Developing Research & Thinking Skills through Active Learning and Assessment in Undergraduate Criminology Core

Janine A. Bower, Ph.D.
Associate Professor of Sociology, Criminology & Criminal Justice
Keuka College

ABSTRACT

This paper chronicles efforts toward creating a student-centered, active learning environment in an undergraduate criminology core to promote the development of research and higher order thinking skills. Using online data analysis tools and Microsoft Excel software, students in an introductory criminology course conduct research and apply theoretical principles and concepts to analyze and understand criminological data. Exercises progressively challenge students to critically evaluate information, perform computations, and interpret findings independently. A capstone project gives students the opportunity to draw upon these skills to create a product that demonstrates their abilities and provides direct evidence of learning. An evaluation rubric facilitates assessment and improvement at the student, course and program levels.

Introduction

This paper chronicles efforts toward creating a student-centered, active learning environment in an introductory criminology class at a small, liberal arts college to promote the development of research and higher order thinking skills. Criminology has been recognized as an ideal discipline for integrating active learning strategies due to the controversial and complex nature of its content (Robinson, 2000; Sims, 2006). Moreover, as websites are abound with freely available online data analysis tools, real statistical data and reports related to a variety of criminological topics, the subject is well suited to using active learning strategies to promote quantitative literacy and reasoning while teaching students about the study of crime. By challenging students to "pose arguments, state opinions, and critique evidence using primary and secondary sources" in the context of analyzing criminological issues, faculty teaching in the discipline can not only promote the development of quantitative literacy skills, but also encourage students' participation in higher order thinking (Limbach &Waugh, 2010, p. 5).

I use a student-centered approach to learning in my introductory criminology course requiring students to become active researchers. Here, students generate their own inquiries, make their own decisions in the use of analytical tools, draw conclusions from their analysis and evaluate information. Frequent learning experiences followed by feedback offer students a means for evaluating their own progress in relation to expectations. Such learning experiences, in turn, advance higher order thinking skills and support broader program and institutional learning goals associated with quantitative literacy and reasoning. In short, these experiences are useful for enhancing student learning and serve as mechanisms for outcomes-based learning assessment (Sims, 2006).

Active and Student-centered Approaches to Learning

Active learning can make the course more enjoyable for both students and teachers alike. Prince (2004) suggests active learning approaches can improve student learning outcomes and overall student satisfaction in their learning experience. Instructors may find themselves applying active learning techniques in the classroom to alleviate a monotonous, passive classroom environment.

Active learning is generally considered synonymous with experiential learning or evidential learning, and represents a shift from teacher-centered, lecture-based instruction. "*Active learning* is generally defined as any instructional method that engages students in the learning process. In short, active learning requires students to do meaningful learning activities and think about what they are doing" (Prince, 2004, p.1). Simply introducing activity into the classroom does not constitute "active learning"; rather, it requires that activity be designed around important learning objectives, encourage thoughtful involvement on the part of students, and allow for reflection and dialogue (Prince, 2004). Student engagement is a central feature of active learning. Hawtrey (2007) points out that experiential or active learning is, at times, also referred to as "data learning" (p. 144). "The premise behind data learning is that students are given the opportunity to see primary data, figure out ways to interact with and understand those data, and can then form their own theories and ideas about the data or put existing theories to the test" (Fogel, 2012, p. 1).

Practice is necessary to master any skill, and an active learning approach would reasonably provide students the opportunity to practice and evaluate their performance.

"Students must have the opportunity to practice the knowledge, skills, attitudes, and behaviors they are expected to learn, apply, analyze, evaluate or create" (Limbach & Waugh, 2001, p. 5). The use of an active learning approach in conjunction with a *student-centered* approach would combine this practice with immediate feedback with specific and corrective information to inform students of their progress (King, Goodson & Rohani, 1998). Quality feedback should be prompt, purposeful, based upon consistent standards, and provide students an assessment of their work in relation to past performance (Froyd & Simpson, 2008). "Teacher feedback, like assessment, compares criteria and standards to student performance in an effort to evaluate the quality of work," (Duron, Limbach & Waugh, 2006, p. 163). The purpose of feedback, however, is to increase the quality of student learning and performance, rather than to assign a grade. Most importantly, "feedback can help students learn how to assess their own performance in the future" (p. 163).

