Transforming F-to-F exams into online exams: considering proctoring tool security & creative pedagogical options

As #COVID19 seems to disrupt our teaching and learning for a longer period of time, this document focuses on online exams and assignments, and what the options are. This document is shared under [Creative Commons Share Alike license](#) which aligns with the EU directive on transparency and sharing as [EIT InnoEnergy](#) for which I work, has a supporting role to the EU and the EU promotes sharing to ensure mutual growth.

This document is an addition to a former document with [10 fast tips to move from face-to-face learning to online learning](#) (with a lot of English resources from University of Cape Town; South Africa; Harvard business, USA; University of North South Wales, Australia; and EU commission on education, ...).
(Disclosure: I don't get or have any benefits suggesting any of the tools or solutions below).

The following topics are discussed:

- **Comparing online proctoring tools** which can be used to ensure safe online exams and assignments (the term 'safe' means non-cheating here). Can we use proctoring tools for team exams, how secure are they, what are some of the options and prices?...
- **Limiting online exam costs** by looking into the usefulness of using **group or team exams** and **open book exams in a digital learning world** (benefits, as all of us can transform some or more of our usual closed book exams (CBE) towards an open book exam (OBE).
- Using **best online exam practices without proctoring tools with audio/video 1on1 only** and assignments (useful for those not having the financial resources, or with limited internet access).

Comparing proctoring and digital exam tools for online assessments and exams

Proctoring or online exam/assessment tools offer a secure exam solution for universities as well as corporations. In case of universities these tools are offered in three different ways. They can be used for

- online exams with live proctoring (= live supervision at a distance by trained professionals while the tool itself is recording all that happens on the device);
- for asynchronous proctoring which is called 'record and review' (this means an online exam is recorded = recording all that a student has done on her/his computer or device,

after which this recording is sent to a proctor who will check whether a student has cheated during the exam or assessment. This feedback is reported within 24 hours, max 48 hours);

- digital exams (= secure computer use on campus supervised by teachers. Here the tool ensures no cheating can be done on the device during the exam, but the proctoring is done by the teachers and on campus).
- Corporations in need of certified training for their employees also use proctoring tools at a distance (either for talent assessment, hiring employees, or career promotions, etc).

Choice of proctoring tool selection: these were selected based on existing tools at some of our EIT InnoEnergy partner institutes (ProctorExam at TUDelft, DigiExam at KTH), as well as the longest standing proctoring tool (ProctorU used by big corporations). These three options also reflect different need models and services.

Important remark: all the below proctoring tools use English language proctors with an English language certification. ProctorExam is planning to train Dutch and other proctors, but this is on their roadmap, so not yet realized.

Proctoring tools	ProctorExam	ProctorU	DigiExam
Orientation	Higher Ed and corporate oriented	Corporate and higher ed oriented	Education (k12, Higher Ed) oriented
API / LTI compliant	Yes	Yes	Yes
Total number of test takers per exam based on contact person info	50 students per 15 minutes (= during COVID March 2020: limited to 150 per hour starting an exam, normally 200 per hour starting an exam)	100 students per 60 minutes	Simultaneous users tested: 25.000 students on campus
ID identification of student	Yes	Yes	Yes

Live proctoring	Yes (EU-based, so they did mention they were expanding their server space for this, so until end of April the live proctoring was being expanded due to COVID overflow)	Yes (US-based, so later in COVID response, so they don't feel the pressure on their servers yet)	No (but working on it)
Record and review proctoring	Yes	Yes	No (but working on it)
Return of reports after review of proctoring	24 hours normally, can temporarily become 48 hours due to COVID demands	24 hours normally, can temporarily become max 48 hours due to COVID demands.	
On campus proctoring of digital exams	Yes	Yes	Yes
Offline, on campus proctoring of digital exams (useful in low resource settings)	No	No	Yes

