Does exposure to higher education writing courses impact engineering students' understanding of plagiarism?

Evaluating Engineering Students' Understanding of Plagiarism

Susan L. Murray, Amber M. Henslee, and Douglas K. Ludlow

Abstract

As plagiarism increases among engineering students, there is a debate whether it is committed willfully or unintentionally. In this article we investigate engineering students' understanding of plagiarism. At Missouri University of Science and Technology (Missouri S&T), 635 first-year engineering students completed a survey/quiz on plagiarism. Only 59% of the freshmen answered correctly when asked about using quotation marks for a direct quote. When questioned about paraphrasing, 52% answered correctly. Recognizing a proper citation was higher with 89% answering correctly. These results suggest shortcomings in first-semester engineering students' understanding of plagiarism. Students who commit plagiarism may lack knowledge rather than willfully violating ethical behavior. Upper-class engineering students were also surveyed. With regard to recognizing a proper citation, their results were similar to the freshmen; however, they performed worse on proper paraphrasing. Neither prior English or technical communication courses, nor years studying engineering, were key factors in engineering students' understanding of plagiarism.

Keywords

Higher Education, Plagiarism, Engineering

Introduction

Academic dishonesty is a serious issue. It affects the students who cheat, those who do not cheat, the instructors, and the academic institutions (Macfarlane, Zhang, & Pun, 2014; McCabe, Trevino, & Butterfield, 2001). Self-report rates for college cheating have been documented as high as 80% (Cochran, Chamlin, Wood, & Sellers, 1999). Researchers have studied more than 20 different types of academic dishonesty (Lambert, Hogan, & Barton, 2003) and have found individual factors that are correlated with cheating (Elander, Pittman, Lusher, Fox, & Payne, 2010; McCabe et al., 2001). These factors include age (e.g., younger students cheat more frequently than older students), gender (e.g., males tend to cheat more than females), marital status (e.g., married students tend to cheat less than unmarried students), and grade point average (GPA) (e.g., students with lower GPAs are more likely to cheat) (Newstead, Franklyn-Stokes, & Armstead, 1996; McCabe et al., 2001). Students studying on campus, rather than in distance mode, committed plagiarism at a higher rate. The rate was statistically higher for international students compared to domestic (New Zealand) students (Walker, 2010). Students ages 21-30 were more likely to commit plagiarism than older, non-traditional students. Students in their first year enrolled at Missouri S&T were less likely to plagiarize than those who had been studying at Missouri S&T longer. In a study of more than 500 students' work, Walker (2010) reported that 23.5% and 12.5% of first-year students plagiarized on the first and second assignment respectively, compared with 28.6% and 15.9% for second-year students, and 33.6% and 30.5% for fourth-year students.

Yet other studies have not found significant differences in individual variables such as gender (McCabe et al., 2001) or GPA (Jordan, 2001). For example, Walker (2010) evaluated over 1,000 writing assignments by more than 500 students to determine the profile of students most likely to commit plagiarism. He found no significant difference between males and females committing violations. Rather than individual factors, contextual

factors (e.g., peer behavior, peer disapproval, perception of peers) appear to be more strongly correlated with academic dishonesty (McCabe et al., 2001; Jordan, 2001).

Given the numerous types of academically dishonest behaviors and variables, both individual and contextual, that affect academic behavior, it is not surprising that the literature in this field is broad and the research continues to grow. One specific area of interest is that of plagiarism.

Plagiarism

"The word plagiarism is derived from the Latin word plagiarius, meaning someone who kidnaps the child or slave of another" (Weber-Wulff, 2014). One early use of the term was by a poet in response to his work being published under another's name. He felt his poems were the children of his mind and they had been kidnapped (Weber-Wulff, 2014). While kidnapping may seem to be a strong term, a person committing plagiarism is taking ideas and words created by another.

