way lecture and passive learning to a hands-on approach practicum combined with critical thinking and problem solving in a specific context similar to that of Experiential Learning [16]. Reese [3] said of the learning-by-doing principle allows for self-discovery or "proof upon practice" (p.1).   Similar to Problem Based-Learning where a collaboration of participants is vital in solving of a problem which reinforces knowledge in a particular subject [17] and direct experience with the stimuli is needed to provide an overall understanding of the application of theory.   In effect, this facilitates the development of analytical thinking and cognition by putting the knowledge learned in class to work because the students are actively involved in a project which creates new knowledge and promotes deeper learning [18].   Rather than surface learning or rote memorization which is typically regurgitated at exam time, deep learning builds upon previous knowledge and apply it to a new set of circumstances, improving both analytical capabilities and memory [19]. This allows a shift from an instructor led class to a student learning focus.   As Kumar [20] uncovered the instructor no longer presents all of the information relevant to the domain, instead the students now play a larger part in their education. In other words, the instructor takes on the role as a guide and directs them "along a pathway towards self-directed learning" (p. 23).   Learner centered education is more engaging and as result is attributed to students completing their assignments with more effort.   "Students are more likely to complete work that they perceive does not waste their time" [21] (p. 26).

A unique benefit of Applied Learning involves student engagement and enjoyment of the activity. Fiorenza [22] analyzed perceptions at various SUNY schools' which implemented applied learning programs and uncovered that "...students have found tremendous value in their experiences...wished they had the chance for more applied learning experiences." (p. 4). In addition to the fun factor, learners who participate in simulations tend to complete their studies and earn degrees at an impressive rate.   Wolff & Tinney [23] found that schools of higher education that offered an applied learning pedagogy as part of their curriculum not only had higher graduation statistics, with many completing their studies in significantly less time as compared to their counter parts who did not participate in applied learning simulations. Because of the improvement to graduation rates, retention and engagement in the classroom, the State University of New York system developed a consortium to enable its 64 SUNY campuses to partner with companies to increase opportunities to enable Applied Learning to take place [24].   Students reported that when they are immersed in a project, they seem to lose track of time [21] which is of good news to instructors.   Especially when they don't want to stop working even as the end of class time approaches, the evidence shows that the instructors who employ innovative methods, namely the applied learning pedagogy, are successful in keeping students engaged. A significant increase in self-motivation to complete and take pride in an assignment's completion, shows a direct correlation to the effectiveness of that learning methodology [25].

In addition to earning college credit for participating in an internship, Ross & Elechi [26] found that undergraduates' attitudes on Criminal Justice internships found this form of Applied Learning to be extremely advantageous for "getting one's feet wet or acquiring a dose of reality" (p. 307).   Furthermore, they highlighted the value and reliance of coursework on the experience; "I found my classroom experience of immense value during my intern at the DAs Office...without doubt, the core knowledge needed to perform functions I did was obtained from the classroom" (p. 307).   Sgroi & Ryniker [27] found that Public Justice fieldwork experience allowed students to get their foot the door by introducing them to Criminal Justice agencies and individuals already in the profession that they otherwise wouldn't have had access to which helped them to reach career goals.

As the literature indicates, the applied learning pedagogy in the form of a crime scene simulation can be an effective way in getting the basics into the brains of students however, the research question that this study sought to uncover;

Q1: Are the students retaining the subject matter learned over the course of the semester?

Q2: Which assessment measure is best in evaluating retention of information in an applied learning environment?

Materials and Methods

This qualitative study was based upon an enhanced Criminalistics course at SUNY Farmingdale State College and engaged students by following the high impact practice of Applied Learning pedagogy through the introduction of a Mock Crime Scene Investigation practicum. This research was funded by a Title III Students First Teaching Grant through the U.S. Department of Education awarded to SUNY at Farmingdale State College.

A total of 50 students participated in this study and were enrolled at SUNY Farmingdale State College at various stages leading to either an Associate or Bachelor degree in Criminal Justice and Law Enforcement Technology over the period of three semesters. Approval was received from the school's Institutional Review Board to collect the qualitative data gleaned from the semi-structured questions administered to the students during the activity.

