UNIVERSITY OF CALGARY

Plagiarism in Engineering Programs: An Annotated Bibliography

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A Message from the Researchers

We are grateful to the University of Calgary, Vice Provost Teaching and Learning, and the Taylor Institute for Teaching and Learning, for funding this work through the Educational Leader in Residence, Academic Integrity portfolio.

The authors previously compiled the Annotated Bibliography of Academic Integrity Research in Canada (Eaton, Crossman & Edino, 2019). Please note that this document is structurally similar to our previous work, and as a result there is some duplication of the text.

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January 2021

Abstract

Purpose: This report documents research and related materials concerning plagiarism in STEM and engineering programs to inform and guide future work in the field. It provides an overview of the literature up to and including 2019 related to plagiarism in STEM and engineering programs.

Methods: Two research questions guided this literature review: 1. What scholarly, research, and professional literature explores and examines plagiarism in STEM and engineering programs? 2. What major themes emerge from scholarly and research literature about plagiarism in engineering? To this end, a methodical research of databases was undertaken, relevant research was compiled, and articles were summarized and categorized.

Results: Our review and search of the literature resulted in 31 sources, which we organized into 7 categories: (a) Background: AI in engineering; (b) student perceptions and attitudes; (c) faculty perceptions and attitudes; (d) cheating and collusion; (e) text-matching software and plagiarism detection; (f) international students and (g) interventions and reparations.

We found that plagiarism in STEM and engineering, as in other fields, is widespread among students and faculty, while policies and their implementation are often inconsistent. Calls for clearer guidelines and greater support for students and faculty resound as a consistent theme in the literature.

Implications: Plagiarism in STEM and engineering research has been slow to develop, but is a continuing field of growth. As more stakeholders become aware of the scope and complexities of plagiarism, many researchers are making recommendations for policy, policy implementation, and support through technology, education, and intervention programs.

Additional materials: 36 References

Keywords: Academic integrity, academic dishonesty, academic misconduct, plagiarism, cheating, engineering

Executive Summary

Background: AI in engineering

- Academic misconduct is widespread in engineering programs, and engineering students report more academically dishonest behaviours than their peers in other fields.
- It appears that these high levels of academic dishonesty in engineering emerge in university, indicating that systemic issues in engineering programs contribute to the high rates of cheating.
- Engineers who engage in unethical behaviour in university are more likely to do so in the workplace.
- Undergraduate engineering programs are well-positioned to design assessments and assignments to encourage moral development.

Student perceptions and attitudes

- Engineering students' perceptions of the severity of different copying practices varies substantially on situational factors. They find it more acceptable to copy materials for homework assignments than on exams.
- When engineering students perceive copying their work is acceptable because it goes unpunished, they are more likely to continue such behavior and view it as acceptable.
- Engineering students tend to be better at identifying plagiarism than they are at preventing it in their own work. A focus on academic writing skills and direct instruction on plagiarism avoidance is especially important in engineering programs.

Faculty perceptions and attitudes

- There is often a gap between faculty beliefs and actions, with faculty having an anti-plagiarism stance but often doing little to promote integrity or prevent misconduct in course work.
- Engineering faculty tend to favour a punitive response to student plagiarism.
- Engineering faculty would benefit from training about preventing academic misconduct and plagiarism

Cheating and collusion

- There are many ways that engineering students may cheat or copy, including high-tech and low-tech methods to use unauthorized materials.
- Unauthorized collusion and collaboration is particularly widespread in engineering programs, and it occurs more in face-to-face courses than in distance courses.

Text-matching software and plagiarism detection

- Text-matching software (TMS) may help instructors identify misconceptions about plagiarism and academic writing conventions so that they can direct students to appropriate support services.
- TMS programs can be used to identify copying between students, which is especially useful in large engineering classes with multiple assessors.
- Engineering students and faculty tend to have favourable views of TMS, but training on its use is important. Similarity reports must be interpreted with caution.
- TMS has some limitations in that it may not identify all plagiarized texts, as many engineering articles are not in some large TMS databases, nor does TMS detect plagiarised figures. There are also ways that students may trick the program or falsify results.

International students

- International students are often highly represented in Western engineering programs.
- International students may have received less education about plagiarism and avoiding it prior to entering a Western educational context.
- Direct instruction and workshops about plagiarism and how to avoid it may be particularly useful and effective for international engineering students.

Intervention and reparations

- Engineering students take varying degrees of responsibility for their actions when found to have engaged in academically dishonest behaviours, with the majority partially accepting personal responsibility and partially blaming instructors or assignment designs.
- There are many reasons that engineering students might plagiarize, and there are many ways that instructors can design tasks to encourage integrity and individual completion of work.
- Experience with academic writing cannot be assumed. Librarians and student support services can be valuable with helping engineering students develop academic writing skills.

Introduction

This report provides an overview of the literature up to and including 2019 relating to plagiarism in engineering programs.

Background and Definitions

Included in this document is a comprehensive overview of research on plagiarism in engineering programs in terms of:

1. Background: AI in engineering
2. Student perceptions and attitudes
3. Faculty perceptions and attitudes
4. Cheating and collusion
5. Text-matching software and plagiarism detection
6. International students
7. Interventions and reparations

We define key terms in relation to the literature:

> ***Academic dishonesty*** is the deliberate violation of academic codes of conduct.
>
> ***Academic integrity*** is based on these fundamental values: (a) honesty; (b) trust; (c) fairness; (d) respect; (e) responsibility; and (f) courage. (International Center for Academic Integrity, 2014)
>
> ***Academic misconduct*** may be either a deliberate or unintentional violation of academic codes of conduct. Regardless of whether the misconduct is intentional or unintentional, students may be held responsible for their actions.
>
> ***Plagiarism*** is a type of academic misconduct in which words and/or ideas are copied from a source and presented as the writer's own work. In such cases, citations may be missing or erroneous. Original source materials could be published work, information gathered online, or the work of peers, family, friends, or associates.
>
> ***Text-matching software*** refers to a software program often used to detect plagiarism. It identifies textual similarities between an uploaded text with a database of other texts. The output is usually in the form of a similarity report that highlights and identifies textual similarities.

Origins and Purpose of This Report

This purpose of this report is to document research and related materials related to plagiarism in STEM and engineering to inform and guide future work in the field. Engineering education is designed to prepare students for a career in the profession of engineering. Similar to other higher education professional programs such as law, education, or social work, there is a focus on preparing students to become professionals in their chosen field of study. In this sense, professional programs differ from liberal arts education, for example, which may not be designed to prepare students for a particular career path.

The link between academic integrity in educational contexts (e.g., classroom instruction, labs, practica, internships, etc.) and professional ethics has already been established in the literature (see, for example, Guerrero-Dib et al., 2020). It is critical for engineering educators to emphasize the links between academic integrity in the classroom and ethics in professional practice. We intended for this annotated bibliography to provide an evidence base for educators, curriculum developers and others to help support instructional approaches that not only promote integrity, but insist upon it.

Methodology

This report provides an overview of the current scholarly literature relating to plagiarism in STEM and engineering programs. In this section we outline the methodology for our review, including some of the complexities encountered during our study.

Intended Audience

This report is for stakeholders more broadly in STEM fields, and more narrowly in engineering programs, who are interested in academic integrity and plagiarism. It is of particular relevance to administrators, faculty, students, and professionals.

Research Questions

With our intended audience in mind, we developed the following research questions to guide our review:

1. What scholarly, research, and professional literature explores and examines plagiarism in STEM and engineering programs?
2. What major themes emerge from scholarly and research literature about plagiarism in engineering?

