Towards a technology-enhanced assessment service in Higher Education

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Abstract. We consider the ultimate goal of introducing as a service to the academic community online formal summative assessments in a blended-learning context at the scale of a higher education institution.. In a first stage, we explore the perceptions of e-assessment by two primary stakeholders: academics and students. We conjecture that a successful global implementation of e-assessment relies on the simultaneous adoption by academics and students. To test this hypothesis, we: 1) define a technological framework that is able to support e-assessment for the whole academic community; 2) identify three main e-assessment scenarios that cover a range of possible domains and contexts; 3) implement experiments with early adopting teachers and collect qualitative and quantitative surveys from students. The results are analysed and discussed in order to assess the current framework and adapt it further to deploy it at faculty level.

Keywords. e-assessment; learning management system; multiple-choice question; knowledge; skills

1 Introduction

Nowadays, it is widely admitted that e-assessment can bring many advantages to higher education institutions, both at administrative and pedagogic levels [1]. As raised in [2], it is recognised that many traditional assessment methods such as multiple-choice questions (MCQ) can be more efficiently conducted with the help of Information Technology (IT). Moreover, IT opens the way to new assessment methods that would be impossible otherwise. The expected advantages associated to e-assessment are well known, some of them, as reviewed in [4], being:

- Automatic grading (when possible) is more objective and at least not prone to errors,

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- E-assessments are scalable,
- They can be performed any time any place,
- They are reusable,
- They offer a wider range of tasks and activities,
- They can provide instant feedback,
- Students can revisit their answers,
- Scoring is instant.

However, even though a lot of efforts have been dedicated to providing the basic technological components for e-assessment, many challenges remain when transposed to large scales such as found for example in higher education institutions. Indeed, most of the available research in the area has been conducted at small scale [3]. As a result, the adoption rate in higher education is slower than expected. Apart from technology, many barriers have to be considered in terms of infrastructure, culture, support, development, resource and policy [1].

Students' perceptions about e-assessment have previously been studied. In [5], the authors specifically target online summative assessment using a LMS (Moodle). The authors first summarize and review previous similar studies. They indicate that students are in favor of e-assessment and have a positive opinion about it in general and about MCQ in particular (within the global assessment process, students had to pass MCQ exams three times during the semester). The negative aspects are related to the time offered to perform the quiz and some instabilities in the infrastructure. Based on the answers collected from open-ended questions, the authors reveal also that they did not observe higher level of anxiety than for traditional exams and conclude that the level of difficulty is the same for both forms of assessment. In [6], medical students' acceptance of being evaluated using an online assessment system is studied. The results report that students prefer online assessment as opposed to other forms. They also note that the acceptance increase from one year of study to the next.

A similar study is also described in [7]. The results are in favour of e-assessment: It does not add stress; it is suitable for students' studies; it is considered secure; it improves the reliability of marking and it brings an added value to learning. The author also checked the correlation with age and with gender. The results indicate that these two characteristics do not significantly influence the answers. The authors of [8] apply a model to understand what affect students' intention to use an e-assessment system. If students feel that e-assessments are useful, their behavioural intention to use it increases. Therefore, the authors suggest that making students aware that online quizzes are useful for themselves will increase their intention to use them. They also indicate that producing creative questions should have a positive impact on the perceived usefulness.

We consider the ultimate goal of introducing online formal summative assessments in a blended-learning context at the scale of a higher education institution as a service to the academic community. A global project has been initially defined that considers four facets: pedagogy, technology, logistic, and legal. In a first stage, we are interested in exploring the perceptions of e-assessment by two primary stakeholders: academics and students, at three levels: pedagogy, technology and to a lesser extent, logistic.

The administrative benefits brought by e-assessment appear usually obvious and immediate. The pedagogical ones are much more hypothetical and greatly depend on the individual implementation of each assessment. Moreover, in the context of a higher education institution, the scope and range of all the possible assessment scenarios is quite large.

