

Evolution of academic dishonesty in computer science courses

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Abstract

Online exams and assignments during the COVID-19 pandemic have introduced new forms of student cheating. In order to maintain evaluation criteria and preserve established ethical standards, professors have introduced new methods to minimize cheating. When returning onsite, the newly created cheating techniques evolved once again. They were supported by special groups on social networks dedicated to easier liquidation of exams and getting better grades. Crowdsourcing became frequent, particularly for homework assignment preparation. Recently, ChatGPT has become a new ally of students. This paper presents the evolution of student cheating in several computer science courses taught by the author of this paper. All examples of cheating are supplemented by the detecting methods and own applications used to prevent them from occurring again. The paper ends by predicting who will win in the eternal war between students and professors, at least in the short run.

Keywords: *Academic dishonesty; contract cheating; crowdsourcing; social media; versatile chatbots.*

1. Introduction

Academic dishonesty is a common phenomenon that has been going on for centuries (Lang, 2013). It is sometimes supplemented by bribing the examiner (Liu & Peng, 2015). Cheating usually happens during exams, but a large amount of cheating also comes from homework. The methods are specific to the field and type of study and are usually applied either during exams or during the preparation of assignments. In the pre-digital era, cheating during exams was done using more than 20 different techniques (Twomey, White & Sagendorf, 2009). At the Faculty of Computer Science and Engineering in Skopje (FCSE), the most common were:

- Cheat sheets, which our students hid in their pockets, inside their pants or taped inside thighs, while the girls hid them under the skirts or in their bras (Erbe, 2007). Sometimes they were placed in logarithmic tables, hidden inside pencils or stuck on plastic water bottles.
- Passing notes, prepared by better students after finishing their own solutions and shared with the students in their vicinity (Yee & MacKown, 2009). For shorter solutions, they could reach more than five students during one exam.
- Peeking into the test of a student who is ahead or behind (Newstead, Franklyn-Stokes & Armstead, 1996).
- Whispering or showing the number of the task and the correct answer with fingers (Twomey, White & Sagendorf, 2009).
- Distracting the proctor, often with banal questions, and enabling other colleagues to copy from the cheat sheets, passing notes or even from the test of a better student unhindered (Yee & MacKown, 2009).

The digital era introduced many new techniques, which complemented the previously mentioned ones (Twomey, White & Sagendorf, 2009). At FCSE, they included:

- Searching the Internet from the computer from which the student takes the exam or from the mobile phone (Harkins & Kubik, 2010).
- Entering the solution into a calculator (Kelley & Dooley, 2014), disk of USB flash drives that is shared with colleagues (Dawson, 2016).
- Sharing the solution using chat communication within the faculty local area network (Khan & Balasubramanian, 2012).
- Sharing the photo of the solution via mobile phone (Tindell & Bohlander, 2012).
- Turning off the screen to hide the solution that is intentionally left for a colleague who will take the exam from the same computer (Moten et al., 2013).
- Taking the exam on behalf of another student by logging into his/her account (Bretag et al., 2019).

Academic dishonesty during homework preparation did not change significantly with the transition to the digital era (Ercegovic & Richardson, 2004). It predominantly includes:

- Various forms of plagiarism, which embrace verbatim or Google translated text (Ducar & Schocket, 2018), fabricated bibliography (Lin & Wen, 2007), paraphrasing without acknowledging the original author (Newstead, Franklyn-Stokes & Armstead, 1996), potlucking sentences from several sources to harmonize them while retaining most of the original text (Myers, 2018) or self-plagiarism from assignments prepared for other courses (Bretag & Mahmud, 2009).
- Various forms of contract cheating that encompass: delivering or copying from other assignments with the approval of the original authors (Zdravkova, 2011).
- Hiring a ghostwriter (Zheng & Cheng, 2015), purchasing from paper mills (Medway, Roper & Gillooly, 2018) or using computer generated solutions (Vasylets & Marín, 2022).
- Appropriating a joint solution or homework assignment as its own (Newstead, Franklyn-Stokes & Armstead, 1996).

