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
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# The Impact of Technology on Cheating and Plagiarism in the Assessment – the teachers’ and students’ perspectives

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**Abstract.** Constantly emerging new technologies have a significant impact on higher education – both positive and negative. One of the negative aspects of using technology for education and especially for assessment is its potential to support academic dishonesty, namely to facilitate students in cheating and plagiarism. On the other hand, it provides an opportunity for academic staff to control academic dishonesty. These opportunities have not been researched enough and the contexts in which technology is able to prevent cheating and plagiarism have not been clearly determined. To address academic dishonesty, the European Commission funded TeSLA project has defined and developed a system which ensures the authentication of learners’ identity and authorship in online and blended learning environments. This paper investigates the impact of technology on cheating and plagiarism from the perspective of teachers and students from Sofia University (Bulgaria) related to both aspects of facilitation and prevention/control of such behaviour. Two online surveys with 100 academic staff and 239 bachelor and master degree students from Sofia University were conducted. The results revealed that the technology affects the opportunities for dishonest behaviour in assessment differently in the three studied contexts: 1) face-to-face exams; 2) submission of paper assignments, prepared in the absence of a teacher; 3) submission of online assignments prepared in the absence of a teacher; but mainly modifies the means of cheating rather than encouraging academic dishonesty. Technological solutions for dealing with cheating and plagiarism proposed by the respondents also appeared to be dependent on the assessment context.

## INTRODUCTION

Academic dishonesty is a long-term issue – it has been a long-standing concern within higher education and has increased a lot over the past years [1, 2, 3, 4, 5, 6, 7, 8]. Reasons offered for the increase of academic dishonesty include the fact that more students are engaged in online learning, and new technology is constantly emerging which can assist students or facilitate the academic dishonesty [9]. Some researchers blame internet for the increased “opportunities” for cheating [10] and other consider the increased incidence of cheating at least in part as a consequence of the use of internet [11, 12]. The advent of social media, Wikipedia and collaborative websites allow students to easily access a wealth of information in a matter of seconds [13]. The ubiquitous ownership of mobile devices provides unlimited opportunities of students to easily take and store pictures or documents of course materials which can be viewed in the exam room. Mobile devices can also be used by students to share information during an examination [13, 14]. The results of internet searches are also electronic, and students can quickly copy and paste the information directly into assignments, papers, and other documents [15, Sterngold, 2004 cited by [16].

However, researchers have questioned both the perception of an increasing problem and of the negative impact of the internet. For example, McCabe [17] in his longitudinal study provides some evidence of a decrease in cheating, and Davies and Howard [18] argue that there is no empirical evidence to support the argument that the internet is a contributor to plagiarism.

Although there are not strong evidences that the technology is the reason for the increase of academic dishonesty, it cannot be denied that rapid adoption of new technologies, such as smartphones and wearable smart devices, combined with the proliferation of social media and online information, have changed the academic dishonesty landscape adding new ways in which cheating can occur [3, 9]. Evidence for this is the emerging of the term e-cheating (electronic cheating), commonly used to refer to the type of academic dishonesty that utilizes some type of technology to electronically copy or use material from an unauthorized source or a source that was not cited or a simple copy and paste from the internet or some other type of electronic media [16, 14, 19]. On the other hand, cheating has been a problem on college campuses before the wide spread use of technology [16]. Szabo and Underwood [15] have even established a link between cheating off- and on-line – according to their research 90% of the students using internet to plagiarise had also plagiarised from written sources [3].

The way the technology may influence the academic dishonesty depends on the specificity of the context. For example, Sayed and Lento [13] define three types of academic dishonesty which are mostly influenced by technology: i) using information without proper referencing; ii) using unauthorized materials during a test; and iii) having another person complete an assignment or using another students' assignments from a previous semester [13]. They compared cheating attempts clearly related to exams with those related to assignments in order to identify any possible differences related to technological impact. Their research revealed that academic staff seems to believe that technology has influenced academic dishonesty related to assignment/papers much more than exams. Prior literature also suggests that academic staff views academic dishonesty relating to exam and papers differently [20]. One reason may be the easier access and the widespread proliferation of information available through the internet [13]. Sayed and Lento also found that most faculty members believe that proliferation of technology has increased the incidences of academic dishonesty and furthermore, the impact of technology on assignments appears to be more pronounced than those on exams.