Plagiarism is different than copyright violations, although there is some overlap. One can copy numerous pages of someone else's work and properly cite the material; that is not plagiarism. However, the act of using a large amount of material, even while giving credit, can violate the fair use provision of copyright laws. The distinction is that plagiarism involves taking and using without proper credit, while a copyright violation is taking and using beyond fair use. One can plagiarize material that is not under copyright. Often copyright violations are also acts of plagiarism but not necessarily.

Plagiarism can have different forms (Walker, 2010). The most blatant is direct copying; one takes the words of another and uses them without quotation marks or citation. Cut and paste features in word processors have made this easy to do both intentionally or unintentionally (Sutherland-Smith, 2008). Often it takes only a few clicks of the computer mouse and the deed is done. Unintentionally, plagiarism can occur if the secondary author plans to paraphrase the material later but forgets where the material came from and the need to cite it. Another example of unintentional plagiarism is a writer with a mistaken belief that listing the original source in the bibliography or footnote provides adequate credit when quotation marks and a citation are required (Hexham, 2013).

Lofstrom (2011) suggested that explicit misunderstandings among students related to ethics were rare but there may be various underlying beliefs and assumptions related to plagiarism and proper credit. In a follow-up study, Lofstrom and Kupila (2013) found that there were three distinct reasons for plagiarism. The first is intentional, which they define as a deliberate behavior among students who often justify this because other students do it, and the risks of being caught are low. The second reason was contextual plagiarism; when students were overloaded and intentionally plagiarized as a way to cope with being overwhelmed. The final reason presented by Lofstrom and Kupila was unintentional plagiarism caused by a lack of knowledge. Both students and faculty in the study felt unintentional plagiarism was the most common type.

A common form of plagiarism involves paraphrasing an original work. Countless writing instructors have been asked, "How many words do I need to change in a passage for it to no longer be plagiarism?" As engineers, we are accustomed to thinking in numerical terms such as percentages. However, changing a few words in a passage does not make the text or ideas within it belong to someone else. Text that has been paraphrased or edited still needs to be attributed to the original source. Unfortunately, this is an area that is not always clear. Rogi (2001) conducted research investigating the definition of plagiarism among faculty members. There were varying understandings of plagiarism among faculty, even within disciplines. The variation in understanding plagiarism resulted in paraphrasing techniques that were considered acceptable by some faculty and considered plagiarism by others.

Rebecca Moore Howard defined the term "patchwriting." This type of writing occurs when a student takes sentences, or even phrases, and pastes them together. Howard explains that it is often committed by inexperienced writers who lean too heavily on their sources while writing (Howard, 1999). Patchwriting is a gray area within plagiarism for many. The writer typically does not intentionally steal the work of others, but rather is too dependent due to a lack of familiarity of the material (Weber-Wulff, 2014). This understanding of material is a challenge for educators. We expect our students to learn and summarize technical material, but where is the line among overuse of the original source, proper paraphrasing, and teaching students to synthesize multiple works to gain a richer understanding of the material?

Frequency of Plagiarism

It is hard to quantify the rate of plagiarism, although many have suggested it is on the rise. In a recent study, Radunovich, Baugh, and Turner (2009) 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. With regard to engineering students specifically, Parameswaran and Devi (2006) report "rampant" copying of lab reports.

The National Science Foundation (NSF) states it is imperative that research is carried out following the highest ethical standards. The NSF has seen a rise in research misconduct associated with NSF proposals and awards. The NSF definition of research misconduct encompasses fabrication, falsification, and

plagiarism. In semi-annual reports to Congress, NSF noted several cases of plagiarism, including:

- A faculty member at an Ohio university plagiarized text into four proposals submitted to NSF. He admitted that he copied most of the material, which he said he did because English was not his native language. He also asserted that citations and quotation marks were unnecessary because the text was copied from a public source or was public knowledge. The university investigation concluded that the faculty member's actions were reckless, and he should have known of the need for citation (NSF, 2012a).

- A New Jersey university investigation concluded that an assistant professor knowingly committed plagiarism in 11 unfunded NSF proposals. He plagiarized the majority of the copied text in one proposal from other proposals previously submitted to the same NSF program by other Principal Investigators (PIs), who had posted them online (NSF, 2012b).

