Using a Course Learning Management System to Promote Academic Honesty

Dr. Gillian M. Nicholls, Southeast Missouri State University

Dr. Gillian M. Nicholls is an Assistant Professor of Quantitative Methods at Southeast Missouri State University. Her research interests are in applying statistical analysis and optimization to supply chain management, transportation management, and engineering education. She holds the B.S. in Industrial Engineering (Lehigh University), Masters in Business Administration (Penn State University), M.S. in Industrial Engineering (University of Pittsburgh.), and Ph.D. in Industrial Engineering (University of Pittsburgh). Prior to entering academia, Dr. Nicholls was a practicing industrial engineer in the freight transportation industry. Address: Donald L. Harrison College of Business, Southeast Missouri State University, One University Plaza – MS 5815, Cape Girardeau, MO 63701; telephone (+1) 573.651.2016; fax: (+1) 573.651.2992; e-mail: gnicholls@semo.edu.

Dr. Neal Lewis, University of New Haven

Neal Lewis received his Ph.D. in engineering management in 2004 and B.S. in chemical engineering in 1974 from the University of Missouri – Rolla (now the Missouri University of Science and Technology), and his MBA in 2000 from the University of New Haven. He has over 25 years of industrial experience, having worked at Procter & Gamble and Bayer. He has taught at UMR, UNH, Marshall University, and the University of Bridgeport. Neal is a member of ASEE, ASEM, and IISE.

Using a Course Learning Management System to Promote Academic Honesty

There are various ways to use a course Learning Management System (LMS) to educate students about what constitutes academic dishonesty, school and instructor policies regarding academic dishonesty, and the sanctions that will be levied for academic dishonesty. Students can be required to sign, scan, and upload a document specifying the policies and sanctions for that course. The LMS can be used to prove students have received training about academic honesty standards and the sanctions for misconduct. Educating students about the policies can assist instructors in deterring academic dishonesty, disproving later claims of policy ignorance, and prosecuting misconduct.

LMS systems also offer ways to limit students' ability to cheat on assignments. Various settings in the systems combined with strategies in designing online assignments discourage students from using unauthorized aids and hamper their ability to share answers. Time limits for completing assignments, using randomized algorithmic problems, randomizing question selection, including conceptual short answer questions, and using an online proctoring service for exams are all methods of deterrence.

Academic misconduct can be detected through the capture of Internet Protocol (IP) addresses and time stamp activity tracking features of LMS systems. The LMS reporting features can be used to research a student's access of an assignment, compare IP addresses with those of other students in the course, and check the IP address location against the likely location of the student. University IT staff may be able to access additional LMS data if misconduct on a wider scale is suspected. These LMS features can rapidly be deployed to investigate suspected cases and provide solid evidence to punish academic dishonesty.

This paper presents best practices for time-constrained educators to use an LMS for supporting academic honesty and protecting honest students. Examples and actual experiences from using an LMS in this way are presented.

Background

Academic dishonesty cases have appeared in the news with greater frequency in recent years. It's no longer a matter of a few students furtively breaking the rules. Organized groups collaborating to thwart the academic policies have instructors outnumbered. The development of new technology has enabled new means of cheating and the increased utilization of online coursework as well as entirely online courses has opened up new frontiers for academic dishonesty. There have been numerous public figures that have plagiarized, but there appears to be little negative outcome. Classic methods of cheating such as glancing at another's exam, smuggling in a note sheet, or using a watch with calculator functions have been joined by more sophisticated methods such as scanner pens, smartwatches, camera-equipped eyeglasses, or impostors with fake ID. Buying a previously used paper has been discouraged by the use of anti-plagiarism software such as Turnitin™, but these tools will not flag papers that were commissioned as new, original work by a student hiring a 'ringer' to do the work. Solution sets and answers to old exam problems are easy to share online in massive pools. Cheating is now commercialized with websites offering solutions for a price, completion of assignments, or "outsourcing" of an entire online course. Instructors and educational institutions are caught in a

veritable arms race to prevent, detect, and punish academic misconduct. New engineering educators are at a particular disadvantage since they are typically pressed for time, less experienced in dealing with cheating, and uncertain about formal "prosecution" of academic misconduct cases. Time spent trying to enforce academic honesty comes at the expense of writing papers, preparing grants, etc.

However, turning a blind eye to academic dishonesty has other costs, and a sense of impunity among unethical students has a corrosive effect on the classroom. Honest students are placed at a disadvantage, and those who realize the cheaters are benefiting at their expense can become embittered. Students accustomed to a lack of accountability for dishonest behavior have little incentive to change their ways later on. Ultimately, the value of a degree in Major X from University Y depends upon the respect that earning it entails. This can be jeopardized long term if pervasive academic dishonesty exists.

Promoting academic honesty starts by understanding the existing university policies and procedures before trying to develop a course policy. It is essential to understand what rules an instructor is allowed to have within the parameters of their course and what sanctions may be imposed at the instructor level, as opposed to what sanctions are available to those at higher levels including the department chair, the college dean, and the university overall. Knowing the university's procedures for academic misconduct cases and following them closely can make the difference between successfully concluding a case of academic misconduct as opposed to having it tossed out. For example, stating in the syllabus that anyone found cheating will automatically fail the course is not a good idea if the university policies do not grant an instructor that sort of authority. Be aware there may be deadlines for how long an instructor can wait to charge a student with academic dishonesty. Some universities require instructors to report all academic honesty cases to an administrator such as the Dean of Students in order to have documentation if a second offense is committed. Make sure the course policies developed and the procedures for following them are on solid ground and will be backed up by the chair, dean, and university. Instructors should not pursue a case if they will not be backed by the administration.

This paper discusses a range of options for using a course LMS to educate students about academic honesty, deter cheating, and detect instances of academic dishonesty. It's helpful to start modestly when seeking to raise the bar on academic honesty standards. Look for efficient ways to get started without an enormous investment of time.

Literature Review

The literature on academic dishonesty covers a wide set of perspectives on the problem. The instances of cheating are depressingly large. McCabe[1] found from survey data the percentage of engineering students that self-reported cheating of any kind was 82%. The prevalence of cheating has been confirmed in other students including Haines, et al.[2] and in a follow up study by Diekhoff, et al.[3], significantly larger percentages of students surveyed indicated they had cheated on assessments. The significant predictors between cheaters and non-cheaters were found to be student age, marital status, employment status, grade point average, parental financial support, sports involvement, Pan Hellenic organization membership, and score on the "neutralization" scale indicating self-justification of cheating. Younger, single students or that were not employed full time had higher instances of cheating. Students with a lower grade point

average or who were more dependent upon financial support also had higher instances of cheating. Involvement in sports or fraternity/sorority membership were also risk factors. Cheaters also scored higher on the neutralization scale. The more a student believed that others were cheating, the more likely they were to cheat. The vast majority of students, even non-cheaters, indicated they would not report or confront another student that was cheating. The largest deterrent factors for cheaters were shame if they were to be caught, fear of failing the course, and fear of further university sanctions. Despite these risks, most cheaters expected to get away with it. McCabe and Trevino[4] found that students at schools with a strong honor code reported lower rates of cheating than those at schools without honor codes.