Inclusion and Exclusion Criteria

We began with a combined search term strategy that included two categories of terms:

Table 1: Search Term Categories

Search Term Category 1	Search Term Category 2
• Plagiarism • Plagiarism detection • Text matching software • Turnitin • Academic integrity • Academic misconduct • Academic dishonesty	• Engineering • STEM

When we began our search, we set inclusion parameters such that a source had to meet at least one criterium from category one and at least one from category two. During our search we used quotation marks to ensure that the entire phrase was searched.

Exclusion Criteria

We included six exclusion criteria for our study, divided into two broad categories: (1) Exclusion of non-scholarly sources and (2) Exclusion of scholarly sources that did not help us meet our primary objective of better understanding the research work that has been conducted about plagiarism and engineering. Our search category focused on literature of a research, scholarly and authoritative nature, necessitating the exclusion of non-scholarly sources including, but not limited to:

1. Institutional reports or policy documents
2. Newspaper articles and other popular media sources
3. Other informal media such as blogs, editorials, letters to the editor
4. Social media outputs such as status updates or Tweets

Because our study was intentionally focused on the engineering context, we also had to make decisions for exclusion criteria based on this primary objective of our study. To that end, further exclusion criteria included:

5. Studies not primarily focused on engineering or STEM disciplines
6. Studies in which the primary focus was other forms of academic misconduct, such as exam cheating or contract cheating.

Inclusion Criteria

We conducted a rigorous search for high-quality, publicly available sources including:

1. Peer reviewed journal articles
2. Conference papers (peer-reviewed and non-peer-reviewed)
3. Books
4. Theses and dissertations
5. Reports

Typology of Evidence

We subscribe to Petticrew & Roberts's (2006) notion that considering the typologies of evidence can provide a useful framework for answering the research questions that guide a literature review. We initiated our search with the following typologies of evidence in mind:

1. Experimental studies
2. Quantitative studies
3. Qualitative studies
4. Mixed methods studies
5. Policy research
6. Literature reviews
7. Other high-quality sources within our search parameters (e.g. scholarly essays).

We did not use these as exclusion criteria, but rather as an overarching guide to keep us sharp when searching for various kinds of sources.

Search Method

We conducted a methodical search of sources available electronically, drawing on four major educational databases available through the University of Calgary: (1) Academic Search Complete; (2) Education Research Complete; (3) ERIC; (4) ProQuest Dissertations and Theses; and the search engine (5) Google Scholar.

We found no sources that were available only as print material (i.e. hard copy), and as our search progressed, we came to rely entirely on digital versions of sources.

Limitations

We identified the need for a resource such as this one during a collaboration with colleagues who are engineers (see Eaton et al., 2020). The team who worked on this annotated bibliography are not engineering content experts and none of us has a background or degree in Applied Science. Instead, we have collective expertise in academic integrity and understand the importance of cross-disciplinary research that brings together researchers from different fields. We also recognize that there are

disciplinary differences between and among different streams of engineering (i.e. structural, chemical, computer, mechanical, etc.), but for the purposes of this document, we have opted to include all streams of engineering together.

The emergence of the informal process we used to locate sources that fit within our inclusion criteria revealed to us that while we had made every attempt to conduct a thorough search, as Booth, Papaioannou, and Sutton (2012) point out, a literature review can be comprehensive without being exhaustive. We recognize that despite our best efforts, our search may not be exhaustive.

I. Background: AI in Engineering

- Academic misconduct is widespread in engineering programs, and engineering students report more academically dishonest behaviours than their peers in other fields.
- It appears that these high levels of academic dishonesty in engineering emerge in university, indicating that systemic issues in engineering programs contribute to the high rates of cheating.
- Engineers who engage in unethical behaviour in university are more likely to do so in the workplace.
- Undergraduate engineering programs are well-positioned to design assessments and assignments to encourage moral development.

Carpenter, D., Harding, T., & Finelli, C. (2010). Using research to identify academic dishonesty deterrents among engineering undergraduates. *International Journal of Engineering Education, 26*(5), 1156-1165. https://deepblue.lib.umich.edu/bitstream/handle/2027.42/86094/E3_Deterrents_Carpenter_et_al_2010.pdf?sequence=1&isAllowed=y

This article reviews these three scholars' extensive research about ethics in engineering programs over a period of ten years between 2001-2010. Over the course of that decade they interviewed over 1500 undergraduates at 23 institutions, mainly in the US, but also in Latin America and the Middle East, about academic integrity. The authors describe two surveys (PACES-1 and PACES-2) they developed and administered to 643 and 527 students respectively. One interesting finding that emerged out of their survey responses is that it appears that although engineering undergrads engage in higher rates of academically dishonest behaviours than do their peers in other programs, it is not because of an innate quality of engineering students. Prior to entrance into engineering programs, students bound for engineering education do not report higher levels of unethical practices than those bound for other programs. The authors conclude that curricula and course design in engineering programs are more important factors that contribute to the ubiquity of academic misconduct in engineering. This paper underscores the importance of encouraging ethical practices in coursework because they have also demonstrated that engineering students engaging in academically dishonesty behaviours in university tend to continue them in the workplace. The authors conclude with practical suggestions for designing and encouraging academic integrity in engineering courses and is of particular relevance to engineering educators.

Vesilind, P. A. (1996). Using academic integrity to teach engineering ethics. *Journal of Engineering Education, 85*(1), 41-44. https://doi.org/10.1002/j.2168-9830.1996.tb00206.x

This short position paper highlights the connection between academic integrity and professional ethics. The author proposes that case studies about academic integrity are relevant and readily understandable to engineering students. Vesilind argues that because ethics are abstract notions that can be difficult for first year students to conceptualize, academic integrity scenarios are an ideal entry point for understanding. Particularly interesting is the mention of research showing the rapid moral development

of students in university and the importance of introducing these notions during training before the students have transitioned into the workplace. Although a number of case studies are outlined, of relevance to this document is one with a student receiving assistance from a writing tutor and deciding whether to cite that assistance. The author states that the goal of these case studies is to "sensitize students to ethical reasoning and introduce them to the concept of ethical decision making" (43) and highlights the importance of fostering a culture of integrity in engineering programs.

Zigmond, M. J., & Fischer, B. A. (2002). Beyond fabrication and plagiarism: The little murders of everyday science. *Science and Engineering ethics, 8*(2), 229-234. https://doi.org/10.1007/s11948-002-0024-3

This paper explores factors that may contribute to a lax view of plagiarism and academic misconduct in science and engineering. The authors argue that although more egregious cases of fraud such as fabrication or falsification of data garner more attention, it is the "little murders" (p. 229) that are more concerning. This paper focuses on researching in the field of engineering, but it warrants inclusion because it speaks to a culture whereby smaller transgressions that are tacitly considered acceptable occur due to environmental factors. For example, the authors draw a parallel between the pressure to publish and self-plagiarism. It is the cumulative effects of these minor infractions that may lead to more serious unethical actions.

II. Student Perceptions and Attitudes

- Engineering students' perceptions of the severity of different copying practices varies substantially on situational factors. They find it more acceptable to copy materials for homework assignments than on exams.
- When engineering students perceive copying their work is acceptable because it goes unpunished, they are more likely to continue such behavior and view it as acceptable.
- Engineering students tend to be better at identifying plagiarism than they are at preventing it in their own work. A focus on academic writing skills and direct instruction on plagiarism avoidance is especially important in engineering programs.