Secure browser (only allowing specific domains or online resources chosen by teachers)	Yes	Yes	Yes
Webshare recording (this looks at screens open on device of the student/learner)	Yes	Yes	Yes
Team or group exams options possible	Yes, by setting up online breakout rooms (external tool) and add links to these rooms as 'safe' links.	Yes, by setting up online breakout rooms(external tool) and add links to these rooms as 'safe' links.	Yes, can be done in situ at universities or corporations.
Mobile secure recording app (prevents virtual machine setup and cheat)	Yes	No	No
One password per exam	Yes	Yes	Unclear
One password per student (specific login)	Yes	No	Unclear

Feedback on contact person providing the information	The CEO immediately set up COVID19 webinars each weekday, where people can join to request demos. He was very open and authentic, which builds trust and showed the tool's dashboards.	This was regional vice-president, he was clear and concise, but sharing mostly only on a need's basis. He felt less involved.	A clear, authentic person with teaching background. Clearly showing the advantages and being open on their current development for the live and recorded proctoring.
Information	https://proctorexam.com/solutions-for-higher-education/ https://proctorexam.com/covid-19/	https://www.proctoru.com/integrity-in-action https://www.proctoru.com/services	https://www.digiexam.com/ https://www.digiexam.com/digital-exams/

Pricing based on maximum prices, each person mentioned options for reduction due to volume.	**Standard pack** (= under 100 student exams per year): No additional cost (= limited support) **Premium pack** (100+ student exams, including API integration, custom URL, branding, student facing language): *Free until 31 July of this year, after that 5000 EUR* **Seats/year per volume cost**: Varying from 500 seats à 2800 EUR to 50.000 seats à 49.000 EUR (see documentation for gradual cost per seat) **With proctoring recording and review** additional cost: 5 EUR / student per 3 hour exam	**One-time onboarding fee**: 4500 $ / EUR After that **Live proctoring**: 20 $ per student for 1st hour, 10 $ per extra hour. **Record & review**: 14 $ per student for 1st hour, 4 $ per extra hour. **University proctoring (teachers on campus supervise exam):** 12 $ per student per exam	(based on their tool which is meant to be set up on campus) **Fixed 6-month pilot fee** to understand as an institute how many licenses you need: 4000 – 5000 EUR **After pilot:** 9 EUR per student per year (academic or physical year).
Example to bring all solutions to a comparable option: 1000 students for 60 min exam per year	5.000 EUR (premium pack) 4.480 EUR for 1000 seats 5.000 (Proctoring recording and review for 1000 students) **14.480 EUR**	4.500 EUR (onboarding cost) 14.000 EUR (1000 students record and review) **18.500 EUR**	5.000 EUR pilot 6 months 9.000 EUR (9 EUR per student) **14.000 EUR**

Conclusion:

ProctorExam seems to be the most agile and focused solution for online proctoring at a distance, while DigiExam is the best on-campus solution where proctoring is done by the teachers on site and that is also the cheapest solution which can tackle large student numbers.

ProctorExam offers an additional security layer compared to ProctorU using a mobile recording to prevent the students from setting up and using a virtual machine. This adds an additional value to possible student hacks that can be used to circumvent the safebrowser issue (see hack links here).

I am fully aware that there are other proctoring tools out there as well, I simply focused on three to move forward quickly. Even if you wish to look at other tools, I hope the table can still be of use.

Transforming closed book exams to open book exams

Decreasing the online exam cost

Purchasing and implementing a proctoring tool can be expensive, and as you can see most of them offer a per exam or seat license. This means that if you were to offer all your exams as an online exam, chances are you will have to pay quite a bit. One way of limiting the costs is to use alternative approaches to exams. One of those approaches is turning part of the exams into open book exams. An open book exam will enable the students to use any or specific resources (online and offline) and to use them as a basis to solve the questions you provide. Organising an open book exam keeps you from having to use a proctoring system. You can also opt to roll out the less sensitive exams via the University LMS or LXP, and combine it with disabling the 'back button' which most LMS's offer as a service. This does mean you need to have a substantial question databank, otherwise students might take screen shots of the questions and pass them on to other students who still need to take the exam.

