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Honors area (eg Molecular and Cellular Biology, English, Studio Art):
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May 5, 2014

Title of Honors thesis:
Online Homework: An Assessment of Student Behavior

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ONLINE HOMEWORK:
AN ASSESSMENT OF STUDENT BEHAVIOR

BY

JULIA NATALIE LEONE

A Thesis Submitted to The Honors College
In Partial Fulfillment of the Bachelors Minor With Honors in Astronomy

The University of Arizona

May 2014

Professor Thomas Fleming

Approved by:

[Signature]

Dr. Thomas Fleming
Department of Astronomy
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Department of Astronomy
STATEMENT BY AUTHOR

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Acknowledgement

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Abstract

As a former user of the MasteringAstronomy program, I am very interested in its data collection of student responses and behavior. This study aims to address the question: are students cheating in MasteringAstronomy and if so, can it be detected? I hypothesize that the students with exceptionally low completion times and very high assignment scores combined with low Concept Inventory (CI) scores may be engaging in academic dishonesty. I predict these particular students will also not utilize the “hint” option. Data analysis includes finding the means and standard deviations for scores and completion times of 4 MasteringAstronomy assignments. Results of this study suggest that some students do indeed engage in academic dishonesty with the MasteringAstronomy program. Since the majority of the class still failed the CI even after an entire semester course, which is composed of simple astronomical questions, this study can lead to many new studies on the topic of online learning.

*Keywords:* online learning, academic dishonesty, MasteringAstronomy
Online Homework: An Assessment of Student Behavior

Online Learning

Online learning was often limited to “non-traditional” students, such as parents or part-time students, in the past. It was an effective way to complete classes at home in an otherwise busy and hectic schedule. However, the use of online teaching and assignments has been recently introduced into the lives of “traditional” students. In fact, over 6.7 million students were enrolled in online courses at higher education institutions in the winter of 2013 (Allen, 2013). That number has increased by now as online courses and homework become more popular in universities across the country. However, courses that have online assignments or exams now often face new problems and issues regarding students properly learning the material. Studies show that the quality of online teaching tools is crucial to the academic achievement and overall satisfaction of the students. Additionally, proper faculty training and support must be up to date in order to have a successful online learning experience (Sammons, 2003). Education is greatly changing with this new technology in teaching and learning and aside from the professors’ training in how to work with online tools and students, they also need to become aware of new issues regarding academic honesty. Massive classes are being assigned similar homework and exams over the Internet, a recipe for disaster. Therefore, there also needs to be proper honor codes and policies in place, plagiarism detection tools, and improved assessment practices for online learning (McCord, 2008). An honor code for a face-to-face classroom has drastically different concepts compared to an online classroom or assignment. Hence online learning has developed into a completely new sect of learning that must be supported with a new set of guidelines and rules.
Mastering Astronomy

There is a series of online learning programs by Pearson Education widely used in university courses, which include MasteringPhysics and MasteringAstronomy. This study will concentrate on MasteringAstronomy, although the series of programs all have the basic Socratic tutoring style. This program creates a tutoring environment while the student completes their assignments online via a system of “hints” available at every question. Using Item Response Theory, studies have shown that when a student uses the “hint” button after answering the questions their skill increases by 0.8 standard deviations. If they use the hint after viewing the question but before attempting to answer it, their skill level increases 1.9 standard deviations (Lee, Palazzo, Warnakulasooriya, & Pritchard, 2008). The difference between these values shows a significant skill level change with the use of the hint button before answering the questions.

MasteringAstronomy collects unique data about student responses such as time to completion, the use of the “hint” option, and scores. This study will use this wide range of data to analyze student behavior with online assignments. Interestingly, the amount of time necessary to complete problems decreases with the use of tutorial problems (Palazzo, Lee, Warnakulasooriya, & Pritchard, 2010). These tutorial problems facilitate problem-solving transfer as well. With this in mind, the time to completion measure is very important and will be a key measure in this study.

Online learning and academic dishonesty

Academic dishonesty “includes, but is not limited to, plagiarism (the appropriation or stealing of the ideas or words of another and passing them off as one's
own), cheating on exams or other course assignments, collusion (the unauthorized collaboration with others in preparing course assignments), and abuse (destruction, defacing, or removal) of resource material” (Popham & Popham, 2005). Academic dishonesty is a disservice to both the student and their university. According to the University of Arizona’s Code of Academic Integrity, “students engaging in academic dishonesty diminish their education and bring discredit to the academic community”.