Our primary objective is to be able to adjust the overall strategy to maximise the potential adoption of e-assessment. One of our hypotheses is that a successful global implementation of e-assessment relies on the simultaneous adoption by academics and students. The adoption by students could be considered as relatively minor because teachers usually impose summative e-assessments to their students who cannot do otherwise than to adapt. However, academics will be more reluctant to introduce e-assessment if students' perception is too negative. Moreover, if e-assessment brings pedagogical benefits, students should be able to positively identify them [10]. Therefore, to test the adoption hypothesis, we 1) define a technological framework that is able to support e-assessment for the whole academic community, taking into account the IT teaching environment currently available at the institution; 2) identify three main e-assessment scenarios that cover the range of possible domains and contexts; 3) implement experiments with early adopting teachers and collect qualitative and quantitative surveys from students and teachers.

2 E-assessment framework

2.1 E-assessment framework

Dedicated and standalone software products present rich features for e-assessment, but generally lack interoperability with existing platforms such as Learning Management Systems (LMS) and are often too specific to cover all the domains and contexts required at an institution scale [11]. Currently a LMS such as Moodle† provides a broad variety of question types that can go far beyond simple multiple-choice questions. The Moodle's standard test module offers sixteen different types of questions, which can easily be extended through third-party modules to cover around fifty other types, including adaptive tests. The resulting ecosystem offers a large range of assessment scenarios with various levels of complexity.

It is also acknowledged that an adoption barrier for academics is the need to learn new software and produce additional contents [9]. Therefore, relying on an available institutional LMS (currently Moodle) for the assessment content production and management offers multiple advantages: 1) the academics already know and use the software; 2) this is also true for students; 3) assessment contents and activities are smoothly embedded within learning tasks; 4) assessment contents can also be reused and repurposed for formative assessment.

Even though students are monitored during the exam session, it is necessary to secure the computers on which they pass the assessment. The assessment framework is therefore completed with a dedicated client software installed on the students'

† https://moodle.org/

computers to control and secure the connexions to the LMS and lock the access to resources not authorized for the exam but otherwise available on the computer and Internet. The selected client software, so-called "Safe Exam Browser" (SEB)[‡], secures any computer by restricting the access to system features, websites and third-party applications and by preventing unauthorised resources from being used during an examination. SEB runs as a standalone application on a local computer (installed once on all the examination computers) and is generally used in conjunction with a LMS. SEB includes a kiosk and a browser component. They are both running on the local computers used by the students to pass the examination. The kiosk component locks the student's computer and the browser component communicates with the quiz module of the LMS running on a dedicated server. The kiosk application starts by locking the examination computer; then it launches the browser and the (optional) third party applications. The browser component uses a pre-defined URL to connect to the LMS quiz page. It also hides all navigation elements. An extension is installed on the LMS in order to downgrade the user interface so that it only contains the navigation features required for the exam (for example, it removes any link that goes outside the quiz page) and to remove access to any unwanted features of the LMS.

The whole system is completed with an automated screenshot capture system to handle any legal disputes and claims from students that could be issued.

The organization of an online examination is organized into five phases, depicted in Fig. 1:

Phase 1: The teaching staff builds the quiz by defining all the questions using the various question types available in the LMS.

Phase 2: A configuration file is setup for SEB.. It mainly includes the LMS quiz page address, the list of third-party applications that are authorized (e.g., a calculator accessory or sophisticated applications such as Matlab) and the list of web places that will be granted in addition to the quiz page.

Phase 3: The setup file is transmitted to the students who pass the exam. It can be send by email or made available on a web page. SEB is launched once the setup file is clicked. Computers are then locked and the browser component connects to the LMS quiz page once the student has authentified himself. The authentification mechanism is conveniently based on a Single-Sign-On Shibboleth[§] system, supported by both Moodle and SEB..

Phase 4: Students pass the exam on the dedicated computers. They interact with the quiz to get the questions and guidelines and save their answers.

Phase 5: Once the exam is finished, all the results are stored and available on the LMS. The teaching staff can then acces the quiz management space to analyze and post-process the results, and the grades and feedbacks can be made available to the students through the LMS.

It is also possible to deploy the e-assessment framework with a Virtual Desktop Infrastructure (VDI) (on standard workstations, or thin clients). This is particularly useful when an assessment requires very specific features, such as a third-party applica-

‡ http://safeexambrowser.org/

§ https://shibboleth.net/

tion not installed by default on the classroom workstations or one that would not run on all the available classroom workstations. The virtual desktop is configured with SEB and all the necessary software, third-party applications. It can then be deployed on all the required classroom workstations. This could also be a solution for passing the exam on students' equipment, by definition quite heterogeneous and not always up to date.