Proctoring is the classic, teacher-driven approach to exams

Using proctoring tools is mostly done by those universities and teachers that offer classic examinations: multiple choice, question and answer of some sort, one-on-one exams where one is the teacher and the other is the student, … Basically these type of exams fall under the title of a closed book exam, where you - as a learner - cannot use any resource to help you answer the exam. But using proctoring tools is not the only option for tackling upcoming, online exams.

Pedagogical options

Proctoring tool driven exams are teacher-driven, where you might opt as a teacher for more student-driven exams (e.g. using open book exams which open up the exam to some input from the student, or enabling peer-to-peer or team exams where (multidisciplinary) teams need to work together as part of the exam objectives.

Team-driven or group exams, cfr hackathon approach

Some subject matter lends itself to group exams, where students or professional learners are gathered into groups to tackle specific challenges or problems. This offers a more open type of exam, which is more inline with innovation and agile topic coverage. A good team-driven exam can be compare to a hackathon: you build a team (or a team is allocated), you set a general challenge as a teacher and the team can choose a specific challenge within that overall hackathon challenge, and then the teams get X amount of time to develop a solution.

A good slide deck here authored by Bente Norgaard (UNESCO, 2019) offering insights into **what universities are doing with group exams** is offered by the University of Aalborg, Denmark. What is of interest, is how they drill down the learning objectives into "knowledge, skills and competencies". Which makes those learning objectives more fitted for group exams as well as real life work competencies. Watch this YouTube video to see how a group exam is organized (in this case the group exam is in IRL, but you can imagine how this can work virtually as well).

A nice paper from University of Calgary, Canada is authored by Kawash, Jarada and Moshirpour (2020) entitled "Group Exams as Learning Tools: Evidence from an Undergraduate Database Course" which uses a quantitative analysis to look at at a form of peer-instruction in an undergraduate course on databases, where students take an exam in teams.

Open book exam

Another option is to transform a closed book exam (CBE) towards an open book exam (OBE). By using this approach you can complement the classical exams with questions or challenges that demand a more indepth implementation of the knowledge that has been provided to learners over the course time. An additional benefit for constructing open book exams is that they fit a quick, agile, innovation-driven learning environment, as these type of exams thrive on students being able to solve problems while finding the right material and composing the answers in a new, yet fitting way.

Closed book exams are ideal for testing memory, factual knowledge and the more classic approach to testing (well known to most of us).
Open book exams allow students or learners to collaborate (which is useful for Problem or Challenge based education tasks), search for live data to underpin their answer (e.g. construct data cases in specific areas). An open book exam also enables the teacher or trainer to observe

how agile the student or student group is to retrieve specific information, weigh that information and apply it in a specific situation.

Open book exam preparation demands for students and teachers

The Canadian Simon Frasier university has a good set of guidelines for their students to prepare them to take an open book exam, the range from what to expect, to practical pointers on time management, deciding what to include as resources…

The Australian University of Newcastle has a set of nice guidelines for teachers, including some useful questions you can use.

Research

There is some research out there, but not too much on the use of an open book exam during an online exam, which is why I selected two papers that I found useful.

Some useful research was done by Green, Ferrante and Heppard (2016) who investigated an alternative testing protocol used in an undergraduate managerial accounting course. Specifically, they assert that consistent open-book testing approaches will enhance learning and **better prepare students for the real-world decision-making** they will encounter.