Although online learning and assignments clearly have many benefits, they are also plagued by the threat of academic dishonesty. This recent issue prevalent on all college campuses that use online learning is spawned from the temptation to cheat and the accessibility of the Internet. Online courses are often for distance programs or non-traditional students, but many traditional courses are increasingly putting their assignments and exams online. This is becoming an outlet for students to use the Internet, their study materials, or each other to successfully pass the course. Although over 80% of college students believe that cheating is under no circumstance justified, it is still very prevalent among students (McCabe & Trevino, 1996). Hence the ease and accessibility of cheating proves to be too tempting to many students.

Professors are developing innovative ways to test if students are truly doing their own work with online programs. Such measures include Concept Inventories (CIs), open response surveys, and interviews. A previous study has shown that when a student copies their homework from an outside source, whether it be another student or the Internet, “problems that require an analytic answer correlates with a 2 standard deviation decline over the semester in relative score for similar problems on exams” (Palazzo, Lee, Warnakulasooriya, & Pritchard, 2010). This, however, does not correlate with the
knowledge, or lack thereof, illustrated on the pre-tests and post-tests.

**Research Question and Hypothesis**

As a former user of the MasteringAstronomy program, I am very interested in its data collection of student responses and behavior. This study aims to address the question: are students cheating in MasteringAstronomy and if so, can it be detected? I hypothesize that the students with exceptionally low completion times and very high assignment scores combined with low CI scores may be engaging in academic dishonesty. I predict these particular students will also not utilize the “hint” option.

**Methods**

**Participants and Recruitment**

Participants for this study were approximately 101 students in Dr. Fleming’s ASTR 170B1 course at the University of Arizona in Fall 2013. The students will be of mixed majors and ages, but predominantly freshman non-science major students. Participants were recruited for this study during the second day of the class. The professor described a general outline of the current study and introduced me as his Honors student. Then I distributed the Concept Inventory (CI), which also includes a consent question. Participants that were excluded from the study are those that did not give consent for the study, dropped out of the class, or did not complete both pre-course and post-course Concept Inventories.
Procedures

The CI is a 16-item questionnaire about light and spectroscopy, Newtonian gravity, and stellar properties. This was compiled from three separate CIs that were entirely based on the three different astronomy topics (Williamson et al, 2013; Bailey & Prather, 2011; Bardar & Prather, 2007). Additional demographic questions are also included. Students answered these questions using Turning Point Technology response clickers that registered the responses. Those who did not have a response clicker by this time answered the questions directly on the CI and handed them in immediately after completion. These CIs were then hand graded by myself and then combined with the rest of the data.

Throughout the semester the participants completed weekly online homework assignments through the MasteringAstronomy program. Four of these assignments directly correlated with the three topics on the CI. The study ended on the last day of class where the students completed the CI for a second and last time.

Measures

There are a few basic measures for this study. Data based on time to complete and assignment scores was collected from MasteringAstronomy software. The use of the “hint” button was also collected. Scores from the Concept Inventories, one at the beginning and one at the end of the course, were analyzed to measure conceptual learning of the course material. Questions were based on light and spectroscopy, Newtonian gravity, and stellar properties such as, “The hottest stars are what color?” Response options on the CIs ranged from 2 to 5 multiple choice answers.
Data Analysis

I used Excel 2011 for Mac to interpret the data. Prior to analysis, I checked for outliers and “cleaned up” the data accordingly. This included removing students who dropped the course throughout the semester, and those who did not complete both CIs. I then calculated the mean and standard deviations for the time to complete and score for each of the MasteringAstronomy assignments relevant to this study, as seen in Table 1. Notice that one of the mean scores is greater than 100%. This is because students can gain extra credit on assignments by not utilizing the “hint” option on questions.

Table 1

<table>
<thead>
<tr>
<th>MasteringAstronomy Assignment</th>
<th>Mean (Standard Deviation)</th>
<th>Mean (Standard Deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time to Complete Minutes</td>
<td>Score %</td>
</tr>
<tr>
<td>MA3</td>
<td>48.15 (21.00)</td>
<td>86.27 (13.97)</td>
</tr>
<tr>
<td>MA4</td>
<td>38.21 (15.38)</td>
<td>88.14 (10.85)</td>
</tr>
<tr>
<td>MA8</td>
<td>36.97 (16.78)</td>
<td>106.49 (18.66)</td>
</tr>
<tr>
<td>MA9</td>
<td>23.46 (14.70)</td>
<td>91.82 (16.23)</td>
</tr>
</tbody>
</table>

I created a range for a normal distribution of the times and scores for each assignment, meaning the data that was within one sigma above and below the mean. I then analyzed the students who were outside this normal range in both time and score, specifically the shorter times and higher scores. Interestingly two students fell within this category for the whole study, implying that all other students performed within a normal range. I then looked back at MasteringAstronomy data to see if these two students
utilized the “hint” button throughout their assignments or not. Lastly I looked at the CIs for these two students to see how much they have learned throughout the course.