2.2 The three assessment scenarios

To reduce the compounding possibilities of the assessment domains and contexts, we have defined a few basic scenarios to communicate and illustrate the potential of the whole framework to teachers and faculties' staff. To identify the most relevant scenarios, we have devised a representation of all the possible variants. A one-dimension continuum model is proposed in [12]. Unfortunately, it only considers the difficulty and complexity of the scenario. We, therefore, propose a two dimensions continuum. The first axis of this continuum corresponds to the questions of the assessment. Questions can range from close to open. The second axis corresponds to the level of IT required to implement the scenario. Three scenarios, whose needs, requirements, and potential advantages are clearly stated, are then defined. As shown in Fig. 1, they can be considered as sufficient to cover the whole continuum.

The first scenario is simply a transposition of the traditional pen and paper quiz to an online version. The second one is also a transposition of the open-ended question/essay assessment (with or without open book) to an online version (with or without online open book). The third one consists of direct evaluation of skill(s), possibly requiring some third party software.

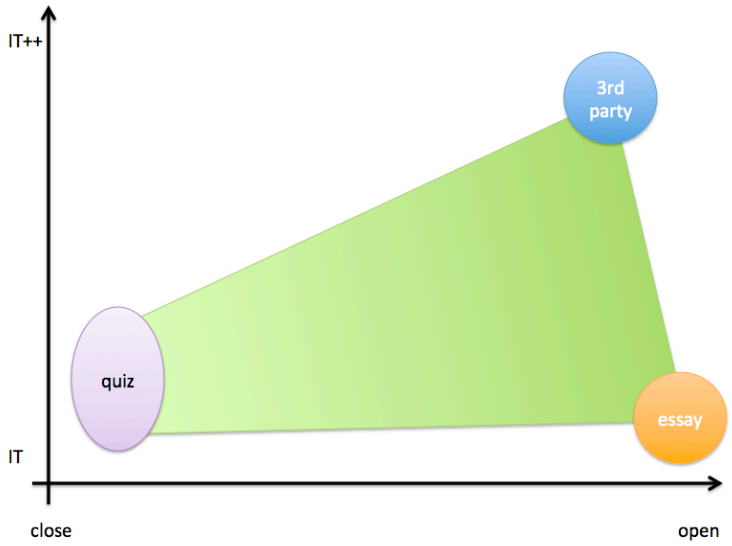

Fig. 1. The 2D e-assessment continuum

2.3 Experiments with early adopters

Various experiments have been conducted with early adopting teachers from various faculties and degrees for around 10 assessments and 2000 students. The e-assessment framework and the three scenarios were first presented to those teachers before defining with them the scenario most suited to their needs (prior to these experiments, assessments were all conducted with a standard pen and paper approach). For two scenarios, we have collected qualitative and quantitative surveys. These two scenarios correspond to standard situations that probably represent the most common cases that arise throughout the University. The first one, an MCQ for law bachelor students in 3rd year, corresponds to a slightly enhanced version of scenario 1, whereas the second one, programming with Matlab for mathematics bachelor students in 1st year, corresponds to scenario 3. These two scenarios have been implemented using the basic five phases process depicted in Fig. 2. The third experiment combines scenario 2 and scenario 3. It is also rather atypical, as it corresponds to a hybrid setup that combines both aspects of paper and online exam.

2.4 Illustration of one specific scenario

Bachelor students at the Faculty of translation and interpreting have an optional seminar assessment for the translation practice course. The transition from paper-pen assessment to online assessment was carried out at the request of students. Their main argument is that they should have access to an environment similar to a professional environment. This implies in particular to have access to software and online resources such as dictionaries and spell checkers. Based on this scenario, students retrieve the text to be translated and the guidelines from Moodle as a word processing document. The translation work is written with the word processing software (with all grammar check features). The access to online resources such as online chat, email, and social networks is disabled. At the end of the exam, each student prints the translation work on paper using a printer and gives it to the teacher.

To implement this scenario, a virtual desktop is setup that includes SEB, the spell checker and grammar software, the word processing software. Screenshot software and a proxy are also installed. The screenshot software continuously captures the workstation screen and the proxy prevents the access to emails, online chats and social networks. Direct printing by each student eliminates the need to print all the works after the exam by the teacher.