Passow et al.[5] argue that cheating on graded assessments should be examined by type of assignment rather than considering all types of academic dishonesty in a single category. They focused on predictive modeling of cheating on homework and exams. Several variables were predictive of cheating on exams. Students that reported cheating in pre-college work were much more likely to cheat in college. Students that were in their 5th year at school, participating in Pan Hellenic groups, or on scholarships were also more likely to cheat on exams. Students with strong moral codes that believed cheating to be wrong were less likely to cheat. Predictive variables for cheating on homework included second year in college, personal pressures leading to situational cheating, degree of moral obligation not to cheat, and whether strong academic policies deterring cheating were present. The strongest bar to cheating in both models was the students' personal moral code.

Carpenter et al.[6] stated that faculty trying to prevent cheating should very clearly define what they consider academic dishonesty since there are varying definitions and attitudes. Students are not always aware of the distinctions, and it is unwise to let them come up with their own interpretation of the term. They discussed the serious harm from allowing students to cheat through college, present an inaccurate educational image to future employers, and potentially continue to act in unethical ways in their professions. Universities need strong policies for academic honesty that are actively practiced and supported. Their study found that a majority of students viewed copying another's work as clearly dishonest while allowing another to copy was not viewed by a majority to be dishonest. There is an effect from students believing that others are cheating more than they are – it makes them more willing to cheat themselves. The students surveyed indicated that they felt it was up to the instructor and the institution to prevent cheating. As other researchers had found, there was very little willingness on the part of students to report cheating by counterparts. Cheating behavior occurs across all disciplines[7].

Harding et al.[8] examined cheating on exams at a series of different institutional types. Students that cheated were more anti-social than non-cheaters. The strongest predictive variables were an expressed intention to cheat in the future, followed by self-reported cheating on high school exams. The students' moral obligation not to cheat was a strong factor in modeling cheating vs. non-cheating. They also reported finding that citizenship status was a significant predictor of the students' sense of moral obligation with U.S. citizens indicating a greater sense of moral obligation not to cheat. They proposed a model with fraternity/sorority membership, U.S. citizenship, and anti-social scoring as affecting moral obligation which then affects intention to cheat along with prior HS cheating behavior. The type of institution attended was not a significant predictor.

Exploring academic cheating from a psychology perspective has found other predictors. Nathanson, Paulhus, and Williams[9] found that scholastic competence and subclinical psychopathy were the major predictors of cheating. They suggested focusing on preventing cheating since altering the main predictors would be difficult at best. In a subsequent study[10], they also identified low verbal ability as a significant predictor of academic dishonesty.

The nature of cheating has also evolved from copying old term papers or buying one from a paper mill. Hunter and Birkenbuel[11] reported on six large summer engineering classes that were badly affected by organized students employing a variety of methods to collaborate in cheating on exams. Students were found to have cell phones and earpieces secreted on their persons and also used fake calculators concealing communication devices. The students outnumbered the faculty and were described as 'belligerent' in opposing efforts to maintain exam proctoring rules. A total of 15 students were expelled, and nearly 90% of the students in the courses earned a D or lower. Instructors started checking student ID cards at exams after assignments were turned in under the same names but with varying handwriting. The cheating students responded by forging IDs. In one exam a student faked a medical emergency to distract the proctors so other students could cheat with hidden cell phones. After paramedics arrived, the student declined medical treatment and gave a false name. Security personnel had to be deployed when students ejected for cheating became threatening.

As technology has changed cheating in face to face classes, it has also affected the potential for cheating in online classes[12, 13]. Malesky, Baley, and Crow[14] conducted an experiment to determine if instructors could identify a student cheating by contracting out an online course to a ringer supplied by a commercial cheating company. They created a pseudo-online course co-taught by two experienced online instructors and recruited students who had already taken the course to participate as students for research experience and/or honors credit. All the students were assigned aliases, false student ID numbers, and new email addresses by the university. One of the students was directed to contact a cheating company, provide the syllabus, and hire them to complete the course for him. All the students were entered into a raffle for a money prize if the cheating student completed the course without being identified. The cheating company charged $917 and immediately upon payment began turning in all the assignments. The cheater received A's without having to do any work aside from a live presentation. The cheating company declined to have their agent do this, but they provided a script and Powerpoint slides. The cheater was able to earn an A on the live presentation despite being unfamiliar with the materials. The instructors were not able to identify the cheater. Regular use of Turnitin and Google searches did not detect this cheating because the content was professionally prepared as original work by the contractor. This sort of cheating has dire implications for online education.

Overall, the research suggests that the best way to deal with academic dishonesty is to prevent and deter it through clear guidelines, strong policies, and honor codes that are accepted and supported throughout the institution.

Educating Students About Academic Honesty

One of the simplest ways to promote academic honesty is to educate students about what is and isn't permissible in the course. Students may have a general sense that cheating is bad without

necessarily having a good idea of what actions cross the line into cheating. This is complicated by generational shifts in attitudes and differences in cultural approaches to academia. If you've grown up with the idea that working together to help everyone out is the right thing to do, it can be hard to distinguish where help ends and academic misconduct begins. Students used to looking up information online in seconds may not grasp that just because something is freely available for view online doesn't make it okay to use in a graded assessment.

The course LMS is a great place to post content that educates students about academic honesty in general and the policies and procedures used by their instructor, department, college, and university. Information can be directly posted as PDF files or as clickable links that take students to university webpages. To make sure students read and review the content, consider posting automated online quizzes in the LMS to test students' understanding of the material and your course policies. Another way to enforce this is to explore settings within the LMS that block students' access to future content or assignments until they have completed actions within the LMS demonstrating review of the academic honesty policies.

The commonly used LMS packages include Blackboard™, Brightspace™, Canvas™, and Moodle™. They are all capable of designating a portion of the course site to cover academic honesty, posting informative content, inserting content links, constructing interactive quizzes, and using settings to direct students to review the material.

Blackboard allows instructors to set availability options on content that is posted based on grades earned on assessments or satisfying other criteria such as group membership, reviewing content, reaching task completion milestones, etc. For example, a student might be required to confirm they have reviewed the academic honesty policy for the course before they qualify to gain access to further content. Students can be categorized into groups and access limited to students in the group that have completed academic honesty content review. Blackboard refers to this feature as "Release Criteria" and has two levels of "Adaptive Release Rules." Not all universities using Blackboard choose to have adaptive release as a function for their instructors. This feature must be enabled by the university.

Brightspace allows instructors to create "intelligent agents" that check for students that have viewed a specified content portion. The "Checklist" feature can be used to construct a list of tasks students need to complete before moving on. Instructors can set "Release Conditions" for course content modules, checklists, assignments, quizzes, etc. that prevent students from seeing the content until they have met the required conditions. These can also be combined with intelligent agents to generate emails to students informing them that they haven't yet completed something required.

Canvas allows instructors to set "Prerequisites" that must be met before a student can access a content module. Instructors can also set "Requirements" that prevent students from moving on to the next module before they have completed all requirements. The requirements can include viewing a content item, submitting an assignment, or reaching a minimum score. To successfully restrict students moving from one module in the course to another, the prior modules must also have restrictions set.

Moodle allows instructors to use "Restrict Access Settings" that limit what content students are able to interact with. Like the other LMS packages, restrictions can be based on a date, a grade on a specific assessment, and instructor-defined group. Moodle also has restriction choices based upon user profile fields (address, email, name, department, and Skype ID among others), completion status of other items, and complex nested logic involving all or any combinations of requirements.