New learning management systems are Web 2.0-oriented, offering students the opportunity to work together using discussion forums, wikis, blogs and chats, enabling new forms of cheating (Aljawarneh, 2020). They introduce several new cheating activities:

- Idea theft in the discussion-based assignments inspired by what colleagues have written (Ellis, 2022; Zdravkova, 2014). Sometimes, the quality of stolen idea overcomes the quality of the original one (Zdravkova, 2014).
- Intrinsic plagiarism by combining parts of previously submitted discussions (Stein, B., Lipka, N., & Prettenhofer).
- Identity fraud when a student gives up his password to a colleague who does assignments for him/her (Bailie & Jortberg, 2009).
- Deliberate destruction of existing wikis or their fake editing (Zdravkova, 2014).

Last but not least is the use of social media in education (Greenhow & Lewin, 2016). They contain massive repositories of all information shared among the students, starting with exam questions and their solutions, through homework solutions, ending with strategies for outsmarting professors.

The paper continues with a review of observed cheating in two types of courses at FCSE during online education caused by the COVID-19 virus. All examples of cheating are supplemented with detection methods and display of proprietary applications used to prevent them from occurring. The paper ends with the post-COVID student cheating methods and the personal impression of the outcome of the eternal war between students prone to cheating and teachers who strive to prevent this academic dishonesty.

2. Cheating and prevention methods during online learning

Online education required extraordinary efforts to prevent students from cheating on exams and assignments. FCSE prepared a completely new environment, which contained many mechanisms to detect and minimize the effects of students' eternal desire to complete their assignments with minimum effort and get the highest grade in the process.

All exams were organized using Safe Exam Browser (<https://safeexambrowser.org>), which disabled browsing outside the exam website. Before the exam, students were identified through their smartphones, which were turned into web cameras using the Manycam (<https://manycam.com/>) or Droidcam (<https://droidcam.en.softonic.com/>) applications. The identification included careful observation of the room from which the exam was taken. During the exam, the proctors monitored each student, his/her computer screen, and listened to all the sounds he/she made. In spite of all these efforts, the success rate during exams increased, probably as a result of communication via alternative communication media.

Exams were recorded and kept for further inspection whenever the proctor suspected that some students were cheating. Based on the re-checking of the recorded exam, several fraudsters were discovered and their studies were suspended for one year.

2.1. Detecting and preventing academic cheating in technical courses

Plagiarism of exam solutions and homework assignments in technical courses was detected with JPlag (<https://github.com/jplag/JPlag>), a powerful tool that discovers software plagiarism and collusion in software development by mutually comparing the code. On each course and during each exam, at least one couple of completely identical and several almost identical solutions was detected, resulting in a disqualification of all involved students from the course. The same approach was implemented to prevent contract cheating of assignments.

The exam questions included the available commands of the programming tool presented as icons that must be correctly selected and assembled to generate the text (Fig. 1). This time-consuming activity for the exam creators has proven to be extremely effective to reduce the use of cheat sheets and avoid the temptation to search for solutions from an alternative laptop or smartphone. Moreover, it enabled the automatic grading of exams.

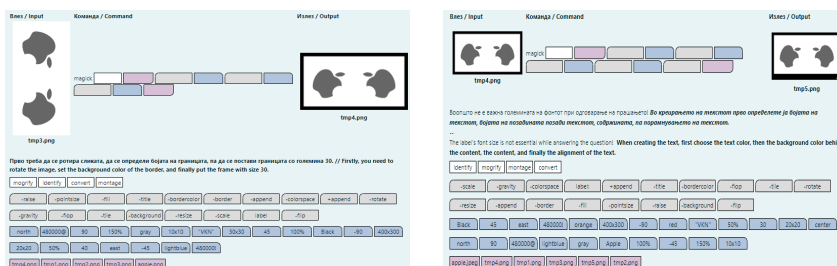


Figure 1. Typical exam questions of the Introduction to computer science course.

2.2. Detecting and preventing academic cheating in soft skill courses

Soft skill courses at FCSE are mainly realized using Web 2.0 features within Moodle (Zdravkova, 2014; Zdravkova, 2022a). Plagiarism by stealing from online sources was detected by careful checking of all posts, particularly those with a writing style not typical for a young computer science student. The professor translated them back into English and then searched the phrases on the web. This manual strategy resulted in the discovery of dozens of plagiarized posts out of hundreds, proving the suspicion that students are easily misappropriating other people's copyrighted material.

