Engineering Students' Understanding of Plagiarism

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Abstract

The engineering profession has clearly embraced the importance of ethical behavior among students and working professional engineers. The prevalence of unethical behaviors, such as plagiarism, among college students has increased significantly in the past 30 years[10]. Research suggests that science and technology students have the highest levels of cheating including plagiarism[10]. University educators often debate whether plagiarism is committed willfully or unintentionally out of ignorance and research investigating this area appears equivocal. Therefore, we sought to investigate first-semester freshmen engineering students' understanding of plagiarism at a science and technology university.

Nearly 1,100 first year engineering students at a Missouri University of Science and Technology (Missouri S&T) completed an online survey and corresponding quiz designed to assess their understanding of plagiarism, and a self-report measure of their perceived academic integrity. The vast majority of students were recent high school graduates from the United States. Males outnumbered female students, as is the case in the freshmen engineering class and student body at the university and across the country.

Participants rated themselves as 5.5 on a 7-point Likert scale of ethical behavior (0 = "not at all ethical" and 7 = "extremely ethical"). Only 5.2% of participants rated themselves below the mid-point on the ethical behavior scale. Additionally, approximately 93% reported having previous training or educational experience about cheating, plagiarism, and/or student misconduct. Three items on the survey provided a passage and then specifically assessed students' ability to determine whether a sentence related to the passage was plagiarized. Response options included "yes", "no", and "I don't know". For the three questions; 60%, 38%, and 87%; respectively, selected the correct answer. The incorrect answer was selected 33%, 51%, and 4% of the time. "I don't know" was selected 7%, 10%, and 8% of the time.

These preliminary findings indicate shortcomings in first semester, freshmen engineering students' understanding of plagiarism and its significance. Although the vast majority of participants' self-identified themselves as ethical and as having previous training regarding academic integrity, when specifically tested on their understanding of plagiarism on average only 60% of students answered correctly. These data suggest the possibility that, in some situations, students failure to follow proper academic guidelines maybe a lack of understanding rather than a willful violation of academic integrity.

The paper concludes with recommendations for improving engineering students understanding of plagiarism and its consequences. An annotated list of references and online training available for instructors' use is provided. A discussion of plagiarism software (such as iThenicate) and referencing software (such as Endnotes) is included.

Introduction

Academic dishonesty is a serious issue. It affects the students who cheat, those who do not cheat, the instructors, and the academic institutions. Self-report rates for college cheating have been documented as high as 80%[2]. Researchers[9] have studied more than 20 different types of academic dishonesty. They[4] have found demographic factors that are statistically significant predictors of cheating. These factors include age (i.e., younger students cheat more frequently than older students), gender (i.e., males tend to cheat more than females), marital status (i.e., married students tend to cheat less than unmarried students), and grade point average (GPA) (i.e., students with lower GPAs are more likely to cheat)[11].

One type of academic dishonesty is plagiarism. In a recent study, Radunovich, Baugh, & Turner[13] questioned 542 agricultural and life science students about their knowledge and understanding of plagiarism. The results suggested that there was confusion among students at all levels about plagiarism. This confusion extends to the faculty ranks. Rogi[14] conducted research investigating the definition of plagiarism among faculty members. There were varying understandings of plagiarism among faculty, even within disciplines. These understandings of plagiarism resulted in paraphrasing techniques that were considered acceptable by some faculty and considered plagiarism by others. With regard to engineering students specifically, Parmameswaren & Devi[12] report "rampant" copying of lab reports.

Given this confusion about plagiarism, it is possible that students commit plagiarism unintentionally—that is, they are unaware that they have committed an act of academic dishonesty because they do not clearly understand the concept or nuances of plagiarism. Therefore, a variety of methods to teach both what plagiarism is and why it is an important issue have been developed. Elander and colleagues[4] proposed that students lack authorial identity or "the sense a writer has of themselves as an author and the textual identity they construct in their writing" (pp. 159). An intervention designed to improve psychology students' authorial identity resulted in significantly greater increases in understanding authorship and knowledge about plagiarism, and the intervention's effect was greatest among first-year students[4]. Jackson[7] assessed undergraduate computer science majors' understanding of plagiarism and evaluated the use of an interactive, online tool to improve students' knowledge. She found students struggle with the concept of plagiarism, specifically paraphrasing. However, the implementation of an

online tutorial resulted in, on average, a 6% improvement in distinguishing paraphrasing from plagiarism.

In addition to Jackson's[7] web-based tutorial, Belter & du Pre[1] also developed an online plagiarism instruction tutorial. Rates of plagiarism among psychology students who completed this online tutorial were 6.5% (compared to 25.8% among students who did not complete the tutorial). In an extension[5] of Belter and duPre's research, a comparison between a generic, pre-recorded lecture and a more specific, online tutorial regarding plagiarism indicated no significant differences between groups with regard to incidents of plagiarism among psychology students. These results suggest that the online tutorial may be an equally effective instructional method compared to a pre-recorded lecture.