Figure 1 shows an example from Moodle of posting files and an interactive forum to educate students about academic honesty. The small gray boxes to the right of each item indicate the completion status of the content. Some are set to allow students to manually check the box indicating completion while others require students to view the content, make a forum post, earn a specific grade, etc.

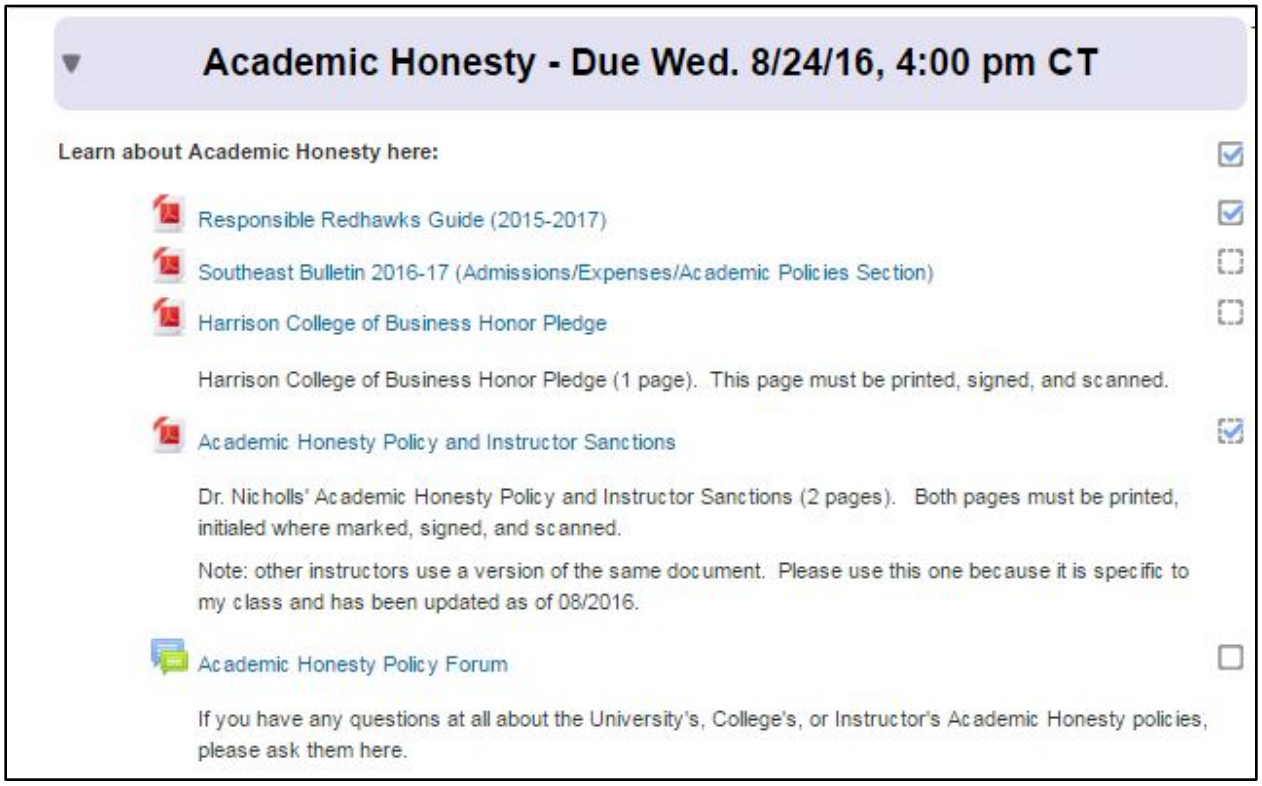

Figure 1 Example of Posting Informational Content about Academic Honesty in an LMS

Figure 2 depicts an assignment and a quiz that have restrictions set in Moodle to prevent students from accessing them without first completing tasks that confirm they've reviewed the academic honesty information. The content postings are "grayed out" to indicate they are restricted. The assignment in this figure is used to collect digital copies of students' signed acknowledgement of the college's honor pledge and the instructor's academic honesty policies and sanctions for violating them. Since many students lack ready access to a scanner, they may find it easier to photograph each page of the signed documents and upload either a jpg photo file or insert the photos into a Word document. Having such an assignment is both educational for the students and also serves to illustrate how seriously the academic honesty policies are taken. Digital copies of the signed documents are gathered in a single repository and are available to provide incontrovertible evidence if needed later to prove that students were informed about the rules in

the course. This sort of evidence makes it very hard for a student facing credible accusation(s) of academic misconduct to plead ignorance.

The Academic Honesty Quiz in this example incentivizes students to study the policies so they can answer the questions. They cannot advance to further course content without scoring a 100% on the quiz, but they can repeat the quiz an unlimited number of times. The quiz is both a learning motivation and provides an opportunity to start the course with an easily obtained high score that counts towards the course grade. Many instructors use syllabi quizzes to ensure students are familiar with other administrative details about the course, so creating a quiz with a focus on academic honesty is an educational tool that doesn't require extensive time to set up.