Correction and scoring are achieved using the traditional way. Indeed, the teacher prefers reading the results of the translation work on paper rather than on screen. In addition to the benefits provided to students who operate in a "real-working" environment, this configuration allows the teacher to obtain paper copies that are easily readable because they are printed and not hand-written (which is also an advantage for students). For this online version of the optional assessment, the number of assessment submission reached 80%, whereas previous traditional session reached a submission rate of 30%.

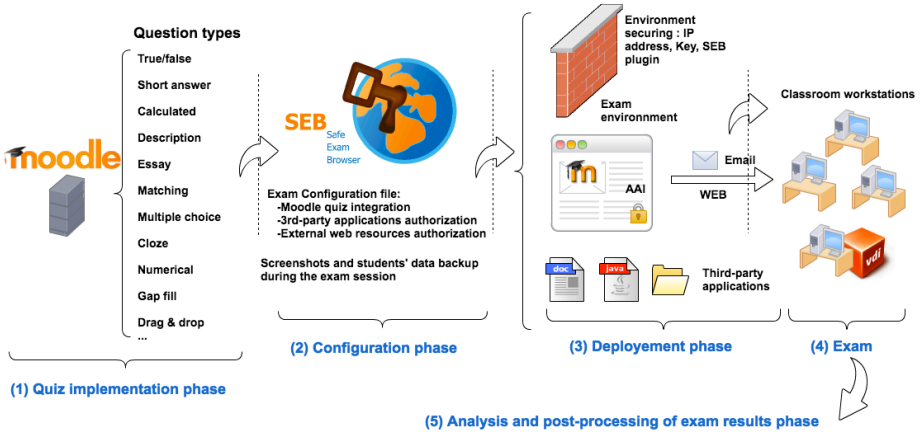

Fig. 2. The five-phase process to pass online examinations

3 Survey setup and analysis

3.1 Methodology

Qualitative feedbacks are collected from the two teachers and an anonymous questions survey is submitted to the students. The questions cover affective factors, validity, practicality, reliability/fairness, security and pedagogy. The survey is based on a five-level Likert-scale question model. The potential benefits of e-assessment are discussed and compared to the perception of students and teachers. The results are analysed in order to evaluate, adapt and adjust the current e-assessment framework and strategy.

An online anonymous questionnaire has been submitted to the two groups of students (we call them “Math group” and “Law group”) few weeks after they passed the online exam and got the results. The questionnaire contains 16 questions for the Law group and 17 questions for the Math group. The 16 first questions of the Math group are the same as the 16 questions of the Law group.

The list of questions is the following:

1. I find that an online exam adds additional stress.
2. I have more difficulty concentrating on questions during an online exam (compared to a traditional « paper » exam).
3. I prefer online tests to paper because I'm used to working online.
4. I think an online exam favours students who are used to work with new technologies.
5. I have more difficulty with an online exam because reading on screen is more complicated / difficult than on paper.
6. The online exam is easier, because I do not have to pay attention to my writing or check the appropriate box properly.
7. I'm afraid that my answers be lost in case of technical incident.

8. I think it is easier to cheat during an online review.
9. I think that cheating can be better controlled and limited (or even completely eliminated) in an online exam.
10. In case of contesting, I cannot be certain that the recorded answers could not be changed afterwards.
11. I'd be more comfortable if I could pass the exam online on my own computer equipment.
12. I found that the exam site offered a suitable workspace.
13. I think online exams can propose activities that paper exam can't offer to allow testing both my knowledge and skills.
14. I note that the online exam allows obtaining my grades faster.
15. I wish that online exams generalize to my other courses.
16. I think in general the online exams facilitate the work of correcting for teachers but they do not bring anything more to students.
17. For online exams, I think it is essential to make a mock exam in real conditions to test and adapt to the online environment.

To answer each question, students can choose between 5 numerical values, ranging from 1 to 5 (1 is labelled “strongly disagree” and 5 is labelled “strongly agree). Value 3 is considered as neutral opinion with respect to the statement. 33 students completed the questionnaire for the Law group and 13 students for the Math group. In the Law group, the sample includes 30% female and 70% male students. Students are mainly (more than 90%) in the range 21 to 30 years old. Most of them (80%) already had online exams before this experiment. In the Math group, the sample includes 54% female and 46% male students. Students are mainly (77%) less than 20 years old. Most of them (84%) never had online exams before this experiment.