Carpenter, D. D., Harding, T. S., Finelli, C. J., Montgomery, S. M., & Passow, H. J. (2006). Engineering students' perceptions of and attitudes towards cheating. *Journal of Engineering Education, 95*(3), 181-194. https://doi.org/10.1002/j.2168-9830.2006.tb00891.x

Although this article does not focus on plagiarism by engineering students, it warrants inclusion because it explores their perceptions of engineering and pre-engineering students on various types of cheating, and some of their most interesting findings were about copying the work of other students, resubmitting the same work in various courses, and submitting copied passages. In this project, a seven-page survey (PACES-1) was administered to 643 participants at 11 institutions in the US. For the purposes of this document, we focus on the results about copying, which revealed that perceptions on the severity of different copying practices varied substantially: 96.4% of students reported that copying answers on an exam was cheating, yet just 73.3% felt that allowing another student to copy answers was cheating. Also interesting was that about half (52.3%) perceived resubmitting previous classes' work was considered cheating and only 19.1% of respondents felt that copying passages from a textbook for homework was considered cheating. The authors speculate that because exams tend to be weighted more heavily than homework assignments, copying on exams is perceived as more serious. The survey results also indicated that students reported blaming poor instruction or tasks as justification for cheating. This paper concludes with practical suggestions to prevent cheating and copying, largely based on what students reported as cheating deterrents such as sanctions and embarrassment. This paper would be of interest to those wanting to better understand engineering student perceptions on cheating and copying such as instructors, program administrators, and policy makers.

Parameswaran, A., & Devi, P. (2006). Student plagiarism and faculty responsibility in undergraduate engineering labs. *Higher Education Research & Development, 25*(3), 263-276. https://doi.org/10.1080/07294360600793036

This article, written from the context of an engineering program in Singapore, presents case study findings from 30 interviews, three focus groups (N=5, N=5, and N=27), and six months of observation with a focus on plagiarism practices in engineering labs. The authors did not provide details about the

total number of participants or the details of their observations, but the authors indicated that respondents were engineering undergrads specifically chosen as representative of particular groups. It focuses on undergraduate engineering students' copying and collusion practices, in particular the widespread practice of lab-report copying. The authors thoughtfully selected participants to represent a wide range of student attributes including program, year, grade point average, and ethnicities. It was found that the practice of copying lab reports was common among the entire population. This paper describes how copying happens and how students share their work and make minimal changes to avoid detection. They also discuss the justifications that students gave for their behaviours, such as instructor inaction, tacit approval, a lack of support with challenging concepts, and time constraints. The authors commented on their own observations that copying was often poorly concealed and that teaching and lab assistants did little to deter or prevent it from occurring. Underscoring the centrality of ethics to engineering as a profession, this paper concludes with a call to change pedagogical approaches and end faculty complicity with cheating.

Songsriwittaya, A., Kongsuwan, S., Jitgarun, K., Kaewkuekool, S., & Koul, R. (2009). Engineering students' attitude towards plagiarism: A survey study. *Education, 69*(9)97.

In response to some high-profile reports of cheating in engineering programs in Thailand, these authors explored how undergraduate engineering students in Thailand perceive plagiarism. In particular, they investigated student "orientation types" and how they correlate with attitudes towards plagiarism. Participants (n=692) completed both an achievement goal survey and a "dimensions of plagiarism" survey; however, of these respondents only 67 were engineering majors which begs the question about why it is framed as an engineering issue. In terms of goal orientation, the participants were grouped as having either "performance goals" or "mastery goals". The authors found that in terms of plagiarism, students engaged in such behaviours to get good grades or to appear intelligent in comparison with others, but did not adequately explain how plagiarism occurs at such a high rate when a majority of engineering students (47 out of 67) were found to be mastery oriented, which is correlated with being less tolerant of plagiarism. In their conclusion, the authors note that perceptions about severity of plagiarism is correlated with its source; for example, copying from friends was considered less serious that copying from other sources. This paper contributes to an understanding of why Thai engineering students might plagiarize and would be of interest within that teaching context. However, there are methodological concerns and a disconnect between reported findings and the conclusions that the authors draw.

Starovoytova, D., & Namango, S. S. (2016). Viewpoint of undergraduate engineering students on plagiarism. *Journal of Education and Practice, 7*(31), 48-65.

This paper investigated undergraduate engineering students' perceptions of plagiarism, in particular how they define and justify plagiarism and what factors they believe contribute to it. The authors also looked at their perceptions of punishment and its severity. Fifty students in their fifth year of program at Moi University in Kenya completed a confidential self-report questionnaire based on Ajzen's theory of planned behavior with regard to plagiarism practices, and results revealed that plagiarism was widespread and ongoing. The authors found that respondents demonstrated poor understanding of plagiarism and academic writing practices. Furthermore, they justified their copying behaviours citing that it was commonplace and largely unpunished. While this paper was written within a Kenyan context, and the results of such a small survey are by no means generalizable, it demonstrates a crucial need for educational change in these programs and would be of interest to students, faculty and administrators that are concerned about the apparent acceptance of plagiarism in engineering programs.

Wan, R., Nordin, S., Halib, M., & Ghazali, Z. (2011). Plagiarism among undergraduate students in an engineering-based university: An exploratory analysis. *European Journal of Social Sciences, 25*(4), 537-549. https://www.academia.edu/25756782/Plagiarism_among_Undergraduate_Students_in_an_Engineering_Based_University_An_Exploratory_Analysis?auto=download

This paper reports on a survey about plagiarism that was administered to 500 undergraduate engineering students at a private-based higher education institute in Malaysia; of those surveys, 378 were deemed usable. In particular, it focuses on four dimensions: (a) awareness of plagiarism, (b) academic reference knowledge, (c) the intent and extent in committing plagiarism, and (d) contributing factors towards plagiarism. Results indicated that students best understood factors that contribute to plagiarism, followed by the intent and extent of plagiarism. Their awareness of plagiarism was the dimension that was least understood by students. The authors argue that more effort needs to be put into educating engineering students about not only the seriousness of plagiarism and its consequences, but also about how to avoid it. They note that greater attention to academic referencing and writing as a process-oriented activity is required, echoing other research on plagiarism in different contexts.

Yeo, S. (2007). First-year university science and engineering students' understanding of plagiarism. *High Education Research & Development, 26*(2), 199-216. https://doi.org/10.1080/07294360701310813

This paper focusses on the findings of a survey administered to 30 third-year or honours first year science and engineering students taking part in a requisite communications course in an Australian university. Approximately half the students completed the survey, and 190 instruments were deemed usable. The author sought to better understand how the students view plagiarism, make decisions about plagiarizing behaviours, and perceive the seriousness of plagiarism . Yeo found that students were generally able to demonstrate an understanding of the definition of plagiarism, but they were less capable of making connections to behaviours, as indicated by their responses to six example scenarios. Like other research on plagiarism, students tended to equate intentionality or deception with severity. In cases where copying was a deliberate act, students were more likely to agree that it was serious. Scenarios involving collusion were perceived as least serious. In terms of penalties, respondents (and males in particular) reported favouring less severe penalties for plagiarism. The author concludes with practical recommendations for first year science and engineering students including direct instruction about policies, ample opportunity to practice and develop writing skills, and clearer guidelines about group work and collusion. This paper is of value to anyone working with and designing tasks for new engineering students.

III. Faculty Perceptions and Attitudes

- There is often a gap between faculty beliefs and actions, with faculty having an anti-plagiarism stance but often doing little to promote integrity or prevent misconduct in course work.
- Engineering faculty tend to favour a punitive response to student plagiarism.
- Engineering faculty would benefit from training about preventing academic misconduct and plagiarism

Beute, N., van Aswegen, E. S., & Winberg, C. (2008). Avoiding plagiarism in contexts of development and change. *IEEE Transactions on Education, 51*(2), 201-205. https://doi.org/10.1109/TE.2007.91240

This paper reports on the use of TMS at a technical university in South Africa with students in a variety of engineering streams and engineering-related programs. The program itself was undergoing large shifts, as its status switched from an institute to a university, resulting in curricular adaptations and changes. The authors administered a survey to 111 faculty members, and the results highlighted a gap between faculty concerns and behaviours. Although nearly half of faculty surveyed reported that plagiarism is a significant issue, only 36% indicated that they had used the TMS available to them. Copy and paste plagiarism was reported to be the most common issue and just over half of instructors reported the belief that students make a deliberate choice to deceive when they engage in plagiarism. One finding of interest was that many faculty members noted a desire for stronger sanctions, including permanent removal of students from the university, although a handful of respondents took a more nuanced view about how students may plagiarize as they develop their academic writing skills. The authors conclude with a need for clear policies and procedures coupled with faculty training about better understanding and dealing with instances of plagiarism. This paper is useful for faculty and administrators to help them better understand plagiarism so that they can take steps to handle it appropriately.