- An assistant professor at an Illinois institution plagiarized text into three proposals. The professor acknowledged copying material without citation, but she argued that the text included basic, common information in her field; she acted in "honest error;" she misunderstood the rules of plagiarism as they apply to proposals; and she was under time pressure (NSF, 2012a).

- A Puerto Rico university researcher plagiarized from multiple documents in an NSF proposal. She argued that much of the text she copied did not require attribution because it was found on government web pages. NSF highlighted the difference between information that is common knowledge, which does not require citation, and information that is in the public domain, such as on a government web site, which requires citation (NSF, 2012a).

- An assistant professor at a New York university submitted a proposal to NSF that contained a large amount of material plagiarized from a previously awarded NSF proposal authored by a PI at another university. The professor said that he told the student merely to use the awarded proposal as guidance, and although he said the student did the actual copying, the professor accepted full responsibility. The university concluded that the professor was guilty of reckless plagiarism due to improper oversight of the graduate student and insufficient care with the content of the draft proposal (NSF, 2012a).

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? Academic dishonesty has implications for future professionalism as well. The engineering profession expects ethical behavior. The National Society of Professional Engineers (NSPE) has a code of ethics (NSPE, 2007). 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 and upper-class engineering students to determine their understanding of plagiarism. We hoped to 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 and du Pré (2009) 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. 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 survey. The survey was completed by 635 students. Responses from students who failed to complete the survey fully were eliminated from the analyses.

Demographic questions were included to verify that a representative sample was achieved. The participants were predominately males (77.9%) who identified as Caucasian, non-Hispanic (83.5%). These characteristics are similar to those for the university's entering freshmen engineering students.

A second group of 129 upper-class engineering students were surveyed to allow a comparison of students' understanding of plagiarism at different points in their undergraduate education. These surveys were distributed on paper in classes within several different engineering departments on campus. The demographics of the upper-class students were similar to those of the freshmen students. The students were asked how many college-level English or technical communication classes they had taken. Fifty-one percent of sophomores had taken two or more classes. The percentage was 86% for juniors and 76% for seniors. Given previous research (Newstead et al., 1996; McCabe et al., 2001; Walker, 2010), we hypothesized that exposure to higher education writing courses may provide the upper-class students with a stronger understanding of plagiarism compared to entering freshmen.

Survey Questions

The survey included three questions modified from Belter and du Pré (2009), as follows:

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 was 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.

Additionally, we assessed students' knowledge of the institution's penalty for academic misconduct and the importance of academic integrity using another question modified from Belter and du Pré (2009).

Question 4: What is the penalty for plagiarism?

A) A failing grade for the assignment, possible a failing grade for the course, and even suspension/expulsion.
B) Not much. Maybe just a few points off for the assignment.
C) I don't know.

The correct answer is A.

Table 1 provides a comparison of the percentage of students who correctly answered the four questions. The more experienced students did recognize the need for quotation marks when using a direct quote at a higher rate than the freshmen (question 1). The

Table 1: Students by Level With Correct Answers

Objectives	Freshmen (n = 635)	Sophomores (n = 31)	Juniors (n = 21)	Seniors (n = 77)
Understand use of quotation marks for a direct quote	59%	77%	81%	71%
Understand appropriate paraphrasing	52%	39%	43%	30%
Recognize a proper citation	89%	84%	86%	92%
Know the penalty for plagiarism	95%	81%	100%	88%

percent of participants who correctly answered the paraphrasing question dropped from 52% for freshmen to only 30% for seniors. Apparently, proper paraphrasing is not clear cut for students. There are no exact rules for how much should be changed to avoid plagiarism, yet it is striking how the percent correct dropped within the samples. Approximately 15% of the students surveyed answered, "I don't know" to this question. Students recognized a properly cited quotation and understood the penalty for plagiarism at all levels. These data suggest that students within this sample know how to cite a quote and that plagiarism is a significant offense.

How Common Is Plagiarism?

