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Non-proctored home exams – is there a solution?

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***Abstract*—Restrictions during the pandemic has forced teachers to replace traditional classroom exams with home exams, which are either proctored by digital tools or non-proctored. In this work, I describe the student response from using non-proctored digital home exams in two university courses in physics. In particular, the advantages and disadvantages of this approach will be discussed, since there are major concern about grading students based on non-proctored exams due to issues related to authenticity and cheating. Finally, I will reflect on the future use of non-proctored exams to evaluate knowledge in physics.**

***Index Terms*—Cheating, digital exams, grading, home exams, non-proctored exams, physics, validity**

I. Introduction

The sudden lock-down during the pandemic required traditional classroom exams to be replaced with different kinds of home exams. However, home exams create major concerns about cheating and the authenticity of the handed-in work [1] and, hence, about the validity of using them for individual grading. A mainstream solution to tackle this challenge has been to use proctoring software with advanced functions for authentication, lockdown and monitoring [2]. An alternative strategy has been to develop methods to minimize the possible gain of cheating during home exams [3]. A special focus has been on non-proctored digital exams, since they offer clear advantages in a home environment, like e.g. the absence of integrity issues, reduced administrative work and a considerable flexibility in the timing of the exam [4]. Correctly used, they can also promote student learning. However, an obvious disadvantage is that cheating and unethical student behavior become harder to prevent [4], which question the authenticity of the work and if the results can be used to individually grade students.

Here, I will describe the results from a project aiming at retaining most of the advantages with non-proctored home exams, while still maintaining a sufficient validity when grading students. These ideas have been tested in two physics courses - one in waves and electromagnetism and one in introductory solid state physics. Finally, I will look forward and give some suggestions about how non-proctored home exams can be used together with other examinations and/or measures to increase the validity of the grading.

II. The home exams

Before the pandemic, both courses had open-book classroom exams at the end of the courses combined with short quizzes during the courses. The quizzes tested a broad basic knowledge of the subject, while the final exam tested problem solving skills. During the pandemic, the open-book classroom exams were replaces with non-proctored home exams. This solution was judged as a viable path forward due to three main reasons:

i) live-proctoring via video does not create any advantages as compared to traditional classroom exams
ii) open-book problems can be formulated in ways that make internet searches too time consuming
iii) physics problems can be individualized, which creates an obstacle for in-class collaborations

In the non-proctored home exams, obvious search keywords were avoided when formulating the problems to make internet searches less efficient and students were assigned individual values to make collaborative work less efficient. Short answers had to be supplied electronically before the end of the exam and hand-written full solutions had to be uploaded within half an hour after the exam had ended.

To increase the psychological barrier for cheating and unethical behaviour, students were obliged to digitally sign a code of honor to get access to the exam questions. After having finalized their exam, they had to digitally attest that they had not have any incidents during the exam. All kinds of incidents had to be reported to the examiner in a written incident report. It was communicated that honestly reported incidents will never be considered as cheating, while unreported incidents would be reported as cheating, since it indicates an intention to mislead during the examination. When an incident report was filed, the examiner firstly read the incident report. If the incident could affect the grading or if the attest was missing, the exam was not corrected and the student was notified about this decision. To preserve the legal certainty in the decision process, the student was given an opportunity to ask for a reconsideration by supplying additional information in writing. Most of the reported incidents in these courses were connected to the novelty of the exam format and did not affect the grading. In these cases, the exams were corrected as usual.

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III. Student views

Directly after each exam, students were asked about their views on the examination method in a questionnaire with free text answers. The answers were analyzed by a contextual text analysis to identify important arguments and to judge if a student was mostly positive or negative to the exam format. For an exam taking place just after the outbreak of the pandemic in late Spring 2020, 50% of the respondents (N_{res}=14) were mostly positive out of a cohort of N=26 active students in the course. After the method of examination had improved for Spring 2021, it was found during three exams that 69% (N_{res}=85, N=152), 77% (N_{res}=65, N=152) and 71% (N_{res}=24, N=34) of the respondent were positive. The results from the two exams with N=152 are for the same cohort, which indicates an increased acceptance of the examination method by time.

Most of the negative comments found in the contextual text analysis were related to the novel burden on students to be responsible for administrating their own exam. This created additional stress due to reading the exam instructions, arranging an examination place in their home environment and additional time spent on exam logistics. Two insightful comments were:

> "*The logistics of navigating web pages and digital documents required a bit more time than I had expected in advance, although this was an aspect I could have been better prepared for."*

> "*It puts a lot of responsibility on the student to memorize all the rules and deadlines for the exam. This format is very different from other exams where another person will tell you when the exam is over and you should stop writing.*"

There seems to be a correspondence between how students experienced home exams and various factors in their home environment. Positive comments highlighted less stress, less disturbances and a better adaptation for students with special needs. Negative comments highlighted disturbances from family members and more stress due to the additional logistic work and/or an increased fear for making mistakes.

Several students remarked that cheating was much easier during non-proctored exams, which created worries about the fairness between students, as e.g. commented upon as

> "*…it feels like it rewards those who are unethical and dishonorable. It is simply too easy to cheat and get away with it, when the one and only thing keeping students away from all kinds of cheating and cooperation is the individual student's sense of honor. Punishing honorable students seems to me unethical.*"

IV. Exam results and disciplinary actions

For one of the courses in this study, the student success rate after the first exam was 66% (N=33) with traditional classroom exam the year before the pandemic and 69% (N=26) and 56% (N=34) respectively during two years with digital home exams. For the other course, a comparision was not possible due to other considerable changes in the exam format.

Students were strictly informed that they were not allowed to be active in the digital course room during the exam. Since such activities were logged, it was possible to check if students had followed this rule and three cases of cherating were filed to the disciplinary committee at our university. In one of these cases, disciplinary actions was taken (6 weeks suspension from studies), while the other two cases are still under investigation.

V. Discussions and future perspectives

Any type of examination (proctored or non-proctored) in a home environment makes it more tempting to cheat. However, non-proctored home exams offer many advantages as compared to proctored ones [4], but various risks for cheating has then to be considered. They are most suitable for open-book exams where internet searches or tools like e.g. Wolfram Alpha [5] does not give any additional aid compared to what is already allowed. The effectiveness of collaborations during exams can be reduced by individual assignments and carefully formulated questions can increase search time on internet. In this work, a few novel concepts that contribute to this development has been discussed. Firstly, demanding digital signatures from students both before and after they take the home exams reminds them about the necessity to act honestly. Secondly, the use of log files to check if students have accessed particularly tempting web pages during the exam, is one way to detect cheating.

An important consequence of home exams is that there is an increased demand on students to be able to administrate their own exam. A classroom exam is a well-defined environment where an invigilator assists students with logistics and time keeping. These things are missing in a home environment and the workload is with the students. Furthermore, students with a noisy home environment need an alternative solution.

In all types of home examinations (proctored or non-proctored), a critical issue is the authenticity of the work, i.e. how do we ensure that we are grading students based on their own knowledge and ability? There are at least two possible ways to improve the situation. The first one is to use digital tools to detect cheating, like e.g. text-matching software, log files from critical web pages, graphological tools to identify differences in hand-writing etc. The second direction is to use digital home exams in combination with short oral exams. If this is done continuously during the course (either announced or unannounced), a better judgement of the consistency in the student's knowledge is obtained, which improves the validity of the grading.

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