During a period of 10 weeks prior to each of the semester's practicums, intensive coursework in the basics of forensic science was covered culminating with a written midterm examination in the form of multiple essays. Following the midterm, a mock-up crime scene practicum was instituted two weeks after the exam. The students were divided into teams and were assigned various responsibilities although they were all required to be strong in all of the tasks as they related to solving a 'homicide'. Included in each crime scene were many pieces of

evidence and a *red herring* [28] which was purposely placed at the scenes in an attempt to throw off the investigators and send them in the wrong direction to for the purpose to probe critical thinking and problem-solving proficiency.

The practicum involved the collection and recording of evidence located at the scene of a simulated homicide and included the lifting of fingerprints, the identification of blood spatter patterns, note-taking and eye-witness interviews. The mock crime scene also included the forensic examination of the items collected in a "CSI laboratory" where the student investigators analyzed striations on bullets, microscopically examined hair fibers and fingerprints, and searched forensic databases. By linking together different pieces of trace evidence the participants reconstructed the events that led up to the murder and identified a suspect.

Gauging Retention of Information

To effectively gauge student retention of the basic theories and knowledge presented in class, each of the students were orally queried during the practicum with open-ended questions similar to the essay questions from the mid-term examination. Utilizing three assessment measures; namely Feedback, Reflection and Debriefing, this study qualitatively analyzed responses as to the overall comprehension and retention of the subject matter it related to each participant's specific case. Comprehension of the subject matter was compared to the Learning Outcomes identified in the course syllabus in terms of overall knowledge of the theories and concepts and capability in problem solving and critical thinking.

Utilizing a form of content analysis, [29], this research coded responses from each of the methods to identify whether students' knowledge learned throughout the semester was retained after the midterm examination. Further coding, similar to latent content was used to reveal underlying meanings in communication. Here, the coding sought to discover deeper thoughts and characterizations to ascertain underlying themes and what this research identified as '*Latent Findings*'. Grounded theory was also used to constantly review results, reshape the collection of data which ultimately increased perception and insight. It is the constant review and analysis of the data that is important to this method and necessary in the current study. "Grounded theory methods consist of simultaneous data collection and analysis, with each informing and focusing the other throughout the research process, in turn, we use those focused data to refine our emerging analysis" [30], (p.508).

Feedback Assessment Measure

The first of the assessment measures provided the instructor a periodic review of students' knowledge and application of theories throughout the activity which offered valuable insight progress. As Frey & Schmitt [31] identified, feedback promotes student's self-learning as the instructor guides the learner along the path to knowledge obtainment. It is here that one needs "to observe and listen to students during cooperative learning activities to see if students are 'getting it'" (p. 415). Especially when it comes to working as part of a team, feedback also comes in the form of collaboration with members of the group. Team-based activities affords students to learn from each other, especially when they come from variety of backgrounds as concepts are reinforced based on the insights of their cohorts [32]. Working together enhances problem solving and critical thinking skills which offers feedback from another source, themselves. "Simulation provides an instructional tool to facilitate practice and allows for immediate feedback regarding interprofessional teamwork and collaboration" [12], (p. 6). Sharing a common objective, as seen in simulation activities, develops a level of trust between its membership which allows for internal feedback to occur. Resolving dilemmas through collaboration enables students to put their minds to work as they discuss and challenge each other in pursuit of answers [13].

Feedback was utilized in the form of instructor's open-ended question and answers were based on subject knowledge and its application to the set of circumstances presented.

Reflection Assessment Measure

This consisted of a Reaction type essay in which the students provided their comments to the activity as it progressed. Types of entries focused on the challenges faced, methods used to overcome them, and the identification of theories learned in class and their application to the activity. This form of personal reflection as a self-assessment tool offers another unique method to gauge student performance to determine whether learning objectives have been met. In Bengtson & Sifferd's [10] research on Mock trial simulations, found that "self-critiques" provided an invaluable tool to measure student outcomes because they are key indicators into "... the strengths and weaknesses of a student's performance" (p. 72). In research on the critical incident method Lean, et. al. [33] uncovered that reflection on experiences is a beneficial tool in the learning environment. Participants identified their errors and offered various courses of action that they should have followed during the activity. These reactions offer an effective guide for assessment purposes as they uncover where problems occur and how students reacted and overcame the challenges. "We finally learned how it really is – and we did not learn it in the classroom" [10] (p. 308). These essays offer a method of assessment that is unique as it provides in-depth insight into the thought processes of students studying a particular topic that otherwise would not be uncovered. Included are observations and interactions with team members, application of appropriate theories and discussion of how their performance could be improved [34].