Academic dishonesty is a concern across the nation. The engineering profession expects ethical behavior. Most, if not all, engineering professional societies have a code of ethics for their members. Ethics is a knowledge area tested on the fundaments of engineering (FE) and professional engineering (PE) exams. Unethical behavior can result in the loss of one's engineering license. As university faculty we seek to better understand our students' behavior. We surveyed freshmen engineering students to determine their understanding of plagiarism. We hope gain insight into the question: when our students commit plagiarism, is it a willful act, or a lack of understanding the importance and methodology of giving proper intellectual credit?

Research Methodology

An online survey modified from Belter & du Pre[1] was used to test first year students' understanding of plagiarism at Missouri S&T. Approximately 1,200 students, in several sections of a first semester, one credit hour, introduction to engineering course had the option of completing the survey. The survey was one of several assignment choices. From the menu of assignment options, students were required to complete 90% of the assignments. Therefore, students were not required to participate in this study. However, for those students who chose to participate, they received course credit regardless of their performance on the plagiarism quiz. The survey was completed by 1,112 students, a 92% response rate. Course instructors were informed who completed the survey but could not see individual students' responses. Responses from students who failed to complete the survey were eliminated from the analysis.

Demographic questions were included to verify a representative sampling was achieved. The participants matched the characteristics of entering freshmen engineering students: predominately males (77.9%) who identified as Caucasian, non-Hispanic (83.5%). The university's freshmen class is 99% full-time students with an average age of 18 years old. Eighty-one percent of freshmen are classified as in-state students (http://ira.mst.edu/decisionsupportreports/reports/factbook/14-15/students/). The mean ACT test score for Missouri S&T freshmen is 28, which corresponds to the 90th percentile nationally (http://www.actstudent.org/scores/norms1.html).

Survey Questions

The survey included three questions modified from Belter & du Pre[1].

> To answer items 1-3, refer to the following passage, which is quoted directly from "The Seven Habits of Highly Effective People", by Stephen Covey (1989), p. 293.
>
> "So the next morning, Gordon went to the beach. As he opened the first prescription, he read, 'Listen carefully.' He thought the doctor was insane. How could he listen for three hours? But he had agreed to follow the doctor's orders, so he listened. He heard the usual sounds of the sea and the birds. After a while, he could hear the other sounds that weren't so apparent at first. As he listened he began to think of lessons the sea had taught him as a child—patience, respect, an awareness of the interdependence of things. He began to listen to the sounds—and the silence—and to feel a growing peace."
>
> **Question 1 - Is it plagiarism if the following sentence appears in your paper?**
>
> He heard the usual sounds of the sea and the birds. After a while, he could hear the other sounds that weren't so apparent at first (Covey, 1989, p. 293).
>
> A) Yes, this is plagiarism. The author's exact words are not in quotation marks.
>
> B) No, this is not plagiarism. The author's exact words are properly cited.
>
> C) I don't know.

This question tested the need for quotation marks. The passage is taken verbatim from the original text. While a citation is given, the necessary quotation marks are not. The correct answer is A.

Question 2 - Is it plagiarism if the following sentence appears in your paper?

He heard the typical noises of the sea and the bird life. In a while, he heard other sounds that weren't so obvious at first (Covey, 1989, p. 293).

A) Yes, this is plagiarism. Only a few words have been changed.

B) No, this is not plagiarism. Enough words were changed to make it my own work.

C) I don't know.

The passage in this question has minor changes in the wording from the original text. "Usual" was changed to "typical". "The birds" was changed to "the bird life." "After a while" was changed to "In a while" and "apparent" was changed to "obvious". The correct answer is A.

Question 3 - Is it plagiarism if the following sentence appears in your paper?

"As he listened he began to think of lessons the sea had taught him as a child—patience, respect, an awareness of the interdependence of things" (Covey, 1989, p. 293).

A) Yes, this is plagiarism. It's not OK to use a direct quote and cite it properly.

B) No, this is not plagiarism. Quotation marks are used and it is cited properly.

C) I don't know.

This question includes a quote that is properly cited. The correct answer is B.

Question Goal	Correct answer	Incorrect answer	"I don't know"
Use of quotation marks for a direct quote	60%	33%	7%
Understand appropriate paraphrasing	38%	51%	10%
Recognizing a proper citation	87%	4%	8%

Figure 1 – Results of Questions Related to Proper Citation

Question 4 - In a paper assignment, should you use a lot of direct quotes, rather than express your ideas in your own words?

A) Yes. The less writing I have to do myself, the easier it is to write a paper.

B) No. The purpose of the paper is for me to express my ideas in my own words.

C) I don't know.