Considering proliferation and pace of new technologies' development, these trends are likely to continue. Bain [16] claims that there are actions academic staff can undertake in order to mitigate, and in some cases, to eliminate the use of technology for academic dishonesty [16]. Underwood [3] emphasises on the essential function of monitoring the assessment of students since the strategies designed could reduce or prevent the cheating, but could not eliminate the problem entirely. Moreover, according to Sayed, faculty members can also use technology to mitigate the impacts of academic dishonesty (Sayed). For example, technologies can be used to monitor the students' digital footprints during online exams, lockdown technologies can be used to control students' internet activity during online exams, and computer software can be used to search for plagiarism [3]. E-cheating outside of the classroom is supported by the use of the internet and the variety of options available online including the access to huge amount of resources. The techniques for preventing e-cheating outside of the classroom are very different in comparison to the ones for inside e-cheating. One of the most popular approaches to resolve the problems in this area is the use of anti-plagiarism software tools [21].

To address the issues of cheating and plagiarism in terms of e-assignments and online exams, the European Commission funded TeSLA project (An adaptive trust-based e-assessment system for learning) has defined and developed a system which ensures the authentication of learner identity and authorship in online and blended learning environments, thus allowing assessment to be securely carried out remotely. The TeSLA system involves authentication checking instruments (face recognition, voice recognition and keystroke dynamics) and authorship (forensic analysis for writing style and plagiarism detection) which can be used in all e-assessment models (diagnostic, formative and summative) to prevent cheating and plagiarism [4, 22]. The use of technology for plagiarism detection is well established, and other technologies such as student authentication, proctoring, and style checking are becoming increasing available to address cheating and plagiarism [23].

Most of the above mentioned studies are focused mainly on causes of cheating and plagiarism and the impact of technology in general. Only the Sayed' study [13] implies that technology impact on the cheating in assessment depends on the educational context. This paper aims to reveal the impact of technologies on cheating and plagiarism in three different contexts – 1) face-to-face exams; 2) submission of paper assignments, prepared in the absence of a teacher; 3) submission of online assignments prepared in the absence of a teacher; from teachers and students' perspective and also the possible strategies they propose to address these issues.

## METHODOLOGY

**Research Questions:** This study will attempt to identify the impact and the role of technologies on cheating and plagiarism in the assessment from the teachers' and students' of Sofia University (SU) perspectives. Hence, the

following research questions are central for the study: 1) Do the technologies impact the attempts of cheating and plagiarism in different contexts of assessment according to SU teachers and students?; 2) How the use of technologies affects students' attempts to cheating and plagiarism?; 3) How the use of authentication and authorship checking system affects students' and teachers' perspectives on the impact of technologies on cheating in assessment?

**Method:** The study design includes a mixed methods research - a methodology for conducting research that involves collecting, analyzing and integrating quantitative and qualitative research methods.

**Participants:** Two online surveys with 100 academic staff and 239 bachelor and master degree students from Sofia University were conducted at the end of academic year 2016/2017.

**Data Collection and Analysis:** The data was collected via online questionnaire built on the existing TeSLA project evaluation tools (questionnaires) extending them to explore the specifics of this study. The questionnaire items consisted of statements for responses on Likert scale of 1–5 (ranging from “strongly disagree” to “strongly agree”), dropdown, multi-choice, closed questions (Yes/No) and open-ended questions.

Descriptive statistics is used for the quantitative data analysis.

## RESULTS

100 teachers and 239 students from Sofia University took part in the study. Female participants in the study were 65% of teachers and 88% of students. Teachers represent 9 faculties of SU and most of them are habilitated (60%). The students represent 3 faculties of SU. 92% of them are studying in bachelor degree programmes and 8% in master degree programmes.