Debriefing Assessment Measure

Debriefing represented the third approach to assess performance in a simulation type of applied learning application and represents a critical component to obtaining a quality education [34]. Unlike the other two assessment methods of feedback and reflection, debriefing in this research occurred at the conclusion of a practicum as the instructor/researcher reviewed with each member certain aspects relating to performance after the activity had finished [35]. It is here that discussions focused on what went wrong, how they overcame them and how plans for future responses [36]. The benefits of debriefing abound on the benefits to learning [37]. These exercises are very similar to the debriefing applications found at the conclusion of military missions as participants collectively account for actions and discuss new tactics to overcome challenges faced [38]. In effect the debriefing process is yet another form of feedback and reflection because it too attempts to derive insights from the mere discussion of the activity with the participant. This allows the instructor to chat about individual roles in the scenario to evaluate and analyze their experiences via plain conversation [1]. This aspect is also covered under the criteria for an Applied Learning experience which specifies that a "formal debriefing" is required at the termination of the activity to best understand achievement [39]. In the case study by Bulen [6] concerning the mock campus shooting scenario, students were debriefed by the instructor after the exercise and found that they did not really enjoy the activity as much as they hoped because of all the effort that went into the study and preparation; these represented responses that otherwise would have been overlooked in a traditional examination assessment method.

In order to conduct an effective debriefing, the instructor also needs to be trained in the debriefing process so to elicit a narrative. Asking the right questions is only part of the facilitators' duty, they also need to instill a level of trust and make the all feel comfortable sharing their feelings as it relates to the simulation. Furthermore, especially as it relates to team-based activities, the facilitator must be able to obtain both personal accounts and group perspectives of the learning that took place [35].

The focus of this research was to uncover insights into students' retention of information learned throughout the semester. Did they simply regurgitate what was learned during the midterm and walk away empty?

Results and Discussion

To best understand student's ability to retain information, each were asked a series of open-ended questions during the collection and analysis of evidence segments of the Mock Crime Scene. These questions were designed to inquire about the knowledge students gained from coursework by having them apply their responses to the task at hand. Part discussion and part demonstration enabled students, especially those with different learning styles to explain the concepts and theories associated to their set of circumstances. Instead of relying solely on oral communication, this feedback assessment was flexible enough for observational testing as well.

Retention via the Feedback Assessment Measure

During the evidence collection part of the simulation, the students actively worked a staged crime scene and were asked questions involving their tasks. Topics included strategies used to search for evidence: *"We chose the grid pattern to search the crime scene because it was most comprehensive and avoided touching evidence, especially latent footprints on the ground which we needed to collect later, the spiral and other search patterns would have led to contamination of evidence"* and proper collection methods, *"I used rubber forceps in order to not damage the striations that were on the bullet shell casing which would ruin and damage that piece of evidence. I put them in vials after I stuffed cotton into them so that the shell casings could not move around and be damaged during transportation."* Comprehension and retention of general theories that apply to forensic science was also apparent; *"I see how the Locard principle applies – every person who is physically involved in a crime leaves some minute trace of his or her presence, and often takes something away."*

As the participants played the role of crime scene lab technicians and examined the evidence, they collected the weeks before, they were careful not to get tripped up by the red herring and thus thought critically based on the facts on hand to figure out the truth and reject different hypotheses. *"Well when we came to a theory to what we believed happened…but there was no blood on the brick along with the brick being void of fingerprints. We believe the brick was used as a red herring meaning in that the suspect placed the brick by the victim to make it seem like it was the murder weapon along with breaking the window."* This was an excellent method to observe problem solving skills as the students discounted various ideas and instead supported theories based on the evidence; *"The reason we believe it was a homicide and not a suicide was because it made no sense…how did the gun get in the opposite(left) hand of the victim, there was no way the bullet wound to the right temple was inflicted from that angle…and… I know that that gun was right on the skin due to the star pattern of the wound. If the gun was just off the skin, then a different pattern would have appeared."*