Another paper that I found useful was authored by **Olha Nahorna (2018)** focusing specifically on "Open Book Exam as Assessment Method at Master Degree Programmes in International Arbitration and Alternative Dispute Resolution: Foreign Experience" She highlighted "a list of an open exam advantages, prerogatively, stimulation of student intellectual vigour and application of theory into practice. An open book exam places the focus on higher abilities such as analysis, synthesis, compilation, interpretation, etc., making a student think deeply and creatively. The most **important condition for successful open book exam is to outline the materials permitted for utilization in the classroom** and insure their availability to the students, guaranteeing equality to every participant." The condition in bold is something you can provide in an online environment as well.

And repeating the earlier mentioned paper on group learning. A nice paper from University of Calgary, Canada is authored by Kawash, Jarada and Moshirpour (2020) entitled "Group Exams as Learning Tools: Evidence from an Undergraduate Database Course" which uses a quantitative analysis to look at at a form of peer-instruction in an undergraduate course on databases, where students take an exam in teams.

Solve the impossible: add a question that cannot be answered

I have always been in favor of redesigning exams so they focus on contextualized integration of the applicable knowledge that has been learned or to build an exam/test that is impossible yet pushes the learner to find and combine alternate solutions. This is much more difficult than

expected, as it incorporates the Learning Outcome 'what if … solution', but it can be done and it has its value. However, in such a case it is important that the students know about this in advance, so that they do not get overly anxious while trying to get to a solution.

My most memorable open ended exam is the Kobayashi Maru test which features in two movies: Star Trek II: the wrath of Kahn (1982) and in Star Trek (2009). Yes, I just had to add this bit of personal information :)

Best online exam practices using audio/video only (no extra proctoring tools)

Here are also Best Practices for online assessments without a proctoring tool:
Best practices using only camera and audio as technology: *Preparing the exam*
- Switch any written exam questions you might have to oral exam questions. These can include notes that need to be shared (ask contextualized questions, questions that show they understand the material yet can apply it to new contexts; e.g. ask short oral essay questions).
- Create original exam questions: i.e. questions are not available in educational textbooks (otherwise tech-savvy students will be able to find them in no time :D
- Choose an online meeting tool that offers recording options (think legal discussions, you need to be able to show why you gave the examination points you gave) and a tool that allows for lengthy recordings at that (no one wants their exam to suddenly stop). Choose a tool that enables sharing the screen (might come in useful for some short essays, designs, stats…).
- Prepare an informed consent document and send that to the student, so they know their exam will be recorded and stored at the admin server space for X time. If possible, indicate the amount of time set aside for the exam.
- Make a designated exam folder structured according to your admin.
- Additionally: you might want to send out a 'code of conduct' to the students, so they know what is expected of them. This is where the penalties might be discussed: what is considered cheating, what is the penalty for each stage of cheating…

Once the exam starts
- Introduce the student to the fact that their online session will be recorded (GDPR) – check that the informed consent was signed and sent back to you.
- Start recording.
- Indicate the overall guidelines of the exam: open book, closed book, time available, number of questions (if relevant). The student must be made aware of what they can expect. Ask whether they understood what you have just said.
- Check identity: ask the examinee to show their passport and take a screenshot, save that screenshot as part of the examination administration.
- Ask them to show their desk, room, and that they need to be in view mid-torso with hands and keyboard visible. (you know why 😊

- In case you choose to go with closed book examination: ask them to share their full screen (look at the tabs that are open!). Of course, there is a workaround if they are tech-savvy, which is why exam questions should preferably be open book, it allows them some freedom, yet they still need to really understand how they come to a solution.
- Only offer one question at the time.
- Feedback is important… but: depending on the number of questions you prepared, you might want to choose a different feedback strategy. If you have different questions for each student: give feedback as you see fit. If you want to reuse questions: limited feedback is preferable. As we all know, students quickly inform each other on which type of exam questions they got, what the answers or feedback was to what they gave, and what feedback they got. Feedback is given at the end
- Stop recording and make sure it is in the right folder.

What can't you address in case you work with audio/video tools only?
Disabling the right-click button (copying and pasting options, so that students can quickly save questions). A reason to go to tailored questions per student, based on comprehension and creative thinking.