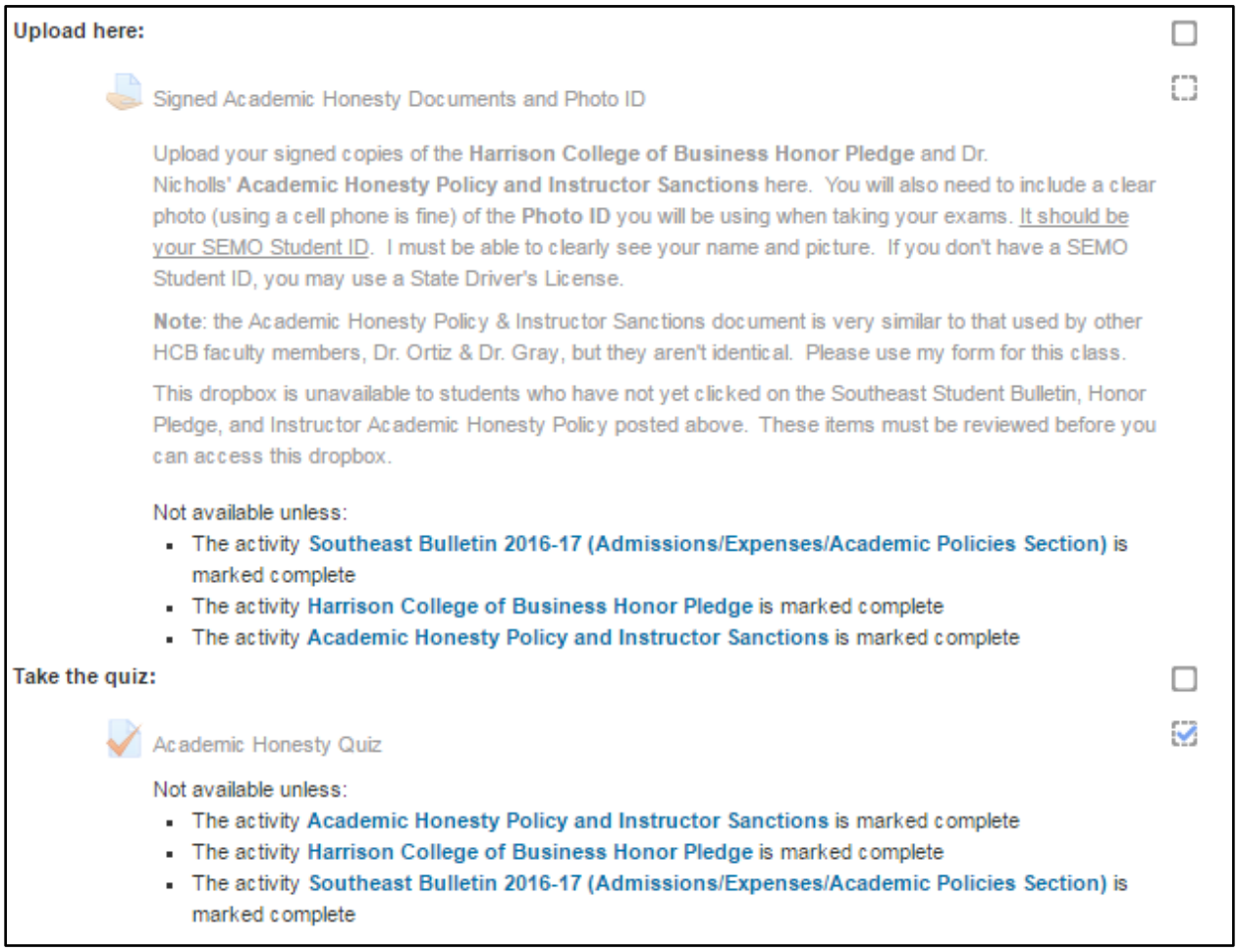

Figure 2 Example of Assignments with Availability Restrictions

Figure 3 shows an example of setting course module restrictions in Moodle. The restrictions follow a Boolean logic that combines instructor-defined group membership with grade performance on specific assessments. The list of potential restriction settings is virtually unlimited although the more complicated the set, the greater the chance that students will find themselves excluded and unsure how to correct this.

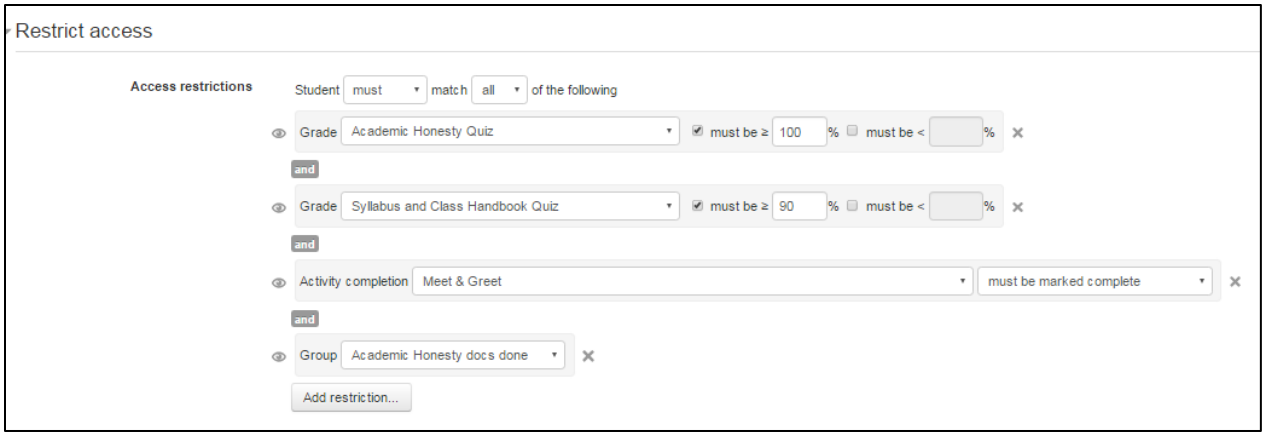

Figure 3 Example of Content Module Restriction Settings

Developing the course's structure within the LMS to provide educational content about academic honesty and to require students' interaction with it takes time; however, once this is set up the marginal effort to recycle it in future courses is very modest. The investment of time in educating students about the rules and how to avoid violating them can potentially save a great deal of time dealing with academic misconduct later. From personal experience, it is best to start small with just a few assignments or review requirements and automate as much of the evaluation as possible. Be very clear with the students what they must review, complete, and do in order to satisfy the restrictions. This clarity is essential to minimize students' frustration and confused requests for instructor assistance. Begin the process by ensuring the policies are worked out, and the instructor has gained familiarity with the restriction process in the LMS. Then you are ready for students to review, sign, scan, and upload digital copies of documents.

Deter & Prevent Academic Dishonesty with an LMS

LMS packages have great potential to deter students from committing academic dishonesty and completely prevent some forms of it. Assignments can be constructed to draw from large banks of random questions that lessen the chances students can easily collude. Each of the major LMS packages offers some ability to construct algorithmic calculated questions where the text remains the same, but problem variables change randomly according to an instructor-defined probability distribution. Randomized algorithmic problems and randomly selected questions in online exercises encourage students to share analysis methods and solution techniques rather than just answers. Online exams and quizzes where students know that everyone gets a slightly different version of the problems discourage copying another student's answers. One of the authors has personal experience spotting answers that were correct for a different version of an exam, but completely wrong for the version the student was taking. The student in this case was sanctioned with a 0 for the exam. More detail about how to build and use algorithmic calculated questions in the common course LMS packages is provided by Nicholls, Schell, & Lewis[15].

The settings for how much time is allowed to complete an assignment can be adjusted to limit the potential for students to consult unauthorized references. Some universities have partnered with textbook publishers that offer online assignments to have custom direct integration between their LMS and the publisher system. Online assignments from a publisher often come with

statistical analysis of how long the average student takes to answer an individual question so that an instructor can reasonably estimate the average time to complete the entire assignment.

LMS questions can be designed to require some individual creative thought so that students can't easily "Google" the answers. Instructors may be able to insert questions requiring students to quickly record a short video of themselves answering a question and upload it to the LMS in order to quickly confirm that the person answering the question is the student registered in the course. Posting lots of assignments that can be automatically graded doesn't create a great deal of work for instructors, and it helps keep students engaged with the course material. It also increases the cost to have a ringer doing the work and can increase prices to the point that fewer students can and will pay for contracted work.

Some LMS packages allow instructors to restrict the range of Internet Protocol (IP) addresses that students can use to access a quiz or exam. For example, if the exam is being given through the LMS in a computer lab, the settings may limit the students to just the IP addresses that belong to that computer lab. This prevents a student from sitting in the lab pretending to take the exam while a more experienced friend or hired ringer is actually logged in as the student and taking the exam for them from another location. This capability has to be used judiciously in online courses since students may be using a Virtual Private Network (VPN) service to access the LMS. In such instances, the VPN access may show up in an entirely different location than where the student is physically located in. This may or may not be legitimate as students who have outsourced the course work to a ringer hired through a commercial cheating website may claim to be using a VPN as a way of explaining course LMS logins from different geographic locations.

Students who must create work in a software package like Word, Excel, Powerpoint, etc. can be required to upload their final version to an assignment dropbox on the LMS. Collecting the files allows an instructor to assess whether the work product was created independently at a time that fits with the beginning of the assignment, quiz, exam, etc. and whether it supports answers given within the LMS assessment. College students nowadays tend to be very comfortable with digital media and online resources, yet they are often unfamiliar with file properties and metadata that can be checked to ensure the file was not created earlier or by someone else.