Results

The results show that some students indeed engage in what appears to be academic dishonesty for one specific assignment. Unfortunately, both students that were “red flagged” in data analysis did not utilize the “hint” button either as illustrated in Table 2 below. This suggests that because they had the answers from a different source, there was no effort put into the questions and therefore no need for the “hint”. Most students use the “hint” button a few times throughout an assignment, so these two students particularly stand out.

Table 2

Student A

<table>
<thead>
<tr>
<th>Title</th>
<th>Use Hint?</th>
<th>Score %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orbits and Kepler’s Laws</td>
<td>No</td>
<td>100</td>
</tr>
<tr>
<td>Kepler’s Laws in Action</td>
<td>No</td>
<td>105</td>
</tr>
<tr>
<td>Kepler’s 2\textsuperscript{nd} Law</td>
<td>No</td>
<td>105</td>
</tr>
<tr>
<td>Kepler’s 3\textsuperscript{rd} Law</td>
<td>No</td>
<td>108</td>
</tr>
<tr>
<td>Motion and Gravity</td>
<td>No</td>
<td>94</td>
</tr>
<tr>
<td>Gravity and Newton’s Laws</td>
<td>No</td>
<td>104</td>
</tr>
<tr>
<td>Newton’s Laws of Gravity</td>
<td>No</td>
<td>105</td>
</tr>
<tr>
<td>Visual Activity</td>
<td>No</td>
<td>93.75</td>
</tr>
<tr>
<td>Problem 4.17</td>
<td>No</td>
<td>100</td>
</tr>
<tr>
<td>Problem 4.28</td>
<td>No</td>
<td>100</td>
</tr>
</tbody>
</table>
Additionally neither student demonstrated much learning through their CI scores as seen in Table 3 below. The students’ names were removed in accordance with the consent form for this study. This further supports my hypothesis that a student may be participating in academic dishonesty if they achieve a record score in a record time and display little understanding of course material through their CI scores. As expected, the majority of students had average scores, average completion times, and some use of the “hint” button. This suggests that they were honest with their work and tried their personal bests on the assignments.
Table 3

<table>
<thead>
<tr>
<th>Student</th>
<th>Pre-course CI Score in %</th>
<th>Post-course CI Score in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student A</td>
<td>0%</td>
<td>56.25%</td>
</tr>
<tr>
<td>Student B</td>
<td>0%</td>
<td>31.25%</td>
</tr>
</tbody>
</table>

**Discussion**

This study not only addresses the effects of online technology on learning, but the act of academic dishonesty as well. The study was indicative of certain complex online behaviors of students although very simple in its design. Results from this study suggest that although online assessments are quicker to distribute and grade, they are possibly not as successful in teaching. For example the majority of the class still failed the CI, which is composed of simple astronomical questions, even after an entire semester course. However there are limitations within this study that may counteract that argument.

**Implications of the Research**

Although Dr. Fleming will not use this study to “catch” cheating students, future implications of this study are plentiful. For example, if midway through a course a professor notices a similar pattern in a student’s scores as described in this study, they can take proactive measures to prevent cheating. This may include a proctored online assignment or a pop quiz. New practices can also be implemented in the classroom to prevent or at least reduce online cheating. These can include training classes for professors, specially designed online programs that combat cheating, in person assessment if possible, and strict honor codes and consequences.
Limitations

The sample size of this study is indeed limited with only one class and one professor. Aside from this, log in and log out times for the online assignments are not always accurate. Some students may keep the homework page open while they do other things or get distracted, therefore lengthening their completion time. Therefore although a student’s completion time may not have been record speed, they still could have been using an outside source for correct answers. Additionally, many students’ data were exempt from this study because they did not attend the last day of class to complete the second CI. Some of these students in particular had red flags in their data, but did not “complete the study” by attending the last day of class and therefore were removed from the data set.

Potential Future Studies

A potential future study could be an exact replica of this one, except with the second CI not on the last day of class. After seeing how many students’ scores were “red flagged”, it made sense that most of them did not attend the last day of class. If they were engaging in academic dishonesty, they clearly do not have a real interest in the class. Given the overall low scores on the second CI, another potential future study may have these CIs actually graded. This would motivate the students to truly answer the CIs to the best of their ability.
Works Cited