Tabsh, S. W., El Kadi, H. A., & Abdelfatah, A. S. (2019, April 8-11). *Faculty Perception of Engineering Student Cheating and Effective Measures to Curb It.*[Conference Session]. 2019 IEEE Global Engineering Education Conference (EDUCON), Dubai, United Arab Emirates. https://doi.org/10.1109/EDUCON.2019.8725199

Although this paper addresses academic misconduct at a wider level, it does discuss plagiarism. The authors collected 53 survey responses from faculty at an American university in the United Arab Emirates, but it is unclear how this relates to the total number of faculty. Most of the survey items were related to the institutions policies and focused on faculty perceptions of student behavior. In general, faculty surveyed indicated that they believed that students more often cheat on take-home assignments than in exams, and inappropriate collaboration was perceived to be the most common cheating behavior. Notably, many faculty reported that punishments were too lax, and that that was the most common reason that students cheat, according to 28% of faculty surveyed. When asked about how to

deal with plagiarism, 30% faculty reported a desire to see stricter punishments and 30% wanted stricter proctoring of exams. Only 24% suggested education as a way to curtail cheating instances. The authors stated their concerns about the survey results, highlighting a need for more faculty and student education about plagiarism and cheating and in particular about follow procedures to ensure more consistency. This paper would be useful for administrators or faculty seeking to better understand how to approach and prevent cheating.

IV. Cheating and Collusion

- There are many ways that engineering students may cheat or copy, including high-tech and low-tech methods to use unauthorized materials.
- Unauthorized collusion and collaboration is particularly widespread in engineering programs, and it occurs more in face-to-face courses than in distance courses.

Brodie, I. M. & Hellyer, L. (2012, September 23-26) *Comparison of plagiarism rates between on-campus and off-campus engineering hydrology students*. [Conference session]. 40th Annual Conference of European Society for Engineering Education (SEFI 2012), Thessaloniki, Greece https://eprints.usq.edu.au/22743/3/Brodie_Hellyer_SEFI_2012_PV.pdf

This conference paper investigated whether or not rates of plagiarism differ between distance (N=285) and on campus (N=112) engineering students. The authors focused on the copying of technical analyses among students enrolled in a third-year engineering hydrology course. Initially, markers did not use TMS, but instead relied on themselves to spot similarities between student work on the assignments. Subsequently, Excel-Smash was used to compare similarities between spreadsheets. It was found that the software flagged more plagiarized texts than did the markers, but this was attributed to the fact that the marking had been done by three individuals, so each marker only saw a third of the papers. The team also found that there was more inter-student copying done by on campus students: 12 out of 112 assignments were deemed to be copied, 4 of which were discovered by human assessors. As for the larger online cohort, just 4 of 285 were found to have been copied, 2 of which were noted by the markers. There was no copying between online and on campus students. This research indicates that less collusion occurred with the online cohort of students and also demonstrated the usefulness of Excel-Smash for large classes with multiple markers. This article would be of interest to faculty and teaching assistants looking for ways to flag inappropriate sharing when marking is divided among assessors, which is common practice in large engineering classes.

Sisson, E., & Todd-Mancillas, W. R. (1984, March). *Cheating in Engineering Courses: Short-and Long-Term Consequences.* [Paper presentation]. Annual Meeting of the Midwest Section of the American Society of Engineering Education, Wichita, NE, United States.

Although this paper is dated, we have opted to include it because it demonstrates that cheating behaviours in engineering programs precede the internet. The authors surveyed 287 engineering students in an US university about their demographics and their cheating behaviours. One particularly interesting finding was that fewer than half (44%) of students reported that they did not and would not collaborate inappropriately with their peers if instructed not to. In other words, more than half of students would collaborate even if instructed not to. The authors discuss the findings of widespread cheating through a preventative lens, and they conclude with suggestions about how to better communicate expectations and consequences and measures that instructors can take when designing tasks. This paper would be of interest to anyone who wants to better understand academic misconduct in engineering programs over time.

Srikanth, M., & Asmatulu, R. (2014). Modern cheating techniques, their adverse effects on engineering education and preventions. *International Journal of Mechanical Engineering Education*, *42*(2), 129-140. https://doi.org/10.7227/IJMEE.0005

This is an interesting overview and description of different strategies that students may use to help themselves cheat. Although it does not focus on plagiarism, it does touch on copying and collusion, and it focusses on how students may bring in materials to copy during exams. It outlines a number of high-tech ways that students might cheat with electronic devices or disguised smartphones in addition to many low-tech methods of bringing in and hiding crib notes for exams. The paper provides ample examples and images to demonstrate these techniques. This paper would be of interest for those who are concerned about exam cheating in particular.

V. Text-matching Software and Plagiarism Detection

- Text-matching software (TMS) may help instructors identify misconceptions about plagiarism and academic writing conventions so that they can direct students to appropriate support services.
- TMS programs can be used to identify copying between students, which is especially useful in large engineering classes with multiple assessors
- Engineering students and faculty tend to have favourable views of TMS, but training on its use is important. Similarity reports must be interpreted with caution.
- TMS has some limitations in that it may not identify all plagiarized texts, as many engineering articles are not in some large TMS databases, nor does TMS detect plagiarised figures. There are also ways that students may trick the program or falsify results.

Cooper, M., & Bullard, L. (2014). Application of plagiarism screening software in the chemical engineering curriculum. *Chemical Engineering Education, 48*(2), 90-96.

This paper was written about the introduction of Turnitin in a chemical engineering program at an American university. The authors were guided by two questions: 1. whether the software would effectively screen for plagiarism in chemical engineering student papers, and 2. what student attitudes were towards their instructors using the software to screen for plagiarism. The authors compared reported cases of plagiarism prior to and following the introduction of TMS and surveyed students about their perceptions; 608 survey responses were collected from junior and senior engineering students, but the authors note that not all were completed by unique students because some students were enrolled in more than one class where it was administered. The authors found no difference in the number of instances of what they label and define as “malicious plagiarism” in the four years prior to and following the TMS adoption; in both cases, three cases were reported over four year periods. Interestingly, they saw a substantial increase in “non-malicious plagiarism” reported following the introduction of Turnitin (two compared to 30). This indicates that TMS can be helpful to flag problems with academic writing or citation practices and then provide support for struggling students. As for the student perception aspect of this work, students had favourable views on the adoption of the software, with fewer than 10% indicated a negative view of its use. Overall, this paper would be useful for institutions considering TMS adoption.

Cox, S. (2012). Use of Turnitin and a class tutorial to improve referencing and citation skills in engineering students. In W. Aung, V. Ilic, O. Mertanen. J. Moscinski, & j. Uhomoibhi (Eds.), *Innovations 2012* (pp. 109-118). iNEER.

This paper reports on research undertaken in Northern Ireland about educational initiatives to help engineering students develop academic writing skills, particularly surrounding referencing and citation. Student participants (n=106) in their third and fourth years of engineering study were provided with a workshop on referencing by a staff member from the institution’s Learning Development Service. In the first year, 37 participants received a basic workshop about citation practices; in the second year, the workshop was expanded to include university policies, a case study, and an introduction to using TMS

for formative feedback on work prior to submission. Students were surveyed after the workshops. The participants from the second cycle of the research more widely reported (80%) that the workshop notes on referencing and citation were helpful, whereas fewer of them (53%) reported that Turnitin was helpful as a formative tool for improving attribution skills. Cox speculated that this could be because students did not fully understand how to interpret Turnitin reports. Additionally, student marks with referencing and citation improved after these interventions. This paper adds to the conversation about best practices with TMS adoption and the efficacy of workshops that target citation skills.