This teaching approach presents students with challenges along with the relevant principles and methods that contextualize the problem, thereby engaging students to actively analyze, hypothesize, experiment, evaluate and create. In short, the fundamental principle of active or "data" learning supports the development of higher order thinking skills.

Conceptualizing Higher Order Thinking

Higher order thinking is a concept based upon learning taxonomies that model categories of cognitive processes. The taxonomy put forward by Benjamin Bloom over 50 years ago offered a direct, qualitative way to differentiate cognitive activities as they advance in difficulty, and remains one of the most universally applied models of learning. Bloom's model included six well defined categories in the cognitive domain: knowledge, comprehension, application, analysis, synthesis and evaluation (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). The

original taxonomy has since been adapted to reflect thinking and reasoning as an active process, and to define and reorganize activities into a hierarchy that best reflects the nature of thinking in each category (Anderson & Krathwohl, 2001; Krathwohl, 2002).

According Anderson and Krathwohl's (2001) revised taxanomy, activities involving higher order thinking include analyzing, evaluating and creating. *Analyzing* involves breaking information into parts to explore understandings and relationships. Activities including comparing, organizing, deconstructing, interrogating, or finding would fall within this dimension. *Evaluating* encompasses justifying a decision or course of action. Activities such as checking, hypothesizing, critiquing, experimenting, or judging are reflective of this category. *Creating* focuses on generating new ideas, products, or ways of viewing things. This includes such activities as designing, constructing, planning, producing, or inventing. In the context of this paper, students are considered to be engaged in higher order thinking when required to perform tasks in the analyzing, evaluating and creating according to this taxonomy.

Quantitative Literacy and Reasoning as Higher Order Thinking

In higher education, institutional and program level learning goals incorporate multiple outcomes that promote the development of higher order thinking skills. It is generally accepted that among these outcomes, quantitative literacy or reasoning, in some form, should play a central role. The Association for American Colleges and Universities (AAC&U) describes quantitative reasoning as "a "habit of mind" and "competency, and comfort in working with numerical data" (The Association for American Colleges and Universities, 2013, para. 2). Accordingly, students with strong quantitative literacy or reasoning skills are able to reason and solve quantitative problems, understand and produce arguments using quantitative data as supporting evidence, and communicate those arguments in a variety of formats to various

audiences. Trends in higher education reform suggest faculty are increasingly recognizing the importance of quantitative literacy and reasoning skills, an attitude shared by employers knowing students need to possess a range of quantitative skills in the increasingly "data dense" world of work (The Association for American Colleges and Universities, 2013, para. 3). Quantitative literacy is "an increasingly important outcome of higher education…all students, regardless of major should have ample opportunities to develop their ability to reason quantitatively" (National Survey of Student Engagement, 2013, p. 39).

Research nonetheless suggests that many students are not afforded frequent opportunity to practice skills related to quantitative reasoning. A new set of questions on the 2013 National Survey of Student Engagement asked students to indicate on a 4-point scale (very often to never) the frequency with which they practice and use skills pertaining to quantitative reasoning. In their survey of 335,000 students at 568 American colleges, researchers found that only "38% of first year students and 44% of seniors surveyed reported having often or very often made use of numerical information to examine a real-world problem or issue" (Barrett & Sander, 2013, para. 5). Just over half of first year students (52%) and seniors (55%) reported often or very often reaching conclusions based upon their own analysis of information (using numbers, graphs, statistics, etc.) while even a smaller proportion of first year students (37%) and seniors (43%) reported often or very often evaluating what others have concluded from numerical information (National Survey of Student Engagement, 2013).

In addition to the lack of opportunities, the assessment of student learning in relation to quantitative literacy and reasoning has proven to be a challenge. "The best evidence of learning comes from direct observation of student work rather than from an input inventory (e.g., list of courses completed) or summary of self reports" (Miller & Leskes, 2005, p. I). Course-embedded

assignments provide the most valid evidence for all levels of analysis because they are closely aligned with faculty expectations and with the teaching-learning process.

