UNIVERSITY WRITTEN EXAMS BEFORE AND DURING THE COVID-19 PANDEMIC

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Abstract

During the lockdown imposed by the Covid-19 pandemic, Universities had to face the problem of online examining students at the end of the various courses planned in their bachelor and master degrees. In particular, different solutions for student proctoring during written exams have been identified, depending on the number of students to be examined. This paper concentrates on the results of application of these solutions for one complete academic year (from May 2020 to April 2021) compared with a normal, non-pandemic year (2018-19). Particular attention is given to number of exams and average grade (i.e., measure of student level of competence, ranging from 18/30 to 30/30 cum laude in the Italian system) attributed to students by the teachers belonging to the different faculties/schools

Keywords: Online written exams, grades by month, grades by faculty.

1 INTRODUCTION

As deeply discussed e.g. in [1], [2] and [3], the lockdown imposed by the Covid-19 pandemic around the end of February 2020 forced the University of Milan (as well as all other Italian Universities) to transfer suddenly online all the teaching activities normally carried on with students physically present in classrooms in a traditional university.

Among the various activities to be transferred online, written exams (i.e., tests requiring simultaneous presence of students in the same classroom) at the end of each single course, present in their study curricula, received particular attention. In fact, e.g. in [4], some comparisons between proctored and non-proctored tests are made, clearly showing that in the absence of some form of proctoring the final grades are higher, due to usage of unauthorized support and cheating.

To better understand the context, it is worth noticing that the University of Milan is constituted by height faculties:

- Agricultural and Food Sciences,
- Humanities,
- Law,
- Medicine,
- Pharmacy,
- Political, Economic and Social Sciences,
- Science and Technology,
- Veterinary Medicine

and 2 schools:

- Exercise and Sport Sciences,
- Language Mediation & Intercultural Communication.

They offer 67 bachelor degrees (3 years, 180 ECTS – European Credit Transfer System – credits) 64 master degrees (2 years after bachelor, 120 ECTS credits) and 9 single-cycle master degrees (5 or 6 years, 300 or 360 ECTS credits). 2179 staff professors and almost 2000 contracted professors, supported by 1960 support people (technical and administrative staff units) teach every year more than 3000 courses.

First, an analysis of what happened in academic year 2018-19 (i.e., before pandemic) has been carried out, to identify the characteristics of written exams. As shown in Table 1, the large majority of written exam sessions has less than 100 registered students (with an overall average of 18,2 students per

session) but there were 260 exam session with more than 100 students each (with an overall average of 149,9 students per session, and the hugest session with 540 students).

Table 1. Exam sessions in 2018-19 having less or at least 100 applying students.

Faculty/School	*# of sessions*	*SMALL sessions <100 students*	*LARGE sessions ≥100 students*
Agricultural and Food Sciences	900	893	7
Exercise and Sport Sciences	182	168	14
Humanities	585	532	53
Language Mediation & Intercultural Communication	622	590	32
Law	154	147	7
Medicine	1816	1814	2
Pharmacy	709	701	8
Political, Economic and Social Sciences	2087	2003	84
Science and Technology	2414	2372	42
Veterinary Medicine	494	483	11
Total	**9963**	**9703**	**260**

The threshold of 100 students has been defined because after some tests, it has been seen that:

- A reasonable student number that can be monitored by a single person is in the range 20-30;
- It is not worth to ask teachers to split students in more than 4 to 5 groups, to be monitored in parallel (with the help of some collaborators) or one after each other.

1.1 Direct proctoring

For SMALL sessions, the envisioned exam scenario requires that each group of 20-30 students is monitored using a web conference platform (e.g., Microsoft Teams, Zoom, etc.) established between the computer of the teacher and the smartphone of each student, placed behind her/him to allow a very effective proctoring. In fact, the teacher can control that no forbidden material (e.g., books, written notes, etc.) is used by the student during the exam; moreover, by zooming on each student window in the web conference, the teacher can look at the desktop and see if the student is operating correctly (i.e., using only the allowed applications).

For open answer tests, the exam is carried on using the exam.net platform ([5]) implemented by the Swedish company Teachiq AB, characterized by:

- The adoption of SEB (Secure Exam Browser: [6]) that turns any computer temporarily into a secure workstation, forbidding usage of other programs and resources during an exam
- A very easy teacher interface, greatly facilitating creation and test of exams;
- Real time monitoring of student work, since the teacher can browse among students and see what each of them already wrote;
- A chat support, allowing the teacher to interact with every student without disturbing the overall group.

For closed answer quizzes, not easy to implement with exam.net, direct integration of SEB with the Moodle LMS hosting the quizzes has been adopted.

1.2 Software supported proctoring

For LARGE sessions, where direct proctoring would require too many teachers/collaborators, different proctoring proposals available on the market, (i.e., systems offering different kinds of monitoring supports) have been considered. These software tools record the behaviour of each student during the exam through the webcam of her/his computer. After the end of the exam, all recordings are processed

by suitable Artificial Intelligence algorithms, that mark in red any “suspect” behaviour of the student (e.g., eyes or head movements, noises, appearance of other people, etc.) to allow the teacher to analyse the suspect behaviours and decide accordingly how to manage them.

After some tests, we adopted Proctorio ([7]) mainly for these reasons:

- Proctorio uses a simple add-on for browsers like chrome that creates a secure exam environment by restricting internet navigation and computer functionality, thus facilitating student computer setup;
- Student behaviour monitoring is very accurate