We choose the Net Stacked Distribution to visualize the collected Likert data. With this visualization technique, neutral opinions (corresponding to value 3) are kept out of the chart. Thanks to the central base, it is straightforward to grasp the skew between total agree and disagree responses. The total width of each bar shows the percentage of respondents with non-neutral opinion towards the corresponding statement. Although neutral opinions are not included, short-width bars indicate that a large percentage of the respondents have neutral feelings. The results for Law and Math groups are respectively reported in Fig. 3 and Fig. 4. The dark blue, light blue, dark red and light red colours of the bars in the chart correspond respectively to the answers 1 (strongly disagree), 2, 5 (strongly agree) and 4. The numbers that appear in the colour bars indicate the percentage of the corresponding answer.

In order to interpret the results, we use two types of metrics. The first one combines the median and the Inter-Quartile Range (IRQ). The median is an indicator of the central tendency. IQR measures the dispersion. Small IQR indicates consensus. As the median may be difficult to interpret when there are lots of neutral answers, we complete it with another metric. This second one consists in computing the Z-score and converting it to a percentile rank. The Z-score is obtained by subtracting the value 3 (which represents the border between the agree and disagree range of values) from the mean and divide the result by the standard deviation. The Z-score result is then

converted into a percentile rank using the normal distribution function. This metric uses the mean and includes variability in the score. It combines information about the distribution's mean and the standard deviation into one score. The corresponding values for each question for the two students groups are shown in Table 1.

Table 1. Median, IQR and Z-Score results

Ques-	Math group			Law group		
	Median	*IQR*	*Z-score*	*Median*	*IQR*	*Z-score*
1	3	1	36,5%	2	2	33,5%
2	3	2	41,5%	3	2	54,5%
3	1	2	27%	2	2	18,5%
4	3	2	57%	2	2	31%
5	3	2	46%	4	1	66%
6	3	2	43%	2	3	35%
7	4	3	63,5%	3	3	44,5%
8	2	1	7,5%	2	2	13%
9	3	2	43%	3	1	37,5%
10	2	3	41%	3	2	45%
11	2	1	26,5%	3	2	62,5%
12	4	1	68,5%	3	2	48%
13	4	1	71,37%	2	2	33%
14	4	2	68,5%	5	1	93%
15	2	2	25,5%	2	1	17,5%
16	3	2	54%	4	1	73,5%
17	5	1	70,5%	-	-	-

3.2 Analysis

E-assessments do not produce additional stress (question 1) for both groups. The feeling is less strong regarding the concentration issue (question 2) and even slightly inverted for the Law group. Both groups show close cohesion regarding the results for these two questions.

For both groups, having the habit of working online (question 3) does not seem to be considered as an element that increases the acceptability of online exams. Coherently, it appears that regular users of new technologies are not considered favored during online exams (question 4) to the Law group. The opinion of the Math group is slightly inversed. This divergence is to put on the account that the Math group relies on the use of a third-party application in addition to the online quiz.