The AAC&U concluded, following their review of existing rubrics and documents from colleges and universities across the United States, that student work products used in assessment may illustrate an ability to compute problems, but do not necessarily demonstrate an ability to think about and understanding the meaning of the work (The Association for American Colleges and Universities, 2013). Additionally, they noted it is sometimes difficult to determine whether analysis and conclusions are generated by the student author or some other source material, or if the work is even accurate. Drawing implications from their findings, the AAC&U notes:

> Given widespread agreement about the importance of QL [quantitative literacy], it becomes incumbent on faculty to develop new kinds of assignments which give students substantive, contextualized experience in using such skills as analyzing quantitative information, representing quantitative information in appropriate forms, completing calculations to answer meaningful questions, making judgments based on quantitative data and communicating the results of that work for various purposes and audiences. As students gain experience with those skills, faculty must develop assignments that require students to create work products which reveal their thought processes and demonstrate the range of their QL skills (The Association for American Colleges and Universities, 2013, para. 5).

In short, as faculty we need to consider how curriculum design and teaching and assessment methods provide students the opportunity to practice and gain feedback on these essential skills, and offer faculty, academic programs and institutions information for evaluating student learning and academic programming.

Teaching and Assessing Quantitative Literacy: an example

The undergraduate Criminology/Criminal Justice program curriculum at my institution reflects a broad scope of the field of criminology and criminal justice and balanced coverage of related contemporary issues. It is based upon three dimensions of academic training: 1) a strong foundational and working knowledge of the criminal justice system, criminal laws, law

enforcement, the courts and corrections, 2) a working and critical understanding of crime and criminal behavior, the treatment of crime, and crime victims; and 3) intensive, applied professional development through field experiences and research skill development.

Assessment of student learning in the program involves multiple types of sources of evidence, and the program faculty design the type of work products used, a range of which includes assigned papers, projects, objective exams, and a portfolio. Direct evidence gathered in individual program courses is compared to detailed statements of learning outcomes and objectives for each program learning goal. Indirect evidence in the form of internship supervisor evaluations and self-report survey data is also used, though to a lesser extent, and compared to learning outcomes and objectives. Evidence is analyzed by a faculty program coordinator, and results are reviewed and discussed by program faculty, leading to modifications of the program when necessary.

A recent analysis of student learning revealed a need for increasing opportunities for students to practice using certain research-related skills, particularly those pertaining to quantitative literacy. Accordingly, we needed to be more deliberate about how frequently students are using quantitative reasoning skills in their coursework. We identified areas in need of improvement and developed the following goals:

1. Increase students' use of primary and secondary data sources to examine real-world issues, and
2. Provide more opportunities for students to develop inquiries and reach their own conclusions based upon their independent analysis of numerical information using divergent techniques.

We began by considering ways to build in more experiences in the criminology core course requirements that would give students direct practice in analyzing data from multiple sources using different software applications in order to study criminological issues. Returning to our curriculum map, we looked for courses 1) where students will have completed a course introducing basic computer applications, including MS Word and MS Excel; 2) where course-embedded activity would support or challenge students to advance knowledge and skills learned in statistics and methods of research courses; and 3) that were required of all program majors. Among the courses identified were an introductory criminology course customarily taken during the sophomore year, a victimology course taken during the junior year, and a senior capstone course. We then considered how existing course design could be enhanced (e.g. modification of existing or introduction of new experiences) in order to meet the goals that emerged from our assessment. Sequentially, these course-embedded experiences were designed to introduce students to and provide them with opportunities to practice qualitative literacy and reasoning skills. Moreover, the design was progressive in that students advance from basic to complex material and applications. We also considered ways in which curricular revision may improve upon existing formative and summative assessment of student learning.

As the instructor of the criminology course, I considered how existing assignments could be enhanced or modified, or new assignments could be introduced. The criminology course, taught over a 15-week term, offers students an introductory-level survey and critical evaluation of methods of criminological research, and an examination and application of criminological theories and research findings in criminology. Class sizes are small, typically with no more than 25 students. The course is required for all Criminology & Criminal Justice majors and minors, is generally taken during the sophomore year, and all students are to have successfully completed

introductory-level criminal justice and sociology courses prior to enrollment. In addition, we suggest that students complete the required computer applications course before entering the class.

Following my revision to the introductory criminology course, students in the class participate in three major exercises occurring at the beginning, mid-point, and end of the term. Additionally, students are given multiple, brief applications in the routines of in-class discussions and short in-class activities to practice using data and interpreting graphs and tables. Combined, these exercises and applications are designed to progressively challenge them to 1) generate their own inquiries and use data to analyze issues, 2) evaluate information and perform computations, and 3) interpret results and draw conclusions and linkages to concepts that enhance their understanding.