Universities can contract with online proctoring services like Remote Proctor™ or Respondus Monitor™ to interact with the LMS to administer password-protected exams and ensure ID authentication. Systems like Remote Proctor (RP) can be particularly helpful in administering online courses. Exams are built in the LMS or textbook publisher site and one or more passwords are assigned. Students log into the Remote Proctor site to authenticate their identification, record web video demonstrating they are alone in their test-taking area and without unauthorized aids, select the exam, and pay the exam proctoring fee. The RP system inputs the password, and the RP software records both the image of the student as they take the exam and monitor screen captures at regular intervals. Once the exam is concluded, the student remains online while the proctoring video is automatically uploaded to the RP server. Later a reviewer watches the video looking for exam violations or suspicious behavior and flags anything found for a second review by a more experienced reviewer. Once all student videos for that exam have been reviewed, RP sends the instructor a link to the proctoring report, and the

instructor is also able to review any videos flagged. If a system like this is to be used, it is helpful for the instructor to collect an image of the students' photo IDs at the start of the course. Knowing that the exam video will be reviewed can cause students to be somewhat anxious, but it also serves as a strong deterrent of academic dishonesty.

Brightspace has a setting in the optional advanced properties area of editing quizzes to disable right clicking, instant messages, and alerts. Restrictions can be set to put in passwords, limit the range of IP addresses allowed to access the quiz to a known set, and even require a lockdown browser. Questions appearing on quizzes can be randomized to draw from a set of possible questions. Randomized algorithmic questions can be built that generate different sets of problem variable values for each students. These capabilities make it harder to cheat during quizzes. Data about the quiz attempts can be downloaded to inspect for suspicious patterns in the data.

Using an LMS to Detect and Prove Academic Dishonesty

If a student taking an online quiz or exam gets an unusually high number of automatically graded questions wrong, it may be time to take a closer look at the student's work in the course. If the instructor is using an online assignment in a publisher's system and observes assignments being completed substantially faster than expected (according to the publisher's completion time prediction statistics), it may suggest that academic misconduct was involved. If a student that has previously turned in marginal work or demonstrated weaker skills with language, grammar, etc. is suddenly turning in work of very high quality with excellent language skills, it may indicate someone else is doing the work for them. An instructor may find that a file turned in to support a student's work looks a great deal like that turned in by another student or appears to have been constructed by modifying an old file. In other cases, the instructor may have observed something in the classroom or received a report from another source that leads to suspicions of academic misconduct.

Once an instructor has become suspicious, the LMS package can be used to check up on the student's interaction with the course and potentially gather very credible evidence of misconduct. LMS packages routinely collect and store data when students navigate around the course site, and this data can include a time stamp, the IP address the student was using to access the site, and what component of the course was being accessed. A student that has LMS records showing that logins are coming from different areas within a short period of time suggests that more than one person is logging in as the student. This is particularly suspicious if all work is being submitted via an address in one location while a different address is just monitoring the grades earned. IP data can frequently be downloaded into an Excel file and sorted to look for patterns. Searches can be run to see if the same IP address is being used by more than one student. The university information technology staff may be able to check IP address data from other courses the instructor does not have access to. This level of investigation normally takes place after the case has been referred to higher ranking members of the administration.

Sometimes roommates using the same Wi-Fi router take the class together so this isn't necessarily a sign of collusion. However, if two or more students normally log in with different IP addresses, but suddenly are using the same IP address and starting exams at nearly the same time, it suggests collaboration. Figure 4 shows an example of checking IP addresses after finding that two students had turned in the same Excel file to document their work on an exam.

Student A's name turned up in the file properties of both Excel files. Student B admitted the collusion when confronted with identical files and the suspicious IP logs. Both students failed the exam, Student B earned a D and had to repeat it while Student A earned a C instead of an A.

Time	IP address		Action	Information
10/14/2014 20:00	IP Address 1	Student B	quiz attempt (https://learn	Exam 3
10/14/2014 20:00	IP Address 1	Student A	quiz attempt (https://learn	Exam 3
10/14/2014 21:20	IP Address 1	Student A	quiz close attempt (https:	Exam 3
10/14/2014 21:44	IP Address 1	Student B	quiz close attempt (https:	Exam 3
10/14/2014 21:44	IP Address 1	Student B	quiz view (https://learning	Exam 3
10/14/2014 21:44	IP Address 1	Student B	course view (https://learni	Fall 2014 QM352

Figure 4 Sample of IP Address Logs Suggesting Exam Collusion

Figure 5 shows another example of IP address logs that demonstrated exam collusion by two students and also the use of unauthorized aids. These two students came under suspicion after turning in very similar answers on a prior exam. On the Final Exam (Exam 3) they turned in Excel files that looked alike with only superficial formatting modifications. The files were found to both be derived from an example problem created in 2006 and posted on the LMS as a learning aid. Student C and Student D sat in university computer lab logged in at neighboring PCs. Student C started Exam 3, relayed exam information to Student D who then downloaded the learning aid file (see arrow below) in violation of the rules, entered the exam data, relayed the file to Student C, made some more modifications, and saved another version for later use. Student C completed the exam and submitted one version of the file. Student D started the exam the next day at an off campus location, and then turned in the file created in 2006 and finalized the previous day. When confronted with the identical files and the IP address logs, Student C admitted the collusion. Both students failed the exam, failed the course and had to repeat it.

Time	IP address		Action	Information
10/16/2014 18:42	IP Address 4	Student D	quiz view (https://learning	Exam 3
10/16/2014 18:42	IP Address 4	Student D	quiz close attempt (https	Exam 3
10/16/2014 18:42	IP Address 4	Student D	quiz view summary (https	31907
10/16/2014 17:59	IP Address 4	Student D	quiz attempt (https://learn	Exam 3
10/16/2014 17:59	IP Address 4	Student D	quiz view (https://learning	Exam 3
10/15/2014 19:11	150.201.128.70	Student C	assign view (https://learn	View own submission status page.
10/15/2014 19:11	150.201.128.70	Student C	assign submit (https://lea	Submission status: Draft (not submitted). The number of file(s) : 1 file(s)
10/15/2014 19:11	150.201.128.70	Student C	assign view (https://learn	View own submission status page.
10/15/2014 19:10	150.201.128.70	Student C	quiz close attempt (https	Exam 3
10/15/2014 18:19	150.201.128.70	Student C	quiz view summary (https	31907
10/15/2014 18:00	150.201.128.69	Student D	folder view (https://learni	Ch. 02 Excel Tools & Resources folder - please review
10/15/2014 18:00	150.201.128.69	Student D	resource view (https://lea	Linear Programming Excel Example file
10/15/2014 18:00	150.201.128.70	Student C	quiz continue attempt (ht	Exam 3
10/15/2014 17:59	150.201.128.69	Student D	course view (https://learn	Fall 2014 QM352-740 Management Science 10511
10/15/2014 17:58	150.201.128.70	Student C	quiz continue attempt (ht	Exam 3
10/15/2014 17:57	150.201.128.70	Student C	quiz attempt (https://learn	Exam 3
10/15/2014 17:57	150.201.128.70	Student C	quiz continue attempt (ht	Exam 3

Figure 5 IP Address Logs Showing Exam Collusion and Unauthorized Aid Usage

Another memorable case detected in the same semester involved a student that turned in an Excel file that didn't match the answers entered into the exam. The file was inspected and found to contain the name of another student who had taken the course a year earlier. Checking the IP address logs revealed that the student had logins coming from two different addresses, sometimes within mere minutes of one another. Work was being submitted from one IP address and grades were checked from a different IP address. The student initially denied committing misconduct after being confronted with the logs and the inconsistent file, but later admitted the violation. While on academic probation from cheating in this course, the student was found to be employing the services of a ringer to perform work in a subsequent course. At this point the student's other coursework was audited and a strange pattern of foreign IP addresses appeared in other coursework leading to very serious additional sanctions.