Participants in the study have different experience in modes of education and assessment. Most of the teachers have strong experience in face-to-face mode (74%) and more than a half of all teachers have strong or a lot of experience in blended mode. Fewer than 20% of teachers have strong or a lot of experience in online distance education. More than 70% of the teachers have taught in a course in which at least some assessment was electronic (computer-based tests, submitting assignments in VLE/email/USB flash drive). Students with different experience in education were invited to take part in the study. Only 32% of the students took part in courses where all the tests and exams were conducted online, but approximately 70% of the students have been assessed online in different forms in the courses they participate (continuous assessment – 40%; diagnostic assessment – 24%; assignments and exams for credits – 24%; progressive performance of assessment activities that can be improved based on teacher's feedback ~20%).

The diverse experience of the respondents (students and teachers) in the various forms of assessment provides a good basis for exploring their well-informed opinion on the research questions of the study.

The next paragraphs present the findings of the data analysis in respond to the first research question: *1) Do the technologies impact the attempts of cheating and plagiarism in different contexts of assessment according to SU teachers and students perspectives?*

The teachers' observations and their experience with the attempts of cheating and plagiarism as well as the strategies to deal with academic dishonesty are investigated in the study through many questions. To the question: *How many students, according to your observations and experiences, have cheated or plagiarized at least once when they were assessed in your courses?* 61% of lecturers answered that the number of those students is small and according to the other 1/3 of the respondents they are quite or very much.

Students were asked *“How often do you cheat or plagiarize in your university education?”* It is not surprising that only 1 student admitted that he does it often. 20 students admitted that they cheat/plagiarize sometimes and occasionally. 40% of the students stated they cheat rarely, and almost 50% - that they never cheat. Teachers' and students' opinions differ to a certain extent, but although student responses are anonymous, there is remaining doubt that students would frankly admit that they are violating ethical rules.

The survey explores three different contexts of assessment: 1) face-to-face examinations under the supervision of a teacher/proctor; 2) submission of PAPER assignments, prepared in the absence of a teacher/proctor; 3) ONLINE submissions of assignments (in a VLE or via e-mail) prepared in the absence of a teacher/proctor. Teachers and students were asked to rate the frequency of encountered cheating and plagiarism in the three different contexts. The analysis of their answers is presented below, grouped according to the context.

1) *In face-to-face examinations under the supervision of a teacher / proctor* as the most common type of cheating, teachers identify copying or receiving hints from the other students in the exam room. The other common type of cheating is copying from materials (on paper or mobile device). The least common observed cheating types are impersonation of the student during the exam, as well as the submission of text written in advance of the exam. Less

than ¼ of the teachers have received an excuse by the student to leave the exam room temporarily, and then gaining access to outside help and about 1/5 of teachers have established the usage of device with headphones to receive assistance from someone outside the exam hall.

	7.1 Impersonation of a student, during the exam by someone else (for example,...	7.2 Copying from the work of other students in the exam room	7.3 Receiving hints from other students in the exam room	7.4 Copying from materials (on paper, on a mobile device, etc)...	7.5 Submission of text written in advance of the exam	7.6 Using a device with headphones to receive assistance from someone...	7.7 Giving an excuse to leave the exam room temporarily, and then gaining access to...
I do not know	18.28%	2.15%	0.00%	3.23%	13.98%	20.43%	21.51%
never	67.74%	2.15%	3.23%	6.45%	38.71%	22.58%	19.35%
rarely	9.68%	21.51%	16.13%	21.51%	25.81%	21.51%	19.35%
occasionally	1.08%	27.96%	26.88%	29.03%	10.75%	16.13%	13.98%
sometimes	2.15%	23.66%	23.66%	21.51%	9.68%	10.75%	17.20%
often	1.08%	22.58%	30.11%	18.28%	1.08%	8.60%	8.60%