The survey also asked the students' perception of the occurrence of plagiarism on a scale from 0-7 (0 = not common, never happens to 7 = extremely common, everyone plagiarizes). The results are shown in Figure 1. Freshmen were not asked this question. Having only been on campus a few weeks, they did not have a basis to answer this question as accurately as upper-class students. The upper-class students rated plagiarism as a "common" occurrence as follows: 17% of seniors, 18% of juniors, and 8% of sophomores.

Students' Ethical Self-Perception

The survey asked students to rate their own level of perceived ethical behavior using an 8-point Likert scale (0 = not at all, 7 = extremely). The results are shown in Figure 2. The students tended to rate themselves above average on ethics. Ariely (2012) has written extensively about honesty and self-perception. He found that most people like to think of themselves as honest. If given an opportunity to cheat, many will behave dishonestly enough to profit a moderate amount, yet still consider themselves to be honest. In a series of experiments, Ariely found students over report their performance on quizzes, took items that did not belong to them, and padded their expense reports in the range of 10-20%, enough to gain some benefit, yet still consider themselves honest.

Recommendations

A variety of methods to teach both what plagiarism is and why it is an important issue have been developed. Elander, Pittam, Lusher, Fox, and Payne (2010) 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" (p. 159). An intervention designed to improve students' authorial identity resulted in significantly increasing the understanding of authorship and knowledge about plagiarism, and the intervention's effect was greatest among first-year students (Elander et al., 2010). Jackson (2006) assessed undergraduate computer science majors' understanding of plagiarism and evaluated the use of an interactive, online tool to improve students'
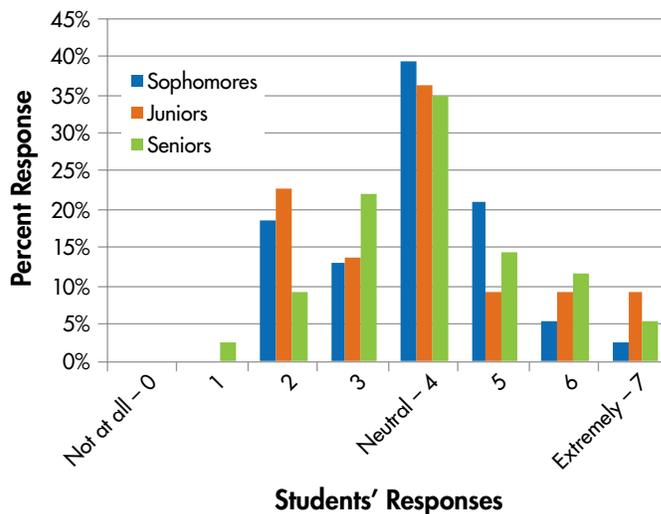

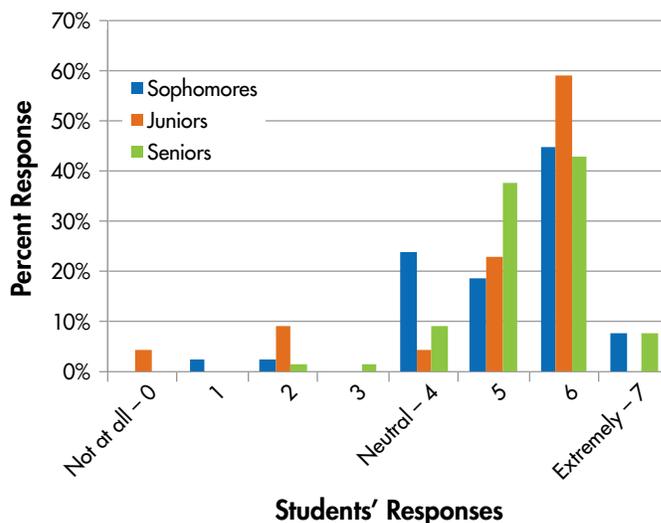Figure 1: Answers to "How common is plagiarism at our university?"

Figure 2: Answers to "How ethical are you?"