After several time-consuming cases were pursued, one of the authors began requiring proctoring for all online course exams. The use of Remote Proctor has dramatically reduced the instances of academic dishonesty, but it hasn't completely ended it. The proctoring service flagged one exam because the student was observed on the monitor view screen captures browsing through the pc's stored files. When reviewing the exam video, the author recognized that the student was using an example file posted on the course site (with the author's name showing prominently) as a learning aid to answer the exam question. Figure 6 shows a portion of an image taken from the proctoring video in which the student is in the process of changing the example problem data to that of the exam question data. The student admitted guilt when charged with academic dishonesty, failed the exam, and ultimately failed the course.

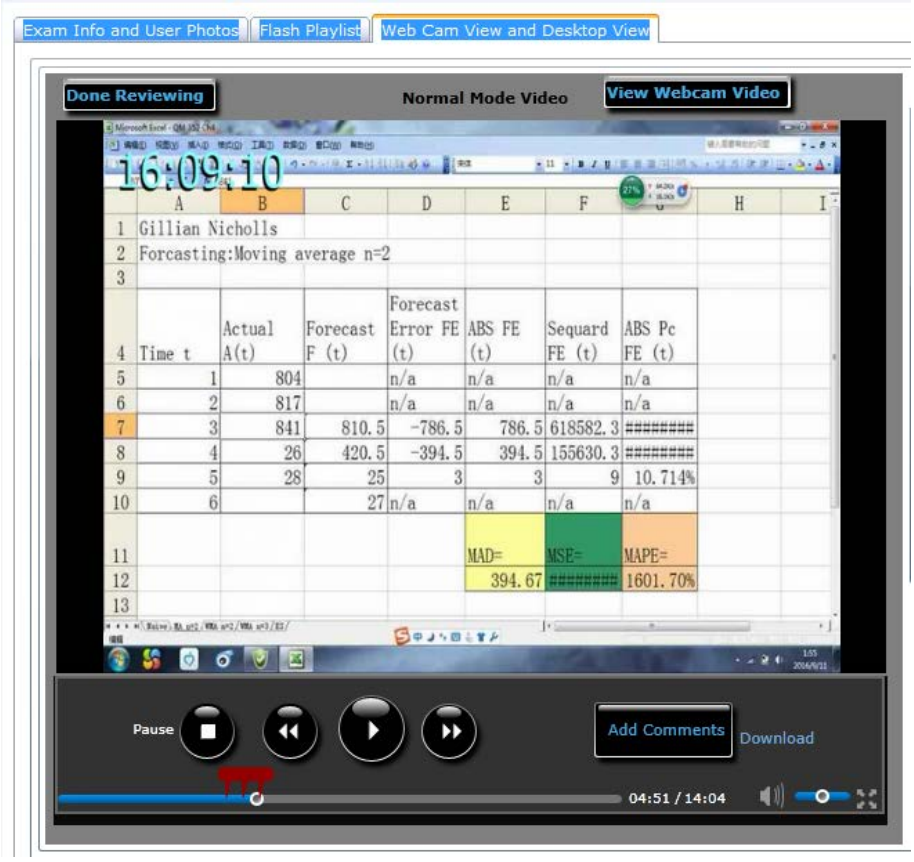

Figure 6 Remote Proctor Screen Capture of Unauthorized Aid Usage

An LMS can also be used to collect written work that can be tested to detect plagiarism. Assignments can be examined using a product such as Turnitin. Blackboard features a "SafeAssign" tool that examines submitted assignments for instances of overlap with existing academic papers in a large set of databases. It looks for lack of originality and suggests where students need to better attribute sources as opposed to just paraphrasing content.

Conclusion

After discovering collaboration among multiple students in an online course, a colleague of one of the authors developed much of the academic honesty course policies and procedures discussed in this paper[16]. They have been subsequently adopted, revised, and are being used by multiple faculty members within the college. This has a multiplier effect in educating the students about academic honesty and instilling in them a sense that it must be taken seriously which serves as a further deterrent to misconduct. Examples of these policies for face to face and online courses are provided in Appendix A.

Academic dishonesty cases can be very time-consuming to investigate and pursue through the university processes. They can be very unpleasant as most educators don't enter academia wanting to investigate misconduct. However, maintaining high academic standards is important. Using the course LMS to educate students, deter and/or prevent misconduct, and gather evidence if need be is the most time efficient way to protect honest students and course integrity. Guilty students are far less likely to be judged innocent or to appeal a conviction when facing the compelling evidence that an LMS can provide.

From personal experience, it is helpful to "accentuate the positive" when instituting new academic honesty policies. Explain to students that these policies are being put in place to protect them from unethical students seeking to gain an unfair advantage over them. The policies serve to protect the integrity of their degree and a diploma from the university. Discuss how unfair it is for students that are part of a clique getting extra help, or wealthy enough to hire a ringer, to be able to claim credit for completing course work that they're honestly trying to learn. Just as shoplifters increase the costs for stores and ultimately honest shoppers, cheaters create extra costs for honest students. Convey the impression that every student starts the course with the presumption of being an honest person. Honest students may find the extra assignments and restrictions irritating, but at least they know every student is operating on a level playing field in the course.

Initially, when the academic honesty procedures were implemented some students expressed unhappiness, particularly in the online class where the proctoring requirement imposed an extra cost per exam. When technical issues occurred with the proctoring software or system, the students reported that they were under extra stress. This has abated and after three semesters, the course evaluations had few if any comments about the proctoring requirement. Several steps made the introduction of the policies easier. In face to face classes, a portion of the first class is devoted to allowing students to complete the initial academic honesty tasks. Bringing paper copies of the honor pledge and the academic honesty policies for students to sign, photograph, and upload allows most students to get the tasks over with that day with minimal extra effort. In online classes, the students are sent an email just before the class starts that explains the policies

and the extra cost for proctoring. Several students across two years of classes have chosen to transfer to a face to face class to avoid the external proctoring. Notes have been inserted into the course registration system (per university policy) to inform students before they register for a class that it involves extra costs and provide an estimate of the total additional cost. In the last two online classes, students have been encouraged to go to a physical testing center to avoid the risk of technical problems. On a positive note, several students have commented that they appreciated the efforts to prevent cheating.

The procedures discussed in this paper are broadly applicable across all of Engineering and other quantitative coursework. Educating students about academic honesty and what actions the instructor deems to be acceptable vs. unacceptable is a good practice regardless of the course subject. Using the course LMS to reinforce this education with items to read, tasks to complete, and a means of electronically collecting signed pledges of academic honesty is also a good practice across academia. However, some tools discussed here may not apply in all courses. For example, the randomized algorithmic questions work best with "bite-size" quantitative problems rather than long multi-stage problems or more qualitative questions. Products such as Turnitin or SafeAssign can be helpful for evaluating students' writing assignments, but they won't help with an assignment to write code for a computer program to run. Some schools have developed mechanisms to evaluate coding projects for impermissible similarity, but that may not be capable of integrating with an LMS. Each instructor needs to consider the way assignments are structured, what sort of academic misconduct could occur, and which tools are best to combat it.