Garcia Adeva, J.J., Carroll, N. L., & Calvo, R. A. (2006, July 10-13). *Applying plagiarism detection to engineering education* [Conference session]. 2006 7th International Conference on Information Technology Based Higher Education and Training, Ultimo, NSW, Australia. https://ieeexplore-ieee-org.ezproxy.lib.ucalgary.ca/stamp/stamp.jsp?tp=&arnumber=4141701

This conference paper reports on a non-commercial TMS program (Beagle) that was introduced to detect collusion in eportfolios submitted by engineering students. The technical conference paper outlines how the program functions. The authors reported that the program has implications for engineering classrooms and eportfolio submission and that Beagle can identify similarities across student submissions, which can be difficult to uncover in large classes with multiple assessors who will not encounter all student submissions. This paper could be of value for those interested in creating a TMS program to flag inappropriate copying of assignments between students.

Holi Ali, H. I. (2013). Minimizing cyber-plagiarism through Turnitin: faculty's & students' perspectives. *International Journal of Applied Linguistics and English Literature, 2*(2), 33-42. https://doi.org/10.7575/aiac.ijalel.v.2n.2p33

This paper reports on a survey of student (n=50) and faculty (n=20) experience with Turnitin in a private engineering university the Sultanate of Oman. Although the participants are mainly Omani, English is the medium of instruction, and students typically have been educated in English since primary school. Faculty reported generally favourable views of Turnitin, with more than half (55%) reporting that Turnitin is an effective tool for preventing plagiarism. Additionally, 85% found Turnitin useful for teaching students about "the boundary of the internet plagiarism" and the vast majority (80%) felt it should be used as an educational tool rather than tool to detect. The student survey revealed that 78% agreed that Turnitin helped them to understand plagiarism, but they also indicated concerns about interpreting reports (78%) and concerns about the software not detecting all matches (64%). Troublingly, 56% of students surveyed reported that they know how to deceive the software. One concern about this paper is that the numbers do not add up and the percentages of survey results exceed 100% for some items. The author concludes that TMS is helpful, especially in understanding plagiarism and flagging potential issues so students can revise prior to submission, but its use is best limited to an educational tool rather than a detection tool.

Jones, K. O. (2008, June 12). *Practical issues for academics using the Turnitin plagiarism detection software.* [Conference session]. Proceedings of the 9th International Conference on Computer Systems and Technologies and Workshop for PhD Students in Computing, New York, New York, United States. https://dl-acm-org.ezproxy.lib.ucalgary.ca/doi/pdf/10.1145/1500879.1500935

This conference paper introduces Turnitin and focuses on how it works and how it can be used in by faculty. It does not report on research, but instead provides an overview of the product, along with some of the issues and strategies to avoid them. Jones notes issues around false matches due to

common phrases and noise matches. He aptly reminds the reader that TMS is not a plagiarism detection program; more accurately, it is a text-matching program. He concludes that Turnitin is a useful tool, but it is only effective when coupled with human interpretation of results.

Jones, K. O., & Moore, T. A. (2010, June 17). *Turnitin is not the primary weapon in the campaign against plagiarism* [Conference session]. Proceedings of the 11th International Conference on Computer Systems and Technologies and Workshop for PhD Students in Computing on International Conference on Computer Systems and Technologies, New York, New York, United States. https://dl-acm-org.ezproxy.lib.ucalgary.ca/doi/pdf/10.1145/1839379.1839454

This conference paper is a follow up to Jones (2008) presentation introducing Turnitin. This paper also highlights the usefulness of Turnitin but cautions users about its limitations. The authors provide a handful of examples of potential ways that the TMS can be fooled by students who are intent on deceiving the system. The authors conclude that despite its limitations, Turnitin remains a useful tool, but instructors and markers must ultimately "remain vigilant" and "use their intuition" (p. 429), even when similarity reports have low scores.

Kaner, C., & Fiedler, R. L. (2008). A cautionary note on checking software engineering papers for plagiarism. *IEEE Transactions on Education, 51*(2), 184-188. https://doi.org/10.1109/TE.2007.909351

This conference paper explores limitations of commercial text matching software programs MyDropBox and Turnitin, specifically in relation to the field of engineering. The authors submitted texts that were that they had copied from IEEE journals to both platforms. They found that much of the plagiarized content was not flagged, largely because the tool corpora do not include articles from the most popular databases of engineering research, in particular software engineering. Of the 13 copied papers they uploaded, Turnitin correctly identified the text matches in three, identified a lower match in one, and failed to identify textual similarities in nine. As for MyDropbox, it correctly identified the textual similarities in four of the papers, flagged some similarities in one paper, was unable to scan one paper, and did not identify textual similarities in seven papers. Notably, the two programs correctly identified different papers, so when used in conjunction, eight of 13 papers were correctly identified. The authors argue that TMS programs have limitations, especially in engineering, as many engineering papers are not in the corporate databases. In institutions where students must submit similarity reports with their assignments, there are concerns that plagiarized material will go undetected because instructors may not investigate further, assuming that similarity reports were accurate. This paper serves as an important reminder to those assessing student work about the limitations of TMS. This paper is a bit dated, and it is unclear if databases have improved in the interim.

Lancaster, T., & Clarke, R. (2014). Using Turnitin as a tool for attribution in cases of contract cheating. *The Higher Education Academy STEM*, 1-5.

This paper presents findings from an investigation about how the text-matching software program Turnitin's non-originality engine can detect contract cheating. Although this topic is situated just outside our conception of plagiarism, it warrants inclusion in this document because of the growing incidents of contract cheating – that is, the commissioning of others to produce one's work. In this research, the authors uploaded known STEM assignments that were completed by a contracted party. Of the 369 contracted STEM papers, 28.5% were flagged by the software. The authors express both hopefulness and concern about anti-contract cheating software, but they underscore the need for educator

awareness about contract cheating and the characteristics of contracted submissions. This paper would be of interest to anyone who assesses student work or has concerns about contract cheating in engineering programs, such as program administrators.

Oghigian, K., Rayner, M., & Chujo, K. (2016). A quantitative evaluation of Turnitin from an L2 science and engineering perspective. *CALL-EJ, 17*(1), 1-18. https://callej.org/journal/17-1/Oghigian_Rayner_Chujo2016.pdf

In this paper, the authors describe a study in which they reviewed the Turnitin similarity results of 68 STEM papers written by L2 English (second language) speakers who were in their third and fourth year of science and engineering programs in a Japanese university. Although the software identified textual similarities in 99% of the papers, upon investigation, the authors found that much of what was flagged were false positives and not plagiarized text. Upon investigation, they found that only 29% of the papers contained plagiarism, which they characterized as "outright plagiarism" (i.e. copy and paste), "paraphrase and patchwork plagiarism", and "stealing of an apt term" (p. 1). This paper has a lengthy and useful description of the methods used and the categories of true and false positives identified. The authors discuss the limitations of Turnitin as a plagiarism detection program, noting that it is marketed as such despite the fact that most of the similarities identified by the program are false positives. The authors make other recommendations about Turnitin's functionality and its limitations with filters. They conclude that Turnitin can be a valuable pedagogical tool, but its usefulness for policing plagiarism is limited and similarity scores must be investigated and never be taken at face value. This paper would be relevant to anyone interested in interpreting and using TMS with engineering students.