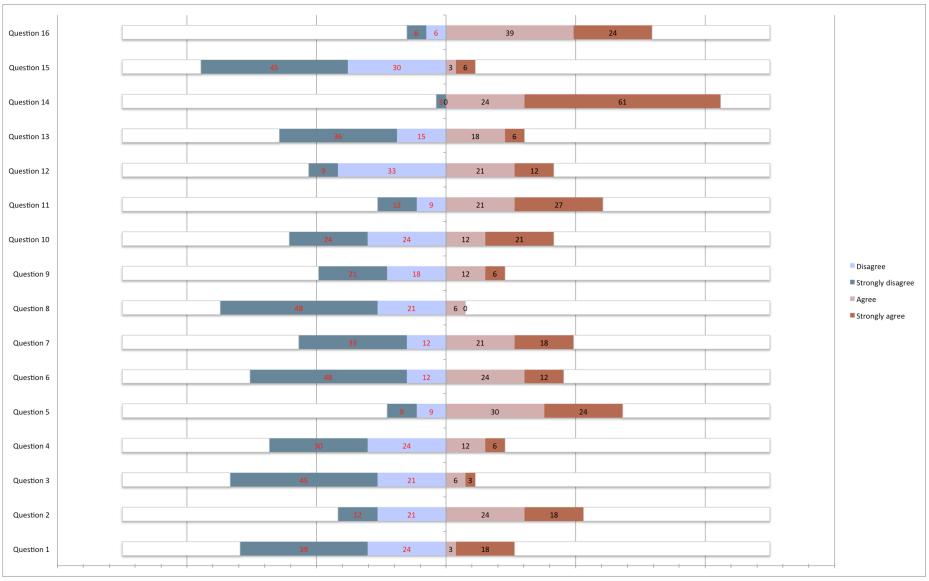

Fig. 3. Net stacked distribution for the Law group

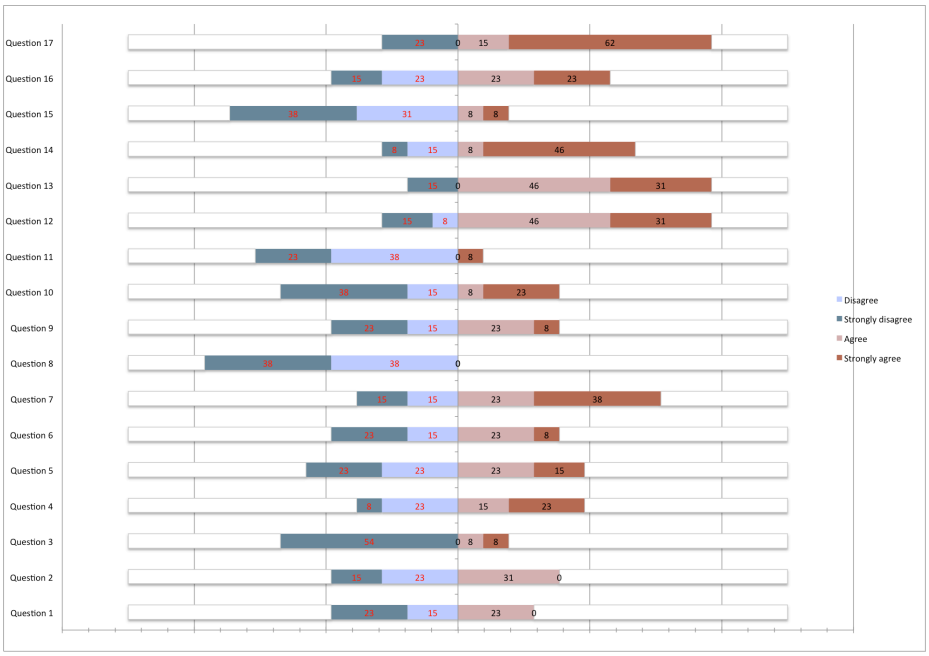

Fig. 4. Net stacked distribution for the Math group

Reading on screen (question 5) seems to be an issue for students. The tendency is obvious for the Law group and more attenuated for the Math group. The different

assessment scenarios can explain the divergence between both groups: the Law group scenario requires much more reading than the Math group one. This result can be related to a previous survey involving the reading preferences of several hundred of students from various countries, analysed in [13]. The survey's results indicate that between books and electronic reading devices, 92% concentrate better with books.

The fact that students don't have to care about their writing or bout the way they check boxes or radio buttons (question 6) does not really seem to matter to render online exam easier than paper ones. The tendency is not significant in both groups.

The two groups' opinions are diverging regarding technical incidents occurring during the exam and the possibility that answers might be lost (question 7). The Math group is rather concerned whereas it does not seem to be a major issue for the Law students. This divergence could probably be explained by the difference of the type of answers that the two groups have to submit. The Law group has to submit standard MCQ answers whereas the Math group has to submit Matlab code, which necessitates more creativity than simply ticking boxes.

Cheating does not seem to appear as an important issue for both groups. They don't think that it is easier to cheat during online exam (question 8). However, they are globally neutral regarding the fact that cheating could be better controlled thanks to online exams (question 9). The tendency is even slightly negative for both groups. According to these results, we can suggest that students don't expect that online exams will change the situation regarding cheating: not more, not less.

Question 10 is designed to test students' confidence in the evaluation system through an extreme hypothesis. In case of dispute, students can ask to see their answers to check their rating. If a written response on paper can hardly be modified, this is not the case in digital. Faced with this issue the answers of the two groups are aligned. They show a rather mixed opinion, even if the trend is slightly oriented towards trusting the system.