The utilization of the Feedback Assessment method showed that the students were able to evaluate different forensic science theories, weigh evidence and apply what was learned directly to the project. The "Red Herring" aspect in particular permitted the students to discount hypotheses by thinking critically based on an analysis of available evidence. Participants were able to think on their feet without reliance on any notes or thought about grading. In addition to the inquiries, the instructor observed student behavior and listened intently to determine whether students in fact comprehended the materials. This complemented Frey & Schmitt's [31] findings which sought to use feedback as a way to determine the level of understanding of subject matter principles. Feedback required more than simple answers, rather thought-provoking exercises were on the menu which occurred regularly. Even the tough questions were answered with ease, at times with students demonstrating the how-to or why they did something: *"After examining the ridges and minutiae on the latent fingerprint found on the knife, we determined it was a match with the one in the AFIS database- you know the fingerprint database!"* This provided a test in a way that differs from standardized examinations as no guessing nor a half-fast understanding can suffice, and the student is aware of this during the process requiring additional efforts to get it right. Retention of course materials was successful during this phase of the study and the Feedback assessment measure was invaluable in testing student knowledge overall.

Latent Finding 1: **The CSI Effect**

An underlying theme that emerged from this research during this Mock Crime Scene activity centered around the concept of the "CSI Effect".   This phenomenon involves the unrealistic expectations jurors have when they are deciding a case where they expect every available test to be run and results to be provided quickly [40]. Based upon television programs such as CSI, Criminal Minds and the like, members of the jury now have a distorted vision in determining the guilt or innocence of a defendant. *"I think most of the students that were influenced by "The CSI Effect" prior to this class, probably saw what reality is after the hands-on experience."* Unfortunately, not every case can be solved in a half hour nor is there always salvageable DNA left at the scene. *"I have a better understanding of the whole CSI Effect and why these television shows are not truthful, as people would like them to be. It takes time and process to learn the steps and put them to use. It was fun for me to learn and enact each step taken."*

Retention via the Reflection Assessment Measure

Writing an essay in college is typically a challenge for students to accomplish however, in this case the students were motivated to complete the writing portion so much in fact, that the majority of journals received exceeded the minimum page count.   Students wrote about the importance of being prepared and organized, how they overcame hindrances: *"A challenge was keeping things in an organized fashion and in order. I overcame this obstacle by grouping everyone together and adjusting what we needed to do at the time to get everything done."* An interesting finding uncovered that the students truly enjoyed this activity and noticed themselves that they were learning by easily applying concepts and theories to the task at hand. *"This was a very cool way to learn. It really makes you think critically and use all of what you've learned in class. Doing the mock crime scene also helped me to learn what we talk about in the class more in depth and it even made me remember some more info than I knew prior to this experience."*

The reflection assessment method showed that students excelled in the comprehension of course materials and application of critical thinking during the practicum and beyond the midterm examination. Similar to Bengtson & Sifferd's [3] research which used "self-critiques" (p. 72) as a method to engage students to analyze and learn from their own behaviors, the reflection method as used in the current study allowed the individuals to become aware of the difficulties faced.   They required the information used in class to solve the problem to figure out the appropriate action to take to overcome the challenges. *"I was forced to think about each step we spoke about in class. A thing I really liked about this class was how different it was than a traditional criminal justice lecture. This method had helped me learn more efficiently and clearly than in my other classes.*   Looking at how they accomplished things and how they could have done them better in essence illuminated their retention of the concepts covered over the semester. *This class does a great job of making you learn something that you keep in your memory, opposed to most classes when you learn for the purpose of the test and a week later its forgotten."* Retention was fortified, learners showed the breadth of their knowledge and critical thinking skills via insight that would not be uncovered in general written exams. Thus, the Reflection Assessment Measure was an effective method to evaluate comprehension of the topic beyond the traditional examination.

Latent Finding 2: Teamwork

An interesting aspect that was uncovered during the reflection assessment method involved the importance of teamwork.   Students learned to rely on each other to accomplish their shared goals and even learned from one another as they brainstormed on theories as to what occurred. *"Our team really meshed well together, we were able to rely on each other to perform the duties expertly and together figured out what happened."* Furthermore, some of the students even developed friendships that wouldn't have occurred without this activity. *"This class did not only educate me but it also brought me great new friends. Working with my teammates was great and we are all close now because of it."* This follows the tenets of problem-based learning as Boud & Feletti [5] expounded upon as students actively seek to acquire the knowledge and skills in a collaborative manner in order to solve a problem, in this case to solving a fictitious crime. Further learning occurred from students working together while exchanging ideas.