Vieyra, M., Strickland, D., & Timmerman, B. (2013). Patterns in plagiarism and patchwriting in science and engineering graduate students' research proposals. *International Journal for Educational Integrity*, *9*(1), 35-49. https://doi.org/10.21913/IJEL.v9i1.846

This article describes some findings from a larger research project investigating 115 science and engineering graduate student research proposals submitted to three universities in the United States. The authors found that 28% of the papers contained plagiarized texts, according to SafeAssign reports. In this paper they investigate patterns of plagiarism that were found in these papers. Textual similarities deemed to be plagiarized were categorized into four types of plagiarism: direct copying, word change (i.e. nearly verbatim with minor changes), grammar change (nearly verbatim copying, but with minor changes to grammar, such as verb tenses), and complex (where multiple strategies were employed to disguise plagiarism). The authors found that direct copying was the most common type of plagiarism, with 68% of plagiarized texts directly copied. Furthermore, the original sources were investigated, and 30% were found to come from technical sources (i.e. patents, drug information), 25% from journals, and 24% from popular websites. It was also found that most of the plagiarized sentenced were uncited (80%) and the remaining were improperly cited. It was also discovered that introductions tended to have the most plagiarized text. The authors also compared patterns of plagiarism between native speaking and second language speaking students and found more examples of plagiarized texts in the work of ESL (English as a Second Language) students. This paper concludes with implications for practice, demonstrating that similarity reports can provide examples of students' struggles with academic writing. The authors argue that the vast majority of plagiarism was likely unintentional and they underscored the developmental process of writing. Those who were poorer writers tended to directly copy more, while stronger writers used more complex strategies of paraphrasing. The authors focus on the pedagogical implications and underscore the need for writing support programs. This article is of relevance to faculty working with engineering students, especially graduate student supervisors.

Zhang, X. X., Huo, Z. L., & Zhang, Y. H. (2014). Detecting and (not) dealing with plagiarism in an engineering paper: beyond CrossCheck—A case study. *Science and Engineering Ethics, 20*(2), 433-443. https://doi.org/10.1007/s11948-013-9460-5

This paper does not focus on engineering education, but it does discuss an often-overlooked type of plagiarism that may take place in engineers' reports or articles: the inappropriate re-use of figures and graphs. In this case study focusing on plagiarism of figures, the authors focus on the TMS program CrossCheck, which is often used by academic journals. They describe its limitation as merely finding textual similarities while neglecting to identify similarities between non-textual elements. The article itself focuses on a case study of two academics and their articles, but then discuss implications for editors of science and engineering papers and highlight the need to evaluate papers more carefully and lower similarity report thresholds. The authors also discuss conceptualizations of plagiarism and a need for increased clarity about what constitutes plagiarism. This paper would be useful for stakeholders in STEM publishing.

VI. International Students

- International students are often highly represented in Western engineering programs.
- International students may have received less education about plagiarism and avoiding it prior to entering a Western educational context.
- Direct instruction and workshops about plagiarism and how to avoid it may be particularly useful and effective for international engineering students.

Duff, A. H., Rogers, D. P., & Harris, M. B. (2006). International engineering students—avoiding plagiarism through understanding the Western academic context of scholarship. *European Journal of Engineering Education, 31*(6), 673-681. https://doi.org/10.1037/rev0000126

This article focuses on how engineering students adapt to Western academic culture in an Australian context. It describes a series of interventions and support systems that were developed in response to a previous incident of plagiarism where nearly half of a cohort (16/35) master's engineering students were found to have plagiarized an assignment. A smaller scale intervention was used at the time, where it became apparent that the students did not have the academic literacy and writing skills that had previously been assumed. In order to address this and promote academic scholarship and make faculty aware of international student needs, six interventions were implemented: 1. Orientation to "the Western way" (p. 678), 2. Provision of online resources, 3. Academic scholarship workshops, 4. A scaffolded assignment, 5. A writers' circle, and 6. Identification of at-risk students. The interventions were embedded in a required course. The authors reported a sharp decrease in plagiarized assignments upon the incorporating the six interventions, dropping from 45.7% prior to the intervention to 0-3.8% in subsequent semesters. The authors conclude that instructional support and engagement are very promising approaches for reducing plagiarism in engineering programs. This article is would be very useful to engineering faculty, particularly those that work with graduate level international students.

Stappenbelt, B. (2012). Plagiarism in mechanical engineering education: A comparative study of international and domestic students. *International Journal of Mechanical Engineering Education, 40*(1), 24-41. https://doi.org/10.7227/IJMEE.40.1.6

This paper describes the transition into engineering programs in a Western academic context (Australia). The participants were either local first year students (n=143) or newly admitted international students (n=56). Stappenbelt (2012) administered surveys and interviewed both groups of learners and found that international students reported far less education about plagiarism than did their local counterparts: nearly half the local students said they had received prior instruction on plagiarism, whereas only 9% of international students reported this. Interestingly, perceptions of plagiarism as wrong were similar between groups, indicating that that main difference is that international students may arrive to Western educational contexts with intentions not to plagiarize but not the skills to avoid it. The author also conducted an assessment of students' abilities to recognize plagiarism and found that the international group was nearly as aware as the local cohort, however, the performed more poorly when it came to understanding university policies and appropriately paraphrasing and citing. Stappenbelt also describes how issues of plagiarism may be compounded by other issues that

international students face such as financial burdens, housing problems, familial pressure, and cultural differences. He concludes that all incoming students need support, but international students in particular, would benefit from increased instruction and practice about academic integrity policies and strategies to avoid plagiarism. This article would be of value for engineering faculty and support services employees working with newly admitted local and international students.

Stappenbelt, B., Kiridena, S., Hastie, D., & Basu, A. (2016). An investigation of international postgraduate engineering students' attitudes and abilities related to avoiding plagiarism. *The International Journal of Engineering Education, 32*(6), 2621-2634. http://h8.relais-host.com/posttowebacu/DownloadDocument?PAT-10304626.pdf

This paper details the results of a study spanning three years of non-English speaking post-graduate engineering students from an Australian university. This is a continuation of earlier work, with a grad student focus. The authors found that language proficiency is correlated with ability to detect and prevent plagiarism. Stappenbelt et al (2016) administered a survey to 416 students, divided into sub-groups based on their geographic region of their country of birth, to assess the students' ability to recognize and rate the severity of plagiarism in a series of writing samples. Students were further invited to participate in a post-survey interview to add their thoughts. Results indicated significant differences between the geographical sub-groups students' ethical stance and their abilities to identify plagiarism. Stappenbelt et al (2016) conclude that understanding student attitudes to plagiarism is the key to preventing recurrence and creating an ethical academic culture. This article would be of value to engineering faculty and support services staff working with international students.

VII. Interventions and Reparations

- Engineering students take varying degrees of responsibility for their actions when found to have engaged in academically dishonest behaviours, with the majority partially accepting personal responsibility and partially blaming instructors or assignment designs.
- There are many reasons that engineering students might plagiarize, and there are many ways that instructors can design tasks to encourage integrity and individual completion of work.
- Experience with academic writing cannot be assumed. Librarians and student support services can be valuable with helping engineering students develop academic writing skills.

Bertram Gallant, T., Van Den Einde, L., Ouellette, S., & Lee, S. (2014). A systemic analysis of cheating in an undergraduate engineering mechanics course. *Science and Engineering Ethics, 20*(1), 277-298. https://doi.org/10.1007/s11948-013-9435-6

This paper investigates how structural engineering students may engage in unauthorized assistance with each other on individual assignments, how and if they come to understand those behaviours as unethical, and how their ethical decisions and actions in school impact those in the workplace. This paper describes the results of a study that was undertaken after an instance of widespread plagiarism in which 66 of 122 mechanical and structural engineering students in an upper division engineering course were found to have used unauthorized materials (i.e. a solution manual or others' work) to complete an assignment. The students sanctioned for academic misconduct were required to write reflections about the incident, and the authors analyzed the 58 reflections that had been submitted. They found that about one third of the students accepted full individual responsibility for the incident, indicating that they understood why it was wrong. Half of the students accepted partial responsibility, taking some responsibility, but tempering it by assigning blame to external factors such as family pressures.. The remaining 16% of students denied responsibility, blaming instructors or arguing the solution manual was an appropriate tool. The reflective pieces written by these students offer insight into the systemic influences, in particular the norms within a program, that may lead students to engage in academically dishonesty behaviours. The results of this study indicate the importance of clearly articulating expectations for the completion of assignments and the need to design assignments that encourage ethical engagement with the materials. This paper would be of value to those designing engineering tasks.