FIGURE 1. Teachers’ observations in invigilated exams carried out in a face-to-face environment

Students’ observations are similar to those of the teachers and again the most common observed cheating attempt in face-to-face exams is copying or receiving hints from other students in the exam hall. Copying from paper or electronic materials is ranked second, but this form was observed significantly more by students than by the teachers (approximately 50% of the students observed it, against about 40% for the teachers). Significant is the difference between students' observations of cheating through submitting text written in advance and those of teachers - nearly 28% of students have often or sometimes seen this form of cheating while only 10% of teachers have established it. From these data it can be assumed that teachers find it harder to identify the use of text written in advance of the exam. The percentage of the students who have frequently and occasionally encountered the usage of a device with headphones to receive assistance from someone outside the exam room, is close to that of the teachers - over 20%. Only 6% of the students have witnessed the impersonation of the student during the exam. In the open answers to the question whether they have encountered other forms of cheating, students note that the most widely proliferated cheating is copying from mobile devices - which is also one of the most common type of cheating observed by all respondents.

	12.1. Impersonation of a student, during the exam by someone else (for...	12.2. Copying from the work of other students in the exam room	12.3. Receiving hints from other students in the exam room	12.4. Copying from materials (on paper, on a mobile device, etc) taken into...	12.5. Submission of text written in advance of the exam	12.6. Using a device with headphones to receive assistance from someone...	12.7. Giving an excuse to leave the exam room temporarily, and then gaining access to...
I do not know	24.31%	6.42%	5.96%	6.42%	11.47%	16.06%	16.06%
never	51.83%	17.89%	13.76%	18.81%	33.03%	38.07%	35.32%
rarely	12.39%	16.97%	18.35%	15.14%	18.35%	16.97%	17.43%
occasionally	5.05%	13.76%	12.39%	14.68%	9.63%	9.17%	9.17%
sometimes	4.13%	19.27%	22.02%	14.68%	13.76%	11.93%	11.47%
often	2.29%	25.69%	27.52%	30.28%	13.76%	7.80%	10.55%

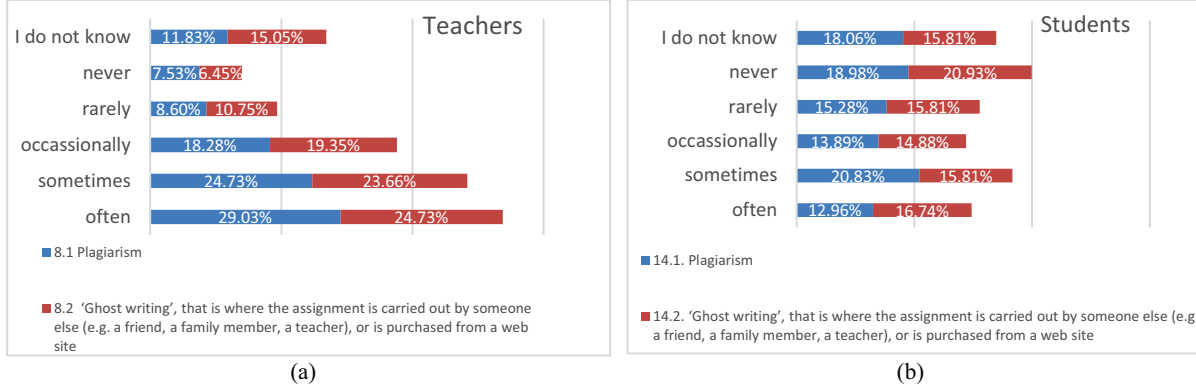
FIGURE 2. Students’ observations in invigilated exams carried out in a face-to-face environment

Based on the data of teachers and students observations it could be concluded that the technologies in the face-to-face examinations impact on cheating and plagiarism by modifying them in two main directions: 1 - copying from mobile devices, where technologies replace traditional paper materials (cheat-sheets); and 2 – receiving hints from someone outside the exam room using a digital device. Unlike the first type of cheating, the second would not have been possible without technology, although its "non-technological" version is the excused temporarily leaving of the exam room, and then gaining access to outside help. It is also more frequently observed by the participants in the assessment.