The major exercises at the beginning and middle points of the semester are useful for formative assessment, or identifying areas where students are struggling and informing instructional and student practice that follows. The criminology course capstone assignment completed at the end of the term offers students an opportunity to create a work product which reveals their thought processes and provides evidence of their quantitative literacy and reasoning skills. As a result, the capstone assignment used in the summative assessment of student learning, and for the purpose of program evaluation allows us to measure the extent to which students have achieved the desired outcomes at this juncture of their academic career.

I draw upon a program-level assessment rubric for formulating clear, consistent expectations for student performance along with indicators for evaluating student learning in the course. Modified from the AAC&U Quantitative Literacy VALUE Rubric, which offers fundamental criteria for learning outcomes, the program assessment rubric contains indicators of

how students show learning at 4 performance levels including underdeveloped (1), developing (2), working (3), and proficient (4), on multiple items. These indicators directly correspond with course and program learning objectives, several pertaining to quantitative literacy, including students' capacity to:

1. Construct useful data displays from a set of data;
2. Accurately interpret charts and/or graphs they create; and
3. Use the analysis/interpretation of the quantitative information to make reasonable statements or conclusions about what the data suggests.

This rubric is important tool for developing class learning objectives and course-embedded activities, assignments, and corresponding rubrics for evaluating student work.

As a tool in formative evaluation, I use the program assessment rubric to keep in mind the broader course expectations for student learning that extend beyond a specific assignment or exercise. As another example, the rubric assists with composing consistent, purposeful written feedback that clearly communicates to students the gap between performance and expectations.[i]

I use the rubric I designed for assessing student performance on the capstone assignment and convert students' scores into grades for the purpose of summative evaluation (see Arter & McTighe, 2001). I define in advance the relative value of each indicator and the point values associated with each level of performance. When scoring work, I determine where the student's evidence best fits according to the performance levels and arrive at an overall score for each indicator based upon the evidence. In addition to recording an overall score, I maintain a spreadsheet of students' scores on each indicator and report on aggregate scores for the purpose of program assessment. In the following subsections, I describe the three main exercises and corresponding student learning assessment processes and results.

Exercise 1: Working with Uniform Crime Reports Data

The first of the series of exercises in the criminology course is introduced toward the beginning of the semester, when students are learning about the measurement of crime in the United States. The initial, multi-stage exercise provides students an opportunity to explore online sources of crime information during in-class guided sessions. Students are informed that lessons learned in this and other exercises will be essential for successfully completing the capstone project for the course. The activity is divided into sections to allow for greater opportunity to assist students as they work through the assigned tasks, and to highlight important points about the information students are accessing and using. I have prepared worksheets that contain a number of questions about the data source, questions to answer using the data, and blank spaces for answers. As a class, we work through the worksheet in a mixture of lecture, guided instruction, and independent student activity.

In the first section of the exercise, students learn about the Uniform Crime Reports as a source of crime data, the resources that are available, and how to navigate the website. At the website, students browse information on widely used Federal Bureau of Investigation (FBI) annual publications that utilize data mined from the Uniform Crime Reports (UCR) database. Next, students are introduced to the online data analysis tool available at the FBI's UCR website, and I then model procedures for analyzing crime rates for various locations. I invite students to delve into the data, and suggest researching crime estimates for their home state and crimes reported in cities or counties where they reside. I have found that many students are inquisitive about crime trends in their communities, and open to experimenting with the data analysis tool. Providing students with situations and materials to encourage exploration and experimentation, as well as time to think about and create their questions and ideas are vital for stimulating

creative thinking and creating an inquiry-based learning experience (Feldhusen and Treffinger, 1980).

Next, students following along as I demonstrate procedures outlined in the worksheet for generating tabled data on violent crimes rates. Student practice retrieving violent crime rates for a span of years at a given locality, transforming the data to an MS Excel spreadsheet, and creating a line graph to display the data and facilitate interpretation.

Most students require considerable assistance at first on this part of the activity, and as the instructor I pause to circulate the room upon the completion of each major task before moving forward as a class. In addition, students are seated at computer stations in groups ranging in 2 to 4 students in size, and encouraged to support one another as the class works through this portion of the exercise. Working together in this way affords students a direct support system as they engage in some of the non-routine, challenging problems that may arise.

Upon successfully creating their graph, students make written observations about the trends they observe, and are given a short time to prepare and record their interpretations before discussing as a class. Throughout the process, I call on students for responses, ask for additional responses from volunteers, and on occasion elaborate on responses as needed.