Cismas, S. C. (2010, February 23-25). *Anti-plagiarism strategies for environment engineering students*. Proceedings of the EE'10 5th IASME/WSEAS International Conference on Energy & Environment, Cambridge, UK (pp. 339-343).

This descriptive conference paper details plagiarism and its scope. It outlines common pitfalls that might encourage engineering students to plagiarize. It also brings forward strategies that instructors can use to prevent plagiarism in their classes through discussion, activities, and material and assessment design. The paper also provides an example of an assignment design used by the author in an engineering course. The author goes on to discuss the impact the internet may have on plagiarism and the extent and severity of different sanctions. Although this is not a research paper, it provides an accessible overview of practical strategies that instructors can use to help design ethical behavior into student learning experiences.

Eckel, E. J. (2010). A reflection on Plagiarism, Patchwriting and the Engineering Master's Thesis. *Issues in Science and Technology Librarianship, 62*(9), 1. https://doi.org/10.5062/F4NC5Z42

This short reflective piece provides an overview of how librarians can support engineering graduate students. The author provides a bit of background about plagiarism in engineering, with a focus on patchwriting as a developmental strategy (as previously noted by Pecorari, 2003) and does not typically indicate an intent to deceive, rather it indicates a need for writing support. Although many assume that graduate-level students should already have developed academic writing skills, issues with patchwriting indicate that this may not be the case. Eckel notes that engineering librarians are well-positioned to provide support for students, and engineering programs should view patchwriting not as a transgression but as a need for support and a larger conversation. This article would be useful to anyone working with graduate level engineering students who are working on their writing skills.

Haddad, R. J., & Kalaani, Y. (2014, March 30-April 1). *Gaming against plagiarism (GAP): A game-based approach to illustrate research misconduct to undergraduate engineering students*. [Conference session]. 2014 ASEE Southeast Section Conference, Macon, Georgia, United States. http://www.asee-se.org/proceedings/ASEE2014/Papers2014/4/45.pdf

Although this paper does not focus on plagiarism, it warrants inclusion in this document because it addresses aspects of plagiarism under the umbrella of research misconduct. In this study, the authors describe how they used a program called "Gaming against Plagiarism" and the results of their students' pre and post-survey results. Prior to completing the games, 24 third- and fourth-year engineering students at a US university did a 14-question survey in which they identified types of research misconduct (including types of plagiarism). They completed the same survey following completion of the games, and the authors report a statistically significant ($p < .05$) improvement on the post-survey, with 73% of correct responses compared to 59.8% prior to the games. The authors conclude that a games-based approach can be an effective way to help students better understand types of research misconduct. One limitation of this study is that it is possible that the positive results are due to test bias. This article could be useful to those developing games-based approaches to teaching engineering students about academic misconduct.

Halak, B., & El-Hajjar, M. (2016, May 11-13). *Plagiarism detection and prevention techniques in engineering education.* [Conference session]. 2016 11th European Workshop on Microelectronics Education (EWME), Southhampton, United Kingdom. https://doi.org/10.1109/EWME.2016.7496465

This conference presentation provides an overview of two assignment approaches used with masters' level engineering students at a university in the UK. Firstly, masters level engineering students in three cohorts of 48 students were given individual assignments and their similarity scores (determined by text-matching software) were recorded. It was found that when students were given similar or identical assignments, the mean similarity score was 21%, but went down to 5% when they had individual assignments. The authors argue that this reduction demonstrates less collusion between students. The second approach involved a task in which students did individual presentations in an attempt to prevent collusion between students. To evaluate the efficacy of individual presentations rather than group presentations, the authors looked at the distribution of marks. They found that they were unevenly distributed for group presentations, with higher marks overall, indicating that a fewer number of stronger students may have done more of the work. The distribution of individual presentation marks was more normal and followed a bell curve. The authors argue that this indicates a reduction in collusion as well. They conclude that individual work can reduce the opportunity to engage in collusion and plagiarism. This paper could be useful to those designing assignments for engineering students.

Conclusions

In this report we have offered a summary of contributions to plagiarism in the STEM and engineering fields in terms of research, scholarship and professional contributions up to and including 2019. As this report is being published in 2021, we recognize that more and more knowledge is being conducted on plagiarism, and there is more work to do. Canada lags behind other nations in terms of research and advocacy. That is not because Canada is immune to violations of integrity, but rather we have yet to develop a critical mass of researchers who engage in sustained programs of research in this area.

As a field of professional education, the importance of academic integrity as a critical aspect of training for aspiring engineers, as educational integrity provides the foundation for professional ethics.

We conclude with these calls to action for Canadian advocates of integrity

- For researchers to develop and sustain research programs on plagiarism, engaging others in productive collaborations to build capacity on a larger scale;
- For professional practitioners to make a point of documenting and sharing the work they do in presentations, papers and resources that are easily accessible by others; and
- For institutions to fund research, as well as evidence-informed tools and resources to help students, faculty and other members of our educational communities.

More engagement at every level is needed among practitioners, educators, researchers and policy makers, to ensure integrity guides our institutions and provides the foundation for learning and teaching.

References

Bertram Gallant, T., Van Den Einde, L., Ouellette, S., & Lee, S. (2014). A systemic analysis of cheating in an undergraduate engineering mechanics course. *Science and Engineering Ethics, 20*(1), 277-298. https://doi.org/10.1007/s11948-013-9435-6

Beute, N., van Aswegen, E. S., & Winberg, C. (2008). Avoiding plagiarism in contexts of development and change. IEEE Transactions on Education, *51(*2), 201-205. https://doi.org/10.1109/TE.2007.912407

Booth, A., Papaioannou, D., & Sutton, A. (2012). The literature review: its role within research. *Systematic approaches to a successful literature review*, *1*, 16.

Brodie, I. M. & Hellyer, L. (2012, September 23-26) *Comparison of plagiarism rates between on-campus and off-campus engineering hydrology students*. [Conference session]. 40th Annual Conference of European Society for Engineering Education (SEFI 2012), Thessaloniki, Greece. https://eprints.usq.edu.au/22743/3/Brodie_Hellyer_SEFI_2012_PV.pdf

Carpenter, D., Harding, T., & Finelli, C. (2010). Using research to identify academic dishonesty deterrents among engineering undergraduates. *International Journal of Engineering Education, 26*(5), 1156-1165. https://deepblue.lib.umich.edu/bitstream/handle/2027.42/86094/E3_Deterrents_Carpenter_et_al_2010.pdf?sequence=1&isAllowed=y

Carpenter, D. D., Harding, T. S., Finelli, C. J., Montgomery, S. M., & Passow, H. J. (2006). Engineering students' perceptions of and attitudes towards cheating. *Journal of Engineering Education, 95*(3), 181-194. https://doi.org/10.1002/j.2168-9830.2006.tb00891.x

Cismas, S. C. (2010, February 23-25). *Anti-plagiarism strategies for environment engineering students*. Proceedings of the EE'10 5th IASME/WSEAS International Conference on Energy & Environment, Cambridge, UK (pp. 339-343).