2) When students submit PAPER assignments, prepared in the absence of a teacher/proctor, teachers have frequently established plagiarism and ‘ghost writing’, i.e. the assignment is carried out by someone else (e.g. a friend, a family member, a teacher, or is purchased from a web site).

In their additional comments, teachers say that students often submit assignments from previous years (written by other students), or they submit written work downloaded directly from internet.

The students themselves are much less likely to witness such types of cheating, but this is understandable due to their more limited observations. However, we should not underestimate the fact that more than one third of the students have frequently and sometimes observed plagiarism and cheating in this context.



**FIGURE 3.** Teachers' (a) and students' (b) observations in non-invigilated assessments (e.g. assignments such as essays, course work, or dissertations) submitted on paper

In their additional comments some students note that they have also observed contract cheating and purchasing materials from internet which students submit as their own work.

The role of the technology in this assessment context (paper-based submission) is mainly related to the downloading materials from web sites. This means that in this context as in above mentioned, the technology only modifies the means of cheating. The plagiarism exists with or without internet – as the Underwood confirmed [3] but in any case the use of the web facilitates this type of cheating making it faster and easier.

3) In the context of *ONLINE submissions of assignments (in a VLE or via e-mail) prepared in the absence of a teacher / proctor* teachers find significantly lower the percentage of plagiarism and “ghost writing”. It is interesting to compare the data provided by teachers on the two types of assignment’ submission: paper and electronic submission. The cases of detection of these two forms of cheating are about 50% for the answers "often" and "sometimes" for paper submission while for *online* submission the same rates are about 30%. This could mean that, according to the data from the survey, students rarely try to cheat when submitting online works, as it is easier to find the source from which the work is plagiarized.

	9.1 Impersonation of the student, during the exam by someone else (for example, by someone who logs in with their id)	9.2 Communication (e.g. by mobile) with other people during the assessment	9.3 Copying from materials on an electronic device where this is not allowed in the exam	9.4 Plagiarism	9.5 'Ghost writing', that is where the assignment is carried out by someone else (e.g. a friend, a family member, a teacher), or is purchased from a web site
I do not know	53.76%	40.86%	46.24%	23.66%	32.26%
never	25.81%	25.81%	18.28%	5.38%	5.38%
rarely	6.45%	11.83%	13.98%	13.98%	10.75%
occasionally	4.30%	10.75%	9.68%	21.51%	19.35%
sometimes	8.60%	8.60%	5.38%	13.98%	19.35%
often	1.08%	2.15%	6.45%	21.51%	12.90%

**FIGURE 4.** Teachers' observations in non-invigilated exams or assessments (e.g. assignments such as essays, course work, or dissertations) carried out in an **online** environment

Similar is the trend for students - the different forms of cheating when submitting electronic/online materials are less frequently observed than in cases of paper-based submissions. Plagiarism and “ghost writing” in online/electronic submissions are 10% less observed by students than the same two forms of cheating in paper submissions.



	16.1. Impersonation of the student, during the exam by someone else (for example, by someone who logs in with their id)	16.2. Communication (e.g. by mobile) with other people during the assessment	16.3. Copying from materials on an electronic device where this is not allowed in the exam	16.4. Plagiarism	16.5. 'Ghost writing', that is where the assignment is carried out by someone else (e.g. a friend, a family member, a teacher), or is purchased from a web site
I do not know	33.94%	27.06%	19.72%	25.23%	19.72%
never	37.16%	30.73%	25.69%	24.77%	23.39%
rarely	10.55%	16.06%	14.22%	11.47%	18.35%
occasionally	6.88%	9.63%	14.68%	16.51%	12.84%
sometimes	7.80%	10.55%	10.09%	11.47%	14.22%
often	3.67%	5.96%	15.60%	10.55%	11.47%

**FIGURE 5.** Students' observations in non-invigilated exams or assessments (e.g. assignments such as essays, course work, or dissertations) carried out in an **online** environment

As in the students' comments about paper submissions, in this context they have also observed contract cheating and purchasing materials from internet which students submit as their own work.