Regarding Question 4, 93.4% of respondents answered correctly (answer A), 1.8% answered incorrectly and 4.8% of respondents indicated they did not know the answer. These results suggest that students understand the broad goal of writing a paper—that is, they understand the purpose of writing is to express their ideas in their own words. However, as previous research suggests[7], students struggle with applying plagiarism principles. Additionally, we assessed students' knowledge of the institution's penalty for academic misconduct and the importance of academic integrity using questions modified from Belter & duPre[1].

What is the penalty for plagiarism, cheating, or any other form of academic misconduct?

A) A failing grade for the test or assignment and possible failing grade for the course and even suspension/expulsion from the university.

B) Not much. Maybe just a few points off for the assignment or test.

C) I don't know.

Approximately, 94% of respondents correctly answered this question (answer A). Only 1.3% answered incorrectly and 4.5% selected the "did not know" answer. Once again, the authors' considered this a relatively simple question and the results would suggest that the vast majority of students understand that the penalty for academic misconduct is more severe than a minor point deduction.

Why are such acts of academic misconduct considered to be serious offenses?

A) It really isn't serious. Everybody does it to get ahead. It's no big deal.

B) It is basically stealing somebody else's intellectual property.

C) I don't know.

Ninety-seven percent of respondents correctly answered this question (answer B), with only 0.7% answering incorrectly and 3.3% answering "I don't know". While the vast majority of students answered correctly, these data should be interpreted with caution. These results could reflect the non-anonymous nature of the data collection (even though answers were not reported to the course instructor). There can be an influence to choose the correct answer because the students felt they should even if that is not how they actually feel or act during a writing assignment. This influence could be a limitation of many of the questions asked in this pilot study.

Conclusion, Discussion, and Limitation

Plagiarism is an important concern in any academic setting. Consistent with previous research, our results indicate that there is not a clear understanding of plagiarism, specifically paraphrasing, among entering freshmen engineering students at our university, despite the vast majority of students understanding the penalty for and seriousness of academic misconduct. Approximately one-third of respondents did not understand the need for quotations marks when citing directly and 51% of respondents did not understand proper paraphrasing. Even more interesting, this confusion regarding plagiarism and paraphrasing exists among students (92% of respondents) who reported having had previous training or education about academic integrity. These students tend to be recent high school graduates, with very high standardized test scores, and class rankings who undoubtedly learned about plagiarism and reference citations previously yet they struggled with the concept on the short quiz.

This initial research project used questions from a previous study by Belter and du Pré[1]. While the questions provide evidence that many of our students do not understand plagiarism, the questions did not prove to be as rigorous or detailed as would be desired for our research project (i.e., given the wording of some items, and current students' experience with multiple-choice test format, the "correct" answer may be easily identifiable)[8]. We hope to repeat our research in following years with a more extensive quiz on plagiarism and a focus on engineering applications. A possible improvement would be to provide examples of plagiarism, paraphrasing, and correctly restating an idea to gain more insight into the engineering students' understanding of the concept.

This study is just the initial step at our university to research and address academic dishonesty among engineering students. It provides support for the belief that some engineering undergraduate students may be committing plagiarism due to a lack of knowledge about proper citations and paraphrasing rather than a willful lack of academic integrity. The results suggest the need for targeted education aimed at incoming freshmen to clarify what is plagiarism and how to avoid committing it.

Recommendations

A variety of potential "solutions" exist that warrant further review. Software programs such as EndNote can provide a tool to assist students managing their references (endnote.com). During the writing process a few simple clicks allow the writer to add a reference citation to the text and a properly formatted reference at the end of the paper. This type of tool should reduce the "accidental" plagiarism of writers using material and later forgetting where the material came from or the need to give credit.

Another group of software is plagiarism detection. Programs such as ithenticate (http://www.ithenticate.com/) compare a document to content available on the Internet. The software provides a measure of originality and cautions of potential plagiarism issues are provided to the writer or the instructor. Use of such software is becoming more common among engineering journals. While a useful tool, this type of software is only a part of solution to the ongoing problem of plagiarism.

Another approach used by some universities in an effort to reduce plagiarism is educational websites. UC Davis has a website geared to students; it educates them on what plagiarism is and how to avoid it as a part of their academic integrity project (http://cai.ucdavis.edu/plagiarism.html). Long Island University has online resources for students (http://www2.liu.edu/cwis/cwp/library/exhibits/plagstudent.htm). Purdue has a well-respected writing research website (https://owl.english.purdue.edu/owl/) that does more than warn students about plagiarism. The OWL site includes content on proper citation formats and plagiarism; it also describes how to paraphrase and has a focus on improving writing.

Some educators have focused on teaching the proper method of paraphrasing. The term "patchwriting" has been defined as when a novice writer in a technical discipline uses bits and

pieces of reference material verbatim rather than writing in their own words[6]. Edward Eckel[3] recommends working with students to develop the skill of synthesizing reference materials rather than punishing plagiarism or pushing honor codes. He believes engineering and science students need to understand the differences between quoting, patchwriting, paraphrasing, and synthesis to become better writers and better professionals.

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