Bibliography

1. McCabe, Donald L., (1997), "Classroom cheating among natural science and engineering majors." *Science and Engineering Ethics*, 3: pp. 433-445.
2. Haines, Valerie J., George M. Diekhoff, Emily E. LaBeff, and Robert E. Clarke, (1986), "College cheating: Immaturity, lack of commitment, and the neutralizing attitude." *Research in Higher Education*, 25, pp. 342-354.
3. Diekhoff, George M., Emily E. LaBeff, and Robert E. Clarke, Larry E. Williams, Billy Francis, and Valerie J. Haines, (1996), "College Cheating: Ten Year Later." *Research in Higher Education*, Vol. 37, No. 4, pp. 487-502.
4. McCabe, Donald L. and L.K. Trevino, (1993), "Academic dishonesty: Honor codes and other contextual influences." *Journal of Higher Education*, Vol 64, pp. 522-538.
5. Passow, Honor J., Matthew J. Mayhew, Cynthia J. Finelli, Trevor S. Harding, and Donald D. Carpenter, (2006), "Factors influencing engineering students' decisions to cheat by type of assessment." *Research in Higher Education*, Vol 47, pp. 643-684. doi:10.1007/s11162-006-9010-y
6. Carpenter, Donald D., Trevor S. Harding, Cynthia J. Finelli, Susan M. Montgomery, and Honor J. Passow, (2006), "Engineering Students' Perceptions of and Attitudes Towards Cheating." Journal of Engineering Education, Vol 95, No. 3, pp 181-194. . Doi 10.1002/j.2168-9830.2006.tb00891.x
7. Marshall, Leisa L., (2016), "Academic Honesty." Lecture, BRAINS from Southeast Missouri State University, Cape Girardeau, MO, November 2, 2016.
8. Harding, Trevor S., Donald D. Carpenter, and Cynthia J. Finelli, (2012) "An Exploratory Investigation of the Ethical Behavior of Engineering Undergraduates." *Journal of Engineering Education*, Vol 101, No. 2, pp. 346-375. Doi 10.1002/j.2168-9830.2012.tb00053.x
9. Nathanson, Craig, Delroy L. Paulhus, and Kevin M. Williams, (2006) "Predictors of a behavioral measure of scholastic cheating: Personality and competence but not demographics." *Contemporary Educational Psychology*, 31, pp 97-122.
10. Williams, Kevin M., Craig Nathanson, and Delroy L. Paulhus, (2010), "Identifying and Profiling Scholastic Cheaters: Their Personality, Cognitive Ability, and Motivation." *Journal of Experimental Psychology: Applied*, Vol. 16, No. 3. Pp 293-307.

11. Pauli, Hunter and Renata Birkenbuel, (2016), “Organized, Belligerent Cheaters Overwhelm Tech Summer Classes.” Montanta Standard, 9/20/2016. http://mtstandard.com/news/local/organized-belligerent-cheaters-overwhelm-tech-summer-classes/article_6e3ba6e6-1302-557b-b8a4-da90e87d7aa7.html
12. Baranovic, Kristopher and Kumar Kashyap, (2016), “Commercialized Cheating.” Lecture, BRAINS from Southeast Missouri State University, Cape Girardeau, MO, September 7, 2016.
13. Youngblood Ortiz, Alisha, Floyd Lockhart, and Lori Mueller, (2015), “Detecting Cases of Academic Dishonesty in Online Classes.” Presentation, *Industrial and Systems Engineering Research Conference* (ISERC), May 30-June 2, 2015, Nashville, TN.
14. Malesky Jr., L. Alvin, John Baley, and Robert Crow, (2016), “Academic Dishonesty: Assessing the Threat of Cheating Companies to Online Education.” College Teaching, Vol 64, No. 4, pp 178-183. Doi 10.1080/87567555.2015.1133558.
15. Nicholls, Gillian M., William J. Schell, & Neal A. Lewis, (2016), “Best Practices for Using Algorithmic Calculated Questions via a Course Learning Management System.” *American Society for Engineering Education Annual Conference Proceedings*, New Orleans, LA, 1-22. https://peer.asee.org/26377
16. Youngblood Ortiz, Alisha (2016), “Academic Mischief Managed.” Lecture, BRAINS from Southeast Missouri State University, Cape Girardeau, MO, March 2, 2016.

Appendix A. Examples of Academic Honesty Policies

Face to Face Course Policies

SOUTHEAST UNDERGRADUATE BULLETIN
All students should be familiar with the current Undergraduate Bulletin.
2016-2017 Undergraduate Bulletin (http://www.semo.edu/bulletin/) (also on Class Moodle page.)

Read the Academic Honesty section in on pages 21-24, which includes the following section:

> ***Cheating.*** *Cheating includes using or relying on the work of someone else in an inappropriate manner. It includes, but is not limited to, those activities where a student:*
> 1. *Obtains or attempts to obtain unauthorized knowledge of an examination's contents prior to the time of that examination.*
> 2. *Copies another student's work or intentionally allows others to copy assignments, examinations, source codes or designs;*
> 3. *Works in a group when she/he has been told to work individually;*
> 4. *Uses unauthorized reference material during an examination; or*
> 5. *Have someone else take an examination or takes the examination for another.*

I (print name here) _____ have read pages 21-24 of the Undergraduate Bulletin and have had the opportunity to get clarification on any items I do not understand.

_____ (Initial here)

HCB HONOR PLEDGE
See the Class Moodle page for a copy of the HCB Honor Pledge. Return and electronic copy of the signed document by uploading it to the "Signed Academic Honesty Documents and Photo ID" dropbox.

I verify that I have signed and returned to the instructor a copy of the Honor Pledge, and have had the opportunity to get clarification on any items I do not understand. **_____ (Initial here)**

CLASS POLICIES AND SANCTIONS
The instructor for this course, Dr. Nicholls, considers the following to be unauthorized aid:

- Collaboration with any other person while working on any quiz or exam, unless the instructions **specifically** allow collaboration.
- any use of reference material on an exam besides the formula/note sheet(s) permitted.
- any materials obtained from other students, including students enrolled in previous offerings of the course or other sections of the course.
- any use of an instructor's solution manual for the book.
- any solution or guidance from the internet, except for the use of the class resources the instructor has provided on Moodle.
- any sharing of files with another student.
- logging into another student's account or allowing another person to log into your account.

If evidence of academic dishonesty is discovered on any work other than a test/exam, the instructor will follow the **Informal Resolution** process on page 22 of the Undergraduate Bulletin.

If the student acknowledges the violation: The grade sanction at that time will be a grade of zero on the work submitted. The instructor also reserves the right to reevaluate any previous submissions by the student to detect evidence of academic honesty not previously recognized. These earlier assignments are subject retroactively to a grade sanction of zero.

If the student does not acknowledge the violation of does not accept the faculty's sanctions: The student can request a formal resolution through the Department Chair.