Detecting the theft of ideas required careful reading of posts and excellent memorization of previously published content. To facilitate visual discovery, the forums were divided into aspects to reduce the amount of published material (Zdravkova, 2022a). The same technique contributed to the detection of intrinsic plagiarism. In several situations, students whose ideas were stolen reacted within the same forum, making the professor's detective work easier.

An application for ghostwriting detection was developed to mutually compare homework assignments according to document metadata, used references, text ngrams and text similarity (Fig. 2.). The main requirement was that the documents should be delivered as source files. The application revealed several key facts:

- Students use their own crowdsourcing repositories where they have collected assignments from many generations. To prepare a new essay or journal, which is a collection of hot topics related to the curriculum, cheaters compose their own assignments from several similar assignments, reducing the text similarity.
- Contract cheating is more than obvious. Students from earlier generations and ghostwriters recruited from the current one create essays that are in accordance with the defined rules. The common feature of these essays is that they have 0 editing time. If the student who was suspected of handing in such an assignment knows well what is written in it, then he / she gets a grade depending on the quality of the work.
- Crowdsourcing was also noticed mainly because the writing style in the homework was too professional. Few students who were suspected admitted that they bought the homework from Amazon Mechanical Turk (<https://www.mturk.com/>).

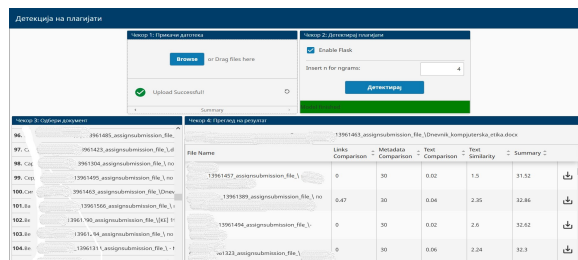


Figure 2. Ghostwriting detecting application at work.

3. Returning to new normal and final remarks

The return to on-site education marked a new shift in academic dishonesty. The long-term reliance of students on the web during exams was the first challenge FCSE had to deal with. This was achieved by activating a firewall that prevents access to all websites except the exam and by disabling access to the exam website from IP addresses outside the faculty labs. That decision drew the ire of some students who insisted on online exams for medical reasons. When entering the exam, students switch their cell phones to flight mode and leave them in a special place. It does not necessarily mean that they are prevented from cheating, because they can always have an alternative device hidden in their clothes.

FSCE has decided not to block the spy earbuds and mobile phones during exams. Typically, one proctor is responsible for a maximum of 20 students, which is more than enough to notice attempts to communicate with colleagues taking the same exam or with the cheating partner via the spy earbud.

The discovery of academic dishonesty in soft skills courses has not changed, as they have been mostly online for over 15 years (Zdravkova, 2022b). The only on-site activities, which are part of the student assessment, are presentations and discussions of collaborative projects. They have always been events that students liked and they never cheated on them. During the last discussions in January 2023, students revealed that there is “a new kid in town”: ChatGPT (<https://openai.com/blog/chatgpt>). Some have already experienced it and were impressed by its functionalities. It is probable that ChatGPT has already been used for the preparation of essays in the computer science course. According to the author of this paper own experience, the writing style in the essays compiled by this versatile chatbot resemble the writing of young students. If these essays are post-edited after being translated using Google Translate, there will no longer be a need for contract cheating and crowdsourcing support. This chatbot will do a great job in replacing days of homework preparation with less than a quarter of an hour of polishing. Ghostwriting detectors will become obsolete.

The paper presented a plethora of various techniques and activities of cheating on exams and during homework preparation. Many new techniques and methods of cheating have appeared, but the old ones still exist and are all widely used by dishonest students. Therefore, it is more than evident who will win in the eternal war between students and professors.

Cheaters are always at least one step ahead of their opponents. New technologies and crowdsourcing initiatives, driven by social media and versatile chatbots are their great allies. No matter how hard the professors try to prevent academic dishonesty, the students will always have an advantage and will manage to outsmart them.

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