Cox, S. (2012). Use of Turnitin and a class tutorial to improve referencing and citation skills in engineering students. In W. Aung, V. Ilic, O. Mertanen. J. Moscinski, & j. Uhomoibhi (Eds.), *Innovations 2012* (pp. 109-118). iNEER.

Duff, A. H., Rogers, D. P., & Harris, M. B. (2006). International engineering students—avoiding plagiarism through understanding the Western academic context of scholarship. *European Journal of Engineering Education, 31*(6), 673-681. https://doi.org/10.1037/rev0000126

Eaton, S. E., Crossman, K., Behjat, L., Yates, R. M., Fear, E., & Trifkovic, M. (2020). An institutional self-study of text-matching software in a Canadian graduate-level engineering program. *Journal of Academic Ethics*. https://doi.org/10.1007/s10805-020-09367-0

Eckel, E. J. (2010). A reflection on Plagiarism, Patchwriting and the Engineering Master's Thesis. *Issues in Science and Technology Librarianship, 62*(9), 1. https://doi.org/10.5062/F4NC5Z42

Garcia Adeva, J.J., Carroll, N. L., & Calvo, R. A. (2006, July 10-13). *Applying plagiarism detection to engineering education* [Conference session]. 2006 7th International Conference on Information Technology Based Higher Education and Training, Ultimo, NSW, Australia. https://ieeexplore-ieee-org.ezproxy.lib.ucalgary.ca/stamp/stamp.jsp?tp=&arnumber=4141701

Guerrero-Dib, J. G., Portales, L., & Heredia-Escorza, Y. (2020). Impact of academic integrity on workplace ethical behaviour. *International Journal for Educational Integrity, 16*(1), 2. doi:10.1007/s40979-020-0051-3

Haddad, R. J., & Kalaani, Y. (2014, March 30-April 1). *Gaming against plagiarism (GAP): A game-based approach to illustrate research misconduct to undergraduate engineering students*. [Conference session]. 2014 ASEE Southeast Section Conference, Macon, Georgia, United States. http://www.asee-se.org/proceedings/ASEE2014/Papers2014/4/45.pdf

Halak, B., & El-Hajjar, M. (2016, May 11-13). *Plagiarism detection and prevention techniques in engineering education.* [Conference session]. 2016 11th European Workshop on Microelectronics Education (EWME), Southhampton, United Kingdom. https://doi.org/10.1109/EWME.2016.7496465

Holi Ali, H. I. (2013). Minimizing cyber-plagiarism through Turnitin: faculty's & students' perspectives. *International Journal of Applied Linguistics and English Literature, 2*(2), 33-42. https://doi.org/10.7575/aiac.ijalel.v.2n.2p33

Jones, K. O. (2008, June 12). *Practical issues for academics using the Turnitin plagiarism detection software.* [Conference session]. Proceedings of the 9th International Conference on Computer Systems and Technologies and Workshop for PhD Students in Computing, New York, New York, United States. https://dl-acm-org.ezproxy.lib.ucalgary.ca/doi/pdf/10.1145/1500879.1500935

Jones, K. O., & Moore, T. A. (2010, June 17). *Turnitin is not the primary weapon in the campaign against plagiarism* [Conference session]. Proceedings of the 11th International Conference on Computer Systems and Technologies and Workshop for PhD Students in Computing on International Conference on Computer Systems and Technologies, New York, New York, United States. https://dl-acm-org.ezproxy.lib.ucalgary.ca/doi/pdf/10.1145/1839379.1839454

Kaner, C., & Fiedler, R. L. (2008). A cautionary note on checking software engineering papers for plagiarism. *IEEE Transactions on Education, 51*(2), 184-188. https://doi.org/10.1109/TE.2007.909351

Lancaster, T., & Clarke, R. (2014). Using Turnitin as a tool for attribution in cases of contract cheating. *The Higher Education Academy STEM*, 1-5.

Oghigian, K., Rayner, M., & Chujo, K. (2016). A quantitative evaluation of Turnitin from an L2 science and engineering perspective. *CALL-EJ, 17*(1), 1-18. https://callej.org/journal/17-1/Oghigian_Rayner_Chujo2016.pdf

Parameswaran, A., & Devi, P. (2006). Student plagiarism and faculty responsibility in undergraduate engineering labs. *Higher Education Research & Development, 25*(3), 263-276. https://doi.org/10.1080/07294360600793036

Pecorari, D. (2003). Good and original: Plagiarism and patchwriting in academic second-language writing. *Journal of second language writing*, *12*(4), 317-345.

Sisson, E., & Todd-Mancillas, W. R. (1984, March). *Cheating in Engineering Courses: Short-and Long-Term Consequences.* [Paper presentation]. Annual Meeting of the Midwest Section of the American Society of Engineering Education, Wichita, NE, United States.

Songsriwittaya, A., Kongsuwan, S., Jitgarun, K., Kaewkuekool, S., & Koul, R. (2009). Engineering students' attitude towards plagiarism: A survey study. *Education, 69*(9)97.

Srikanth, M., & Asmatulu, R. (2014). Modern cheating techniques, their adverse effects on engineering education and preventions. *International Journal of Mechanical Engineering Education*, *42*(2), 129-140. https://doi.org/10.7227/IJMEE.0005

Starovoytova, D., & Namango, S. S. (2016). Viewpoint of undergraduate engineering students on plagiarism. *Journal of Education and Practice, 7*(31), 48-65.

Stappenbelt, B. (2012). Plagiarism in mechanical engineering education: A comparative study of international and domestic students. *International Journal of Mechanical Engineering Education, 40*(1), 24-41. https://doi.org/10.7227/IJMEE.40.1.6

Stappenbelt, B., Kiridena, S., Hastie, D., & Basu, A. (2016). An investigation of international postgraduate engineering students' attitudes and abilities related to avoiding plagiarism. *The International Journal of Engineering Education, 32*(6), 2621-2634. http://h8.relais-host.com/posttowebacu/DownloadDocument?PAT-10304626.pdf

Tabsh, S. W., El Kadi, H. A., & Abdelfatah, A. S. (2019, April 8-11). *Faculty Perception of Engineering Student Cheating and Effective Measures to Curb It.*[Conference Session]. 2019 IEEE Global Engineering Education Conference (EDUCON), Dubai, United Arab Emirates. https://doi.org/10.1109/EDUCON.2019.8725199

Vesilind, P. A. (1996). Using academic integrity to teach engineering ethics. *Journal of Engineering Education, 85*(1), 41-44. https://doi.org/10.1002/j.2168-9830.1996.tb00206.x

Vieyra, M., Strickland, D., & Timmerman, B. (2013). Patterns in plagiarism and patchwriting in science and engineering graduate students' research proposals. *International Journal for Educational Integrity*, *9*(1), 35-49. https://doi.org/10.21913/IJEL.v9i1.846

Wan, R., Nordin, S., Halib, M., & Ghazali, Z. (2011). Plagiarism among undergraduate students in an engineering-based university: An exploratory analysis. *European Journal of Social Sciences, 25*(4), 537-549. https://www.academia.edu/25756782/Plagiarism_among_Undergraduate_Students_in_an_Engineering_Based_University_An_Exploratory_Analysis?auto=download

Zhang, X. X., Huo, Z. L., & Zhang, Y. H. (2014). Detecting and (not) dealing with plagiarism in an engineering paper: beyond CrossCheck—A case study. *Science and Engineering Ethics, 20*(2),

433-443. https://doi.org/10.1007/s11948-013-9460-5

Yeo, S. (2007). First-year university science and engineering students' understanding of plagiarism. *High Education Research & Development, 26*(2), 199-21. https://doi.org/10.1080/07294360701310813

Zigmond, M. J., & Fischer, B. A. (2002). Beyond fabrication and plagiarism: The little murders of everyday science. *Science and Engineering ethics, 8*(2), 229-234. https://doi.org/10.1007/s11948-002-0024-3

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