Retention via the Debriefing Assessment Measure

At this final component of this research, students were at ease talking about their experiences because they had completed the mock crime scene practicum. They were quite transparent in talking about what they should have done and areas overlooked. *"We should have identified how the bloody handprint got on the wall and who it belonged to, we should have compared it with victim's hand because if it didn't match, then we could have tied it to the suspect."*

Debriefing proved itself to be an effect measure to gauge retention of information and application to the activity. Students were whole-heartedly involved in their cases and it required significant knowledge to entertain questions proposed by the instructor during this phase of the practicum.   Furthermore, students felt comfortable enough to reveal their concerns and how they could have improved in the activity based on the foundations learned throughout the semester. This assessment measure highlighted what Shaw [34] uncovered about evaluating student performance via a debriefing session.   Through simple and natural conversation, the students verbally discussed their roles and evaluated their efforts publicly and in a non-judgmental atmosphere. *"Not only was it fun but it also put everything that we learned in class to use. I found myself during the process refining the information and that I had already learned and applying it really made it stick. I also think collectively as a group we did a great job remembering how to process this information."*

In addition, the ability to debrief at the close of the activity enabled the instructor to recognize the attributes that were retained by the student to best realize the level of achievement reached in this Applied Learning setting. The retention of information was apparent, students were able to apply what they learned and discuss it in great detail. As an assessment measure, Debriefing proved itself as an invaluable evaluation tool.

Latent Finding 3: Impact on Law Enforcement Careers

An important aspect that that arose from the Debriefing aspect involved how this activity overall will impact the students' future in law enforcement.   It reinforced some student's decisions to enter into the criminal justice field and open others' eyes of unexplored areas. *"I wasn't really sure what I wanted to after college, now I have a better idea, I want to be a part of the criminal justice system to improve it. By me being able to participate in a mock investigation, I believe I'll be a better investigator one day."* Some viewed the knowledge and skills gleaned from the coursework and simulation as an excellent foundation for when they enter into police work. *"I personally had a blast during every phase of the mock crime scene. Most people do not know how much goes into completing an investigation of a crime scene. You need to make sure you put the right evidence in the right bags or it could ruin the evidence.   I cannot wait to take the knowledge I've learned in this mock crime scene and apply it to my future as a NYPD crime scene lab technician."*

Conclusions

Implementation of a Mock Crime Scene practicum into the classroom is an effective method to enhance student learning and more importantly in their retention of information. Learning by doing gives the ability to apply the skills and knowledge of the subject in a distinctive encounter which warrants a solid comprehension of coursework materials to accomplish the task.   Instead of merely regurgitating data at test time and walking away a blank slate, the students were able to reinforce concepts from doing the activity.   For example, merely defining the concept of the CSI Effect as compared to experiencing the time and effort it takes to process and present evidence, allows for the comprehension unmatched by traditional instruction. Thus, in terms of the retention of information, students maintained a level of knowledge and skills learned throughout the semester and successfully applied it to the activity equivalent or possibly exceeding their performance on the midterm examination. They were confident in their answers and were more detailed as compared to their essay answers.

In terms of assessment measures, no single method reigns superior, rather all three work well in tandem within an applied learning setting.   The Feedback measure enabled the instructor to successfully test the comprehension of theories during implementation of the activity while the Reflection measure provided insights from the students themselves.   Debriefing also was advantageous to evaluating retention of knowledge through discussions at the conclusion of the practicum.   In essence, the various assessment measures acted as three

additional types of examinations all which provided a unique perspective on student retention of forensic science.

The benefits to education are obvious, students enjoy the process of learning in simulations while the knowledge and skills they learned …stick.   Research Question 1 found that Retention of course knowledge was achieved, that a more in-depth understanding of the coursework was enhanced and retained.   Research Question 2 found that when incorporating an applied learning activity, a mixture of the assessment measures is necessary to understand retention of information: feedback, reflection and debriefing.   Future research should seek to uncover long-term retention, beyond the semester that the coursework occurred in and the applicability to real life, especially of those who have entered into law enforcement careers.

Acknowledgement

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