Students now work independently to repeat the entire process in order to create a line graph using the same tool, this time displaying property crime trends. Students are encouraged to review the detailed instructions provided in the handout that guided the class's analysis of violent crime data, and seek assistance as needed. Once again, I move throughout the room to monitor students' progress, paying particular attention to those that struggled during the first part of the exercise, and encourage students to support one another in completing the assignment.

This method known as i*nstructional scaffolding* gives students opportunities to practice and receive support as they are learning new concepts and skills, but gradually require them to work autonomously. As a way of offering instructional support, scaffolding is effective for helping students learn difficult tasks and reach a higher level of thinking (King, Goodson & Rohani, 1988). Furthermore, it is beneficial for creating a learning environment that promotes the construction of new knowledge. I use a variety of strategies in this and the subsequent exercises to offer structural support including breaking up complex processes into concrete steps, providing and discussing examples in detail, and structuring opportunities for practicing and checking understanding.

At this juncture, the assessment rubric is used for formative assessment. It aids in constructing useful feedback for students to consider in their own evaluation of their performance, and informing subsequent instructional practices. An analysis of student performance on this initial exercise reveals useful information on the level of and variations in students' quantitative literacy and reasoning skills upon entering the course.

During the most recent administration of the activity, I observed that throughout this first exercise, a fair number of students struggled with the complexity and the level of precision with the tasks involved, particularly in importing the data to MS Excel and creating their own graph. I observed their lack of attention to my oral and written instruction impeded their progress on and led to frustration with this portion of the exercise, as they had to return to steps they previously overlooked. As a class, we talked about approaches to complex tasks such as this, and how their ways of thinking about these tasks influences their learning and performance.

I noted all students (N=19)required at least some assistance with creating graphs, while 88% of students required considerable assistance, scoring between a 1 (underdeveloped) and 2

(developing), in both creating and interpreting their graphs. The majority of their interpretations lacked detail, were awkwardly stated, or contained minor errors. Most students demonstrated an inability to adequately explain information presented in the tables and graphs and struggled to find the language to make reasonable statements or conclusions about the data independently. Gaps in knowledge and/or comprehension are important for both the instructor and the student to identify in establishing a baseline, or starting point, of performance. Instructional methods can be subsequently adjusted to address and reinforce problem areas during these structured exercises, and in the course of class discussions and other in-class activities. The information is also useful for informing non-classroom instruction plans such as referrals for supplemental instruction or tutoring.

Exercise 2: Working with National Crime Victimization Survey Data

In the second exercise, students practice using data by accessing online data analysis tools in context of learning about theories of criminal victimization. For this activity, students utilize the National Crime Victimization Survey (NCVS) Victimization Analysis Tool available through the Bureau of Justice Statistics website to create tables and analyze and the relationship between violent crime victimization, age and victim-offender relationship. Before delving into the data, students review relevant variable definitions to familiarize themselves with the concepts. I reiterate that lessons learned in these applications will inform their work on the capstone project for the course.

As with the first exercise, I provide worksheets and model procedures for creating tabled data using the NCVS data analysis tool, entering the data into an MS Excel document, and generating line and bar graphs. Students extract data from the online table to create their own data set and graph the relationship between age and rate of violent victimization by a stranger.

Students provide a written description of their analysis, and practice interpreting their findings using the lifestyle theory of criminal victimization.

As benchmarks for performance in this second exercise, students are expected to utilize the online data analysis tool to retrieve the appropriate data and import it to MS Excel, and create an appropriate data display with limited assistance. I anticipate students' ability to create graphs and interpret data has improved since the first exercise, but their ability to accurately and effectively apply theoretical concepts is still somewhat limited. They are expected to provide somewhat accurate explanations of information with minor and minimal errors. Here, I draw upon our program assessment rubric for formative assessment and to guide my composition of written feedback. Grading is based upon the accuracy and completeness of the work.

I noted that the majority of students over the course of this experience demonstrated a greater ease in using an online data analysis tool and importing the data to MS Excel as compared to the previous exercise. Moreover, students required less support in creating their own graphs using MS Excel. In fact, several students required no assistance in performing these procedures and were observed offering support to other students, a vast improvement over the first exercise. In assessing their written work I found that students were generally more accurate and provided greater detail, indicating working ability to comprehend and interpret the data. The proportion of students able to explain the meaning of the data in everyday language and refer to specific data in reporting the results increased over the previous exercise. For most students, however, there remained a lack of substantial analysis of the graphs and tables. A small proportion of students demonstrated a poor understanding of the measure or drew incorrect conclusions about the meaning of the data. Nonetheless, there was a marked improvement over that observed in the first exercise.