BYOD (Bringing Your Own Device) is more and more considered for teaching and assessment (question 11). The current framework we are experimenting can be easily extended to this context. It appears that the opinions of the two groups differ regarding this option. The Law group seems in favour of passing the exam with their personal equipment whereas the Math group appears against. We check later in this section if the divergence is really significant and propose a possible interpretation.

Question 12 evaluates if students find their workplace suitable for the exam. Workplaces for online exams are setup differently than for traditional exam. The space is occupied with the screen and the keyboard. Students need to be able to read on the screen, which implies to have appropriate lighting conditions for example. Both groups passed their exam in the same room. It is therefore important to evaluate this issue. The Math group globally felt that their workplace is suitable, whereas the Law group is balanced. It may appear that workplaces need to be adapted according to the assessment scenario.

It is commonly admitted that e-assessment offers a wider range of tasks and activities than paper assessment and that these activities should allow better testing students' knowledge and skills (question 13) [3.1]. The results of question 13 are coherent with these expectations. Indeed, both groups show opposed opinions, which

aligned with the assessment scenarios they have experienced. The scenario for the Math group is expected to test the skills they have developed during the course and seminar with Matlab, usually not applicable with pen and paper, whereas the scenario for the Law group reproduce the same scenario as in the paper assessment.

Even if the tendency is less marked for the Math group, students definitely acknowledge that online exams allow instant scoring (question 14). This is a “traditional” advantage of e-assessment that is confirmed once more with our study.

Unanimously, both groups reject the idea of the online exams being generalized to other courses (question 15). This is surprising if one refers to previous studies indicating that students report being in favour of online examinations or even prefer them. It would be interesting to further explore this issue with students in order to know the precise reasons behind this rejection. This is however inline with the study described in [3.5] where the authors report quantitative data they have collected regarding the perceived usefulness, the behavioural intention and the content of online questions. They identify that "if students felt that e-assessment was useful, their behavioural intention to use it was more positive". It can also be argued that the studies in favour of online exams were applied to experimental scenarios particularly adapted to the use of technology.

Both groups tend to estimate that online exams do not bring much added-value to students (question 16). The tendency for the Law group is much stronger than for the Math group. This can be explained with the difference in the scenarios: for the Law group, the online exam is mainly a replicate of the paper exam. This is also coherent with the results for question 13. What may appear more surprising is the balanced and almost neutral tendency of the Math group, as their exam scenario is expected to really test their skills. As raised in [8], it appears critical for the teachers to produce creative questions in order to increase the feeling of usefulness for the students.

Finally, students strongly agree that it is important to have mock exams before the real ones in order to train with the online environment of the exam (question 17).

We also looked at whether there are correlations between students’ feedbacks and their experience; the exam group from which they come from; and the fact that they already passed or not online exams. We used the Fisher’s exact test of independence at the 5% level. The results of the test indicate that feedbacks are affected by their experience (we compare the population of students under 20 years – novice students - against the population whose age is between 21 and 30 – experienced students) the student population for questions 1, 5, 11 and 13 and by the origin of the test group for questions 1, 11, 12 and 13. Feedbacks are not affected by the fact that students were having an online test for the first time or not for any of the questions.

Students in the category 21-30 years predominantly claim that they do not experience additional stress while for the category of less than 20 years, the distribution is less pronounced with a slight tendency to recognize an additional stress. Only a small minority of students of the category 21-30 years found that reading on screen is not more difficult than on paper. A strong minority shows a neutral opinion. In the category of less than 20 years, the distribution is balanced between the two views with still a slight majority that tends to find that reading on screen is not more difficult. The majority of students under 20 years would not feel more comfortable with their

own equipment while the trend is reversed for the 21-30 years group. A strong majority of students under 20 years think that online exams offer different assessment activities. This tendency is inverted for students of the 21-30 years category.

3.3 Summary

A strong majority of students from the Law group rejects the idea of additional stress generated by the online exam while opinions are more spread out for students of the Math group, with no real trend that stands out. Students from the Math group overwhelmingly consider that online exams provide other assessment activities to test knowledge and skills. The trend is less marked for students of the Law group with a slight majority who claim they see no difference with the traditional paper exam. Students of the Math group would feel mostly not more comfortable to pass the online exam if they could use their own equipment. Students of the Law group are more divided with a slight tendency to estimate they would be more comfortable with their own equipment. The neutral opinion also represents a strong minority. A large majority of the Math group students believe that their exam site offers them a suitable workspace. For students of the Law group, there is no trend that really emerges, opinions are spreading pretty evenly between the 3 categories: agree, neutral, disagree with the statement of the question 12.

In the assessment scenario for the Law group, the IT environment is only here to transmit students' answers whereas in the assessment scenario for the Math group, the IT environment also requires a third-party application for the production of students' answers in addition to the answer transmission. This may explain the difference observed for the stress related survey question. The interpretation that can be proposed to explain the difference in results regarding question 13 is also based on the difference of the assessment scenarios. In the case of the Math group, the test replicates exactly the scenario of skills and knowledge practiced during the semester in the course through the third-party software, whereas in the case of the Law group, the assessment scenario replicates the traditional paper exam one almost identically. Only the medium to transmit the answers is changed in the transition from paper to digital assessment. It may seem surprising that students in the Math group would not tend to feel more comfortable with their own equipment than students of the Law group. But again, the differences in the assessment scenarios can be envisaged to explain it. The technical environment required for the scenario of the Law group corresponds to a standard personal computer environment that uses mostly the Web browser. For the Math group, the technical environment and setup is more complex and probably too complicate to consider replicating it on a personal computer. Especially taking into account that even if the course uses computer software, the main discipline of students remains Mathematics and they are not necessarily very comfortable with complicated configurations on their own equipment.

Students' feedbacks confirm some of the results from the literature. They also show that the perception differs on some criteria depending on the assessment scenario. For both experiments, students strongly reject the idea to generalize e-assessment for other courses. They also globally consider that e-assessment reduce teachers'

workload but do not bring much added value for them. However, it must be balanced by the fact that for the experiment corresponding to scenario 3 (direct evaluation of skill(s) requiring some external software), students mostly agree that e-assessment contributes to better evaluating their knowledge and skills. The third experiment with the translation scenario (Section 2.4) also proves that it is possible to adapt the framework to reproduce real or professional environments in order to assess students' skills.

For teachers, the experiments appear globaly positive and time saving, avoids errors with copies manipulations and fights intelligently against cheating. They also afford statistics reports per student, per question and per class that allow highlighting and detecting gaps and misinterpreted or too difficult questions. Timeliness of corrections allows communicating very quickly the results to students. Students also positively recognise this aspect. The translation scenario supports that hybrid scenarios are possible where an online environment can be offered to students and a more traditional one can be maintain for teachers. It allows introducing e-assessment for teachers who are not comfortable with the technology.

In the course of these experiments, some stringent logistics requirements were also identified. The first is the presence of a technician in the room to provide hardware and software support. The second is the need to have spare computers for dealing with technical problems that may occur to students individually.

4 RESULTS AND DISCUSSION

The different experiments validate the current setup. It appears to be flexible and adaptable and covers the needs and requirements expressed by academics and in the case of the translation scenarios to requirements expressed by the students themselves. A convenient assessment scenario could be setup for each of them. The qualitative feedbacks collected for three different scenarios show that e-assessment brings valuable benefits. The translation exam scenario demonstrates that it is possible to propose hybrid scenarios mixing online and traditional steps during the assessment. This is a good approach to motivate teachers who would be initially reluctant to use the technology for the correction and the scoring steps. Also, the main issue clearly consists now in shifting from early adopters to other categories.

Results are much mixed regarding students and confirm that summative assessment remains mainly a teacher-centric activity. It gives some directions for improving the current setup and indicates the need for an appropriate communication plan. However, the results also indicate that students acknowledge when the shift from assessment to e-assessment is noticeable and sticks to the knowledge and skills taught in the course. The results show also that students' feedback depends on the type of assessment scenario for some criteria. The situation calls for a differentiation of the communication and management strategy of the assessments depending on the type of scenario. It also request teachers to imagine creative scenarios and questions and to convince students about the usefulness of the e-assessment.

We note that there are no significant variations between students who have already passed exams online and those who have never passed any. Overall, the perception among novice students and experienced students is substantially identical. There are significant differences only for 4 of the 17 questions. It is similar for the difference between the scenarios. These differences in perception are easily explained by the characteristics that differentiate the scenarios. These changes in perceptions should be taken into account to adjust the online exam environment based on these categories of students.

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