In the contexts of online submission the following forms of cheating using technology are outlined – mobile communication with others for assistance during the assessment; as well as copying texts from an electronic device during an online exam. These forms facilitate cheating in online real-time assessment activities. Teachers have seen such forms of cheating at a relatively low rate - about 10% for responses are often and sometimes. For students, however, this percentage is higher - slightly over 15% for mobile device communication, and over 25% for copying from electronic device. This data indicates that teachers are unlikely to detect such type of cheating because it is well hidden by the students. However, the analysis of the data collected leads to the conclusion that the submission of artefacts in online format does not lead to an increase in the frequency of cheating and plagiarism compared to the use of the traditional paper submissions.

Reasons for the attempts of cheating and plagiarism were also investigated in the survey. Although it is not outlined as the main reason, some teachers (1/4 of respondents) say that the internet promotes cheating and plagiarism by making them easier. For students this percentage is significantly lower - only 14% or less than 1/7 share the same opinion. Considering that the students are the perpetrators of cheating and plagiarism, it is logical to accept their views as more realistic, though they may not realize that the internet encourages them to cheat. However, the data we collected and analysed does not give reasons to assume that the internet has an impact on the increase of cheating in any of the discussed assessment contexts.

The next paragraphs are presenting the findings that address the second research question: *How the use of technologies in the assessment affects students' attempts at cheating and plagiarism?*

As mentioned above, almost 50% of students say they never cheat, and most of the others admit that they cheat rarely. The questionnaire is conducted anonymously and it is presumed that students should be honest in their responses, nevertheless we assume that not everybody is sincere when they have to admit that they violate ethical rules. By comparing the reasons that students pointed out for cheating and plagiarism, it appears that 23% of students who said that they do not cheat, believe that the internet facilitates the plagiarism and cheating, whereas only 1/5<sup>th</sup> of the actual perpetrators (the students who admit that they cheat) support this belief. It leads to the conclusion that internet technologies are not the most important but only one of the factors that influence cheating in assessment.

It is interesting to know how students who admit that they cheat define the role of technology in the assessment process, and when they cheat more often - in presence or in absence of technologies during the assessment. In order to identify if there is any difference between the perspectives on the impact of the technology on the academic dishonesty of students who admit cheating (often, occasionally, occasionally, and "rarely") and those that state they don't cheat we analysed comparatively their opinions in relation to the three difference assessment contexts. The study of these dependencies stems from the assumption that the actual perpetrators of cheating have better insights into this issue and identify it more accurately and easily. This is also confirmed by the data showing that the incidence of most forms of cheating have been observed by the students who cheated twice as often as by those who claim they do not cheat. The comparisons of the observations of both groups in different contexts are presented below:

1) *Face-to-face exams* – it is not surprising that students who claim that they are not cheating during assessments have observed much less often the various forms of cheating. Significant difference between the observations of "cheating" and "non-cheating" students is revealed with regard to copying from materials ("cheat-sheets" - on paper or mobile devices imported into the exam hall). While only 28% of students who do not cheat, often and sometimes have seen this form of cheating, it has been observed and probably used by over 65% of the "cheating" students. The difference between the observations of both groups associated with submitting text prepared in advance

of assessment is more than double – 18% for "non-cheaters" vs. 42% for "cheating" students. Similar is the difference in the encountered use of a device with headphones to receive assistance from someone outside the exam hall – almost 30% of the "cheating" students vs. just 13% of the non-cheating have observed such type of cheating during face-to-face exams.

2) *Paper assignments submission* – nearly half of the students who admit to cheat have observed plagiarism and probably plagiarized themselves, while only 20% of non-cheating students have witnessed plagiarism. The rate of encountered cases at which the paper was written by another person or downloaded from a website are almost the same for both groups (almost 50% for "cheaters" to 24% for "non-cheaters").