Exercise 3: Capstone Crime Fact Sheet Project

For the final project of the course, students work autonomously to design and create an original professional-quality multi-page fact sheet on a Part I offense of their choosing (excluding arson). It is at the end of the course that students are expected to do their best work in relation to the outcomes of the assignment, and the capstone assignment serves as a summative assessment of the student's skill in relation to quantitative learning objectives. While students are provided a detailed description of the project requirements, they must now rely upon their own knowledge and skills, introduced and practiced earlier in this course, to complete the complex task at hand.

Students use online and library resources to show their ability to conduct research, and evaluate and synthesize information to provide an accurate report on the definition, characteristics, patterns, trends, and sources of data for the crime they have chosen. In addition, students demonstrate their ability to create graphics that meaningfully display important trends and patterns using the UCR and/or NCVS online data analysis tools and Excel software. At this point in the term, these are skills that have been introduced and practiced earlier in the course.

Students are expected to generate graphs that illustrate at least one pattern and one trend they judge to be valuable and important. Each graph is to be accompanied by an explanatory narrative authored by the student. In describing a line graph, for instance, students are expected to report the overall appearance of the line, and include quantitative information by reporting on peaks, valleys, range, percent increase or decrease, etc.

Students are also asked to provide an account of how criminological theory has been used to explain this type of crime, and may be used to make sense of patterns or trends discussed in their fact sheet based upon their review of the literature.[ii] For instance, some students have

drawn upon concepts related to social disorganization theory to explain why burglary rates are higher in urban areas compared to suburban and rural areas. Students who have chosen to focus on motor vehicle theft often point to how rational choice theory and the concept of target hardening may, in part, explain patterns and trends related to this crime.

Feedback is provided to students using a grading rubric which, in part, reflects elements of the program assessment rubric. For the purpose of program assessment, I utilize the assessment rubric to formally evaluate students' ability, compute statistics using software and covert data to meaningful forms, interpret charts and/or graphs they create, and make reasonable statements or conclusions about what the data suggests based upon their analysis. At this point in the course, students are expected to perform these tasks independently with minimal minor errors or no errors, scoring a 3 (working) or 4 (proficient) on the 4-point rubric scale. Students are also assessed on their ability to select and utilize literature effectively and ethically.

Results from the assessment of student work on the capstone assignment revealed 89% of students (N=19) earned a score of 3 or higher as they were able to construct useful, meaningful data displays (graphs, charts) using software, and make reasonable statements about the statistical data presented. A few students did, however, have difficulty accurately or effectively labeling their graphs or incorporating their graphs into the format of the fact sheet. In evaluating the accuracy of their information, 77% of students earned a score of 3 or higher suggesting at least a working ability to effectively describe the data, with 55% of students committing no errors, and another 22% making minimal minor errors. About seventeen percent, or 3 of the students, made more frequent or serious errors, but overall demonstrated that their abilities were developing, while one student's work suggested that, for them, these skills remain largely undeveloped. Assessing students' work in relation to their use of the literature, I found that the

majority (83%) of students demonstrated at least a working ability to select and use, and appropriately cite quality, reliable sources.

In the process of working on the project, some student expressed apprehension about creating and interpreting their own graphs independently, and evaluating their own work for accuracy. I talked with students about this in the context of being academically challenged by the curriculum. I invited students to share their work in progress with me, and provided support in the form of reassurance and reinforcement as they worked through the more challenging elements of the capstone project.

Implications

Classroom Instruction

The results from the assessment of student learning offered several implications for classroom instruction. Just over half of the students (55%) made no errors in their interpretation of data on the capstone project, suggesting that students need additional opportunities for practice and feedback in interpreting tables and graphs, in addition to practice labeling graphs and arranging statistical tables. I noted that some students seemed reluctant to elaborate on or infer conclusions from the summary graphs. Though this improved over the course of the semester, it is important that students explain further and with greater detail their observations, inferences and conclusions in order to reach levels of learning required for mastery. Based upon my interaction with students during these exercises, I speculate their reluctance was in part due to the fact this was the first time many of them were asked to express their statistical thinking in their own words. I considered that, lacking confidence in their ability, students may limit the extent to which they explain the data to avoid making errors or drawing incorrect conclusions. Given these observations, and that quantitative reasoning represents “a "habit of mind” and

"competency, and comfort in working with numerical data" (The Association for American Colleges and Universities, 2013, para. 2), I concluded that improving students' confidence and attitudes toward these activities needs to be more explicitly stated among the course objectives and assessed.