I verify that I understand what constitutes "unauthorized aid" on an assignment, and have had the opportunity to get clarification on any items I do not understand. **_____ (Initial here)**

I verify that I will receive a grade of zero for any assignment on which I used unauthorized resources. **_____ (Initial here)**

I verify that if an instance of academic dishonesty is discovered, the instructor reserves the right to reevaluate all previous submissions and adjust the grade to a zero if additional academic dishonesty is discovered. **_____ (Initial here)**

I understand that any instance of academic dishonesty that results in sanctions will also result in a report being filed with the Office of Student Conduct. **_____ (Initial here)**

The instructor for this course, Dr. Nicholls, considers the following to be egregious violations:

- a second offense after already having received a grade sanction.
- academic dishonesty (as defined above) on a test/exam.
- having another person complete any portion of the class work for the student enrolled in the class.
- logging into another student's account or allowing another person to log into your account.
- the use of ANY resource that provides assistance with online coursework.

In addition to the Informal Resolution process, in the event of an egregious violation (such as those listed above) the instructor will follow the **Formal Resolution** process starting on page 23 of the Undergraduate Bulletin. For this type of violation the student will receive a grade of zero on the assignment and will be referred to the Department Chairperson for judicial action. Possible sanctions are listed on page 24 and include Disciplinary Probation, failing the course, suspension, or expulsion from the University.

I verify that I understand what constitutes an egregious violation, and have had the opportunity to get clarification on any items I do not understand. **_____ (Initial here)**

I verify that in the case of an egregious violation I will receive a grade of zero for the assignment and will be referred to the Department Chairperson for judicial action. **_____ (Initial here)**

I understand that the sanctions recommended to the Department Chairperson by my instructor may include being prohibited from taking Quantitative Methods classes online in the future. **_____ (Initial here)**

I (print name here) _____ have
1) read and understand the Academic Honesty section of the Undergraduate Bulletin,
2) read and signed the HCB Honor Pledge,
3) understand the instructor's expectations with respect to Academic Honesty, and
4) understand the sanctions of violating the standards of Academic Honesty.
I have had the opportunity to get clarification on any portion of the instructor's policy.

_____ _____
(Student Signature) (Date)

Online Course Policies

SOUTHEAST UNDERGRADUATE BULLETIN
All students should be familiar with the current Undergraduate Bulletin.
2016-2017 Undergraduate Bulletin (http://www.semo.edu/bulletin/) (also on Class Moodle page.)

Read the Academic Honesty section in on pages 21-24, which includes the following section:

> ***Cheating.*** *Cheating includes using or relying on the work of someone else in an inappropriate manner. It includes, but is not limited to, those activities where a student:*
> 6. *Obtains or attempts to obtain unauthorized knowledge of an examination's contents prior to the time of that examination.*
> 7. *Copies another student's work or intentionally allows others to copy assignments, examinations, source codes or designs;*
> 8. *Works in a group when she/he has been told to work individually;*
> 9. *Uses unauthorized reference material during an examination; or*
> 10. *Have someone else take an examination or takes the examination for another.*

I (print name here) _____ have read pages 21-24 of the Undergraduate Bulletin and have had the opportunity to get clarification on any items I do not understand.

_____ (Initial here)

HCB HONOR PLEDGE
See the Class Moodle page for a copy of the HCB Honor Pledge. Return and electronic copy of the signed document by uploading it to the "Signed Academic Honesty Documents and Photo ID" dropbox.

I verify that I have signed and returned to the instructor a copy of the Honor Pledge, and have had the opportunity to get clarification on any items I do not understand. **_____ (Initial here)**

CLASS POLICIES AND SANCTIONS
The instructor for this course, Dr. Nicholls, considers the following to be unauthorized aid:

- Collaboration with any other person while working on any quiz or exam, unless the instructions **specifically** allow collaboration.
- any use of reference material on an exam besides the formula/note sheet(s) and course textbook permitted.
- any materials obtained from other students, including students enrolled in previous offerings of the course or other sections of the course.
- any use of an instructor's solution manual for the book.
- any solution or guidance from the internet, except for the use of the class resources the instructor has provided on Moodle.
- any sharing of files with another student.
- logging into another student's account or allowing another person to log into your account.

If evidence of academic dishonesty is discovered on any work other than a test/exam, the instructor will follow the **Informal Resolution** process on page 22 of the Undergraduate Bulletin.

If the student acknowledges the violation: The grade sanction at that time will be a grade of zero on the work submitted. The instructor also reserves the right to reevaluate any previous submissions by the student to detect evidence of academic honesty not previously recognized. These earlier assignments are subject retroactively to a grade sanction of zero.

If the student does not acknowledge the violation of does not accept the faculty's sanctions: The student can request a formal resolution through the Department Chair.
I verify that I understand what constitutes "unauthorized aid" on an assignment, and have had the opportunity to get clarification on any items I do not understand. **_____ (Initial here)**

I verify that I will receive a grade of zero for any assignment on which I used unauthorized resources.

_____ (Initial here)

I verify that if an instance of academic dishonesty is discovered, the instructor reserves the right to reevaluate all previous submissions and adjust the grade to a zero if additional academic dishonesty is discovered. **_____ (Initial here)**

I understand that any instance of academic dishonesty that results in sanctions will also result in a report being filed with the Office of Student Conduct. **_____ (Initial here)**

The instructor for this course, Dr. Nicholls, considers the following to be egregious violations:

- a second offense after already having received a grade sanction.
- academic dishonesty (as defined above) on a test/exam.
- having another person complete any portion of the class work for the student enrolled in the class.
- logging into another student's account or allowing another person to log into your account.
- the use of ANY resource that provides assistance with online courses.

In addition to the Informal Resolution process, in the event of an egregious violation (such as those listed above) the instructor will follow the **Formal Resolution** process starting on page 23 of the Undergraduate Bulletin. For this type of violation the student will receive a grade of zero on the assignment and will be referred to the Department Chairperson for judicial action. Possible sanctions are listed on page 24 and include Disciplinary Probation, failing the course, suspension, or expulsion from the University.

I verify that I understand what constitutes an egregious violation, and have had the opportunity to get clarification on any items I do not understand. **_____ (Initial here)**

I verify that in the case of an egregious violation I will receive a grade of zero for the assignment and will be referred to the Department Chairperson for judicial action. **_____ (Initial here)**

For an online course, I understand that the sanctions recommended to the Department Chairperson by my instructor may include being prohibited from taking any additional Quantitative Methods classes online in the future. **_____ (Initial here)**

For an online course, if it is necessary to initiate the Informal Resolution process, all correspondence between the instructor and student will be conducted via email. **_____ (Initial here)**

Online course exams will be conducted in a proctored environment. I verify that I understand if I choose to use Remote Proctor® for the proctored environment that it is my responsibility to remain online for at least the length of the exam time after completing an exam to permit the upload of all proctoring file(s). I further verify that I understand all grades received are provisional until and unless RP certifies there were no exam violations. If there is a file upload problem, it is my responsibility to work with the RP staff to enable them to recover the proctoring file(s) so exam certification can take place. **_____ (Initial here)**

I (print name here) _____ have
1) read and understand the Academic Honesty section of the Undergraduate Bulletin,
2) read and signed the HCB Honor Pledge,

3) understand the instructor's expectations with respect to Academic Honesty, and
4) understand the sanctions of violating the standards of Academic Honesty.
I have had the opportunity to get clarification on any portion of the instructor's policy.

_____ _____

(Student Signature) **(Date)**