3) *Online assignment submission* – the "cheating" students are more likely to identify the impersonation (17%) than "non-cheating" students – only 6%. The difference between the observations of two groups in relation to plagiarism (36% for "cheaters" vs. 17% for "non-cheaters") and in relation to copying from an electronic device (31% for the "cheaters" to 15% for "not-cheaters") is similar – cheaters have encountered these forms of fraud twice as often. Another significant difference between the observations of both groups is found in relation to the downloading and submitting a material from a web site – 37% of the "cheaters" encountered (and probably did) it, while for students who do not admit to cheat this percentage is only 18%. Cheating in terms of communication (eg. through a mobile phone) with others during the exam is witnessed from 22% of the "cheating" students against just 11% of the students who do not admit to cheat.

The data above clearly shows that different forms of cheating and plagiarism in the three contexts (including facilitated or not facilitated by technology) are seen twice more often by "cheaters" than by "non-cheaters". The most significant differences between the observed cheating forms between "cheaters" and "non-cheaters" in different contexts are as follows: 1) face-to-face exams – copying from materials (including mobile devices); 2) paper assignment submission – plagiarism; 3) online assignment submission – impersonation. No definitive conclusions can be drawn from the obtained data about the impact of technology on cheating attempts in the assessment, but one of the aspects in which technology modifies cheating is outlined once again. It appears that mobile technologies are replacing traditional means of cheating such as copying from paper materials to copying from electronic materials. Receiving assistance from someone outside the exam hall with the help of a digital device is the upgraded version of the temporarily excused leaving of the exam room, and then gaining access to outside help. From the analysis of these data it seems that technologies do not lead to cheating and plagiarism themselves, but mainly modify the already existing forms.

Findings on the third and the last research question: *How the use of authentication and authorship checking system affects students' and teachers' perspectives for the impact of technologies in the assessment?* are presented below.

One of the questions from the questionnaire, which is not directly related to the present study, but reveals some related aspects, is asking the students about the advantages they find in e-assessment. When comparing their answers, it appears that almost the same number from both groups of students (45% of the "cheating" and 40% "non-cheating" students) find as a major advantage of technology preventing cheating. This leads to the conclusion that despite of their experience in cheating a large number of students are aware that technology has the potential to detect and prevent cheating.

In an open question, teachers and students were asked to list the strategies that they believe will help to prevent or reduce cheating and plagiarism at the university. In teachers' replies, three main groups of strategies could be identified: administrative, pedagogical and technological. One of the largest distinct groups of strategies is those related to technology (indicated by 36 teachers). Teachers' answers in this category can be grouped around two main strategies:

- Use of specialized plagiarism detection software;
- Use of signal silencers in exam halls (to prevent receiving help from outside the exam hall through mobile devices).

It is clear that the first strategy is related to online and the second to the face-to-face exams. The missing context is the paper submission without the presence of a teacher / proctor during its development. This indicates that technologies can be used to prevent plagiarism, but mainly in the context of online assessment and face-to-face examinations. Assessment based on paper submission is not seen as a context where the technology as a preventive factor for plagiarism could be used.

The strategy for using anti-plagiarism software has been proposed by about 2/3 of all teachers who are supporters to technological strategy to prevent academic dishonesty (25 teachers). According to them, the way to deal with cheating and plagiarism is the use of specialized plagiarism detection software.