Accordingly, I plan to enhance the formative assessments by building in more opportunities to practice creating and formatting graphs and preparing written interpretations tables and graphs. In addition, a survey administered at the beginning and end of future semesters may be useful to assess students' confidence in using various tools and their attitudes toward such activities.

Academic Program

The first cohort of students to enter the senior seminar capstone course having the described preparation will be the class of 2015. It is at this stage of our efforts that we may better assess the program modifications made more holistically. That being said, we are collecting and analyzing data on student performance on those assignments identified as key points for the purpose of program-level assessment. The assessment of student performance on the criminology course capstone project has already generated important information for improving our academic program. First of all, given the intent to use scaffolding in the program curriculum as a strategy to help students with difficult learning tasks, it is important that students take classes according the plan of study recommended for our majors. Prior to taking the criminology course, students are advised to complete a course introducing basic computer applications. Yet, I found several students in the class had yet to enroll in or complete the computer applications course. Having no previous experience working with MS Excel initially placed them at a significant disadvantage as they attempted to complete some of the tasks, not to mention the valuable instruction time this

takes from the topic at hand. Strict adherence to course sequencing guidelines is needed, and we are currently considering how the use of additional prerequisite requirements and academic advising may enhance our efforts.

Third, the scaffolding of student learning within courses and the program curriculum implies the need to connect course content in a way that enables students to build upon prior knowledge and internalize new concepts and skills, and develop autonomous learning strategies as they advance through the program curriculum. In turn, this places considerable emphasis on the value of collaboration among program faculty. In situations such as ours, where a single faculty member is teaching multiple courses identified as crucial locations for practice and assessment, it is still important to collaborate with other faculty in the design of their courses to support student learning and promote the development of autonomous learning strategies. Learning opportunities that serve to reinforce or advance knowledge and skills taught in preceding courses should be deliberately woven into the curriculum.

Lastly, our plan for assessing the effectiveness of our academic program involves the use of direct and indirect evidence. We currently use self-report data from the National Survey of Student Engagement to measure students' experiences on a variety of topics. Given the modifications made to the program curriculum, investigating the relationship between these modifications and students' self-reports on experiences related to active learning, higher order learning, level of academic challenge, and the use of technology in their learning may yield information useful for further refinement our academic program.

Conclusion

Challenging students to engage in activities that require them to generate questions, analyze and interpret data, evaluate information, and create new ideas or work products are ways

to promote quantitative literacy. Coursework that emphasizes more complex thinking skills by providing opportunity for practice and feedback contributes to the development of higher order thinking skills necessary for functioning in school, work, and everyday life. The results of activities are indicators that students are approaching course material in deeper ways.

In sum, this paper demonstrates how learning opportunities may be structured in a criminology core to support the development of quantitative literacy and reasoning skills. Combined, the activities described herein encourage students to actively engage course material in deeper ways to promote the development of higher order thinking skills. These experiences advance skills for evaluating, analyzing, and synthesizing a sizeable amount of information, as well as increasingly challenge students to practice and apply these skills independently. The importance of an active-learning, student-centered approach and the use of instructional scaffolding are demonstrated as key features to an effective plan for enhancing the development of these skills. From these course-embedded experiences, key assignments that require students to create work products which reveal their thought processes and demonstrate a range of their quantitative skills can offer faculty, programs, and institutions information for evaluating and improving upon student learning and academic programming.

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[i] The Association for American Colleges and Universities Quantitative Literacy VALUE Rubric is available online at http://www.aacu.org/value/rubrics/QuantitativeLiteracy.cfm.

[ii] Prior to this requirement, students engage in a series of exercises where they practice applying theoretical principles and concepts to interpret criminological data and events. A film analysis paper serves as a summative evaluation the student's ability to select a theory and relevant observations from

the film, summarize the theory, and meaningfully apply at least two theoretical concepts to interpret their observations.