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 (2006) web-based tutorial, Belter and du Pré (2009) 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 of this research, Henslee, Goldsmith, Stone, and Krueger (2015) compared a generic, pre-recorded lecture to a more

specific, online tutorial regarding plagiarism. Results 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.

A variety of potential solutions exist that warrant further review. Software programs such as EndNote can provide a tool to assist students in managing their references. 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.

Other types of software aimed at plagiarism detection include Turnitin and iThenticate. Turnitin allows educators to submit student work and then provides reports identifying original and unoriginal content. Programs such as iThenticate compare a document to content available on the Internet. The software provides a measure of originality and cautions of potential plagiarism issues to the writer or the instructor. Use of such software is becoming more common among engineering journals. Jocoy and DiBiase (2006) found plagiarism among 13% of adult learners in an online course when utilizing detection software. For the same assignments, only 3% were found to have plagiarism when the work was reviewed manually. In a study across multiple disciplines at three universities, Gilmore, Strickland, Timmerman, Maher, and Feldon (2010) found plagiarism to range from 36.3% to 42.6% when student proposals were evaluated using plagiarism detection software. While useful tools, these types of software are only a part of the solution to the ongoing problem of plagiarism.

Another approach used by some universities to reduce plagiarism is educational websites. University of California, 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. Long Island University also has online resources for students. Additionally, Purdue University has a well-respected writing research website, known as the Online Writing Lab (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 how to improve writing.

Some educators have focused on teaching the proper method of paraphrasing. Eckel (2010) recommends working with students to develop the skill of synthesizing reference materials rather than punishing plagiarism or pushing honor codes. Eckel states that engineering and science students need to understand the differences among quoting, patchwriting, paraphrasing, and synthesis to become better writers and better professionals. We agree with Eckel that, ideally, engineering students should learn how to conceptualize and synthesize multi-dimensional issues. This higher-level thinking skill is not only important during formal education, but for continued professional development as well. However, this does not necessarily negate the benefit of an honor code. Jordan (2001) reported that 40% of students believed that signing an honor code decreased academic dishonesty. Perhaps instilling allegiance among students to such a code is akin to the professional engineer's allegiance to the NSPE Code of Ethics. That is, instilling respect for ethical behaviors among students should be encompassed as part of comprehensive efforts to teach proper citation, paraphrasing, etc.

Conclusions

Academic integrity, including plagiarism, is an important concern in any academic setting (Macfarlane et al., 2014; McCabe et al., 2001); therefore, efforts to teach students about plagiarism adequately and how to avoid it are imperative. 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. Also consistent with other studies (Newstead et al., 1996; McCabe et al., 2001; Walker, 2010), an understanding of plagiarism did not improve as the students took college-level writing and/or technical communication classes or were upper-level engineering students.

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.

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Susan L. Murray

Susan L. Murray, Ph.D. *is a professor in the Engineering Management and Systems Engineering Department at Missouri University of Science and Technology. Her research and teaching interests include human systems integration, productivity improvement, human performance, safety, project management, and engineering education. Prior to her academic position, Murray worked in the aerospace industry including two years at NASA's Kennedy Space Center. Her goal is to continuously improve engineering education. Murray can be reached at Murray@mst.edu.*

Amber M. Henslee

Amber M. Henslee, Ph.D. *is an assistant professor in the Psychological Science Department at Missouri University of Science and Technology. Henslee's clinical specialties are in the areas of addictions and trauma. Her research interests include college student health-related behaviors and the scholarship of teaching and learning. She can be reached at Hensleea@mst.edu.*

Douglas K. Ludlow

Douglas K. Ludlow, Ph.D. *is a professor in the Chemical & Biochemical Engineering Department at Missouri University of Science and Technology and director of the Freshman Engineering Program. Ludlow's research interests center on the characterization of surfaces of adsorbents and catalysts. His teaching interests include chemical reactor design and chemical process safety and recently the first-year experience for incoming engineering students. He can be reached at dludlow@mst.edu.*