Interestingly, the smallest share of students - only 19 out of 119 respondents of the open question support the technological approach to prevent cheating and plagiarism. In some of the answers of the students – supporters of the



technology approach, their participation in the TeSLA project is revealed. One of the students directly cites TeSLA as an opportunity to reduce these phenomena. The rest of the students consider the following technological solutions: the use of plagiarism software (5 students); the use of camcorders during the exam (3 students); the prevention of internet access (including taking away student mobiles). One student believes that reducing cheating and plagiarism will occur when "most of the courses become electronic". The analysis of students' opinions within the technological approach suggests that, due to the lack of significant experience in e-learning and e-assessment, students, despite their participation in the TeSLA project (it should be taken into consideration that most students have participated in the testing of only one TeSLA instrument), the proponents of this approach are relatively small number, and their proposals for addressing the problem technologically are relatively limited. However, as the most important factor in dealing with cheating these students attribute to the use of plagiarism software. Maybe it is due to the fact that plagiarism is widespread both in the face-to-face and in the distance form of education.

The teachers as well identify as the most important factor the use of anti-plagiarism software. It is interesting to note that the group of teachers who have identified technology-related strategies as a solution to cheating and plagiarism are much larger proportion of the total number of teachers than the same ratio amongst students. Two assumptions can be made here and they require further research - one is that students think that technology will not stop them from attempting to cheat, and the other is that they probably do not have enough knowledge about such technologies and experience in assessment contexts in which such technologies have been used. Having in mind the clearly recognizable responses of students who have experience with systems such as TeSLA, it is more likely that a technology approach to prevent academic dishonesty is proposed only by students who know and have used in their education such technological solutions.

From all the above the role of technologies for prevention of cheating and plagiarism in the assessment is clearly highlighted. Integrating software systems to authenticate students and their authorship would likely change the mindset of more sceptical participants in e-assessment. Outside the context of e-assessment, technologies can be used in face-to-face exams to mute the signal from mobile devices and prevent their use for an unauthorized purpose.

## CONCLUSIONS

This study aimed to determine the impact of technology on cheating and plagiarism according to SU teachers and students. Academic dishonesty was investigated in three different contexts of assessment (face-to-face exams; paper assignment submissions and online submissions) and the study revealed that in all contexts the technology is mainly modifying the already existing forms of cheating / plagiarism rather than leading to academic dishonesty itself. Mobile technologies are replacing traditional means of cheating such as copying from paper materials or copying of paper assignments to such in electronic format; receiving assistance from someone outside the exam hall is now facilitated by a digital device instead of the excused temporarily leaving of the exam room; re-writing already prepared paper materials is replaced by downloading them from the web. In the *face-to-face* exams technology modifies cheating / plagiarism predominantly in copying from mobile devices instead of traditional paper materials and in the usage of digital device to receive hints from someone outside. The role of the technology in *paper assignments submissions* is mainly related to the downloading materials from web sites. In *online submissions* the forms of cheating using technology which are outlined are related to the real-time assessment activities – mobile communication with others for assistance during the assessment; and copying texts from an electronic device during an exam.

An important conclusion from this study is that the submission of works in online format does not lead to an increase in the frequency of cheating and plagiarism compared to the use of the traditional paper submissions. The preventive role of technology was highlighted here by the finding that students more rarely try to cheat when submitting online works, as it is easier to find the source from which the work is plagiarized. Further investigation of the perspectives of students, who admit to cheat, confirms their awareness that technology has the potential to detect and prevent cheating.

We did not find an evidence that the internet has an impact on the increase of cheating attempts. As it was revealed in other studies [3], the plagiarism exists with or without internet. It only helps to make this type of cheating faster and easier.

Another finding is that despite the fact that mainly the teachers found the solution for cheating and plagiarism in technology, both teachers and students who support technological solution of the problem determined as the most important factor in dealing with academic dishonesty the use of plagiarism software.

It can be concluded that according to the perspectives of SU students and teachers the role of technologies for prevention (rather than occurrence) of cheating and plagiarism in the assessment is emphasized. The authentication

and authorship checking systems such as TeSLA allow multi-component verification of the students' identity and the originality of their submissions thus having the potential to change the perspectives of sceptical teachers on e-assessment and prevent students' attempts of cheating and plagiarism. It is important to be pointed that although during face-to-face examinations technology could assist proctoring in muting mobile signals or detecting them, the complete technological solution what TeSLA system offers is available only in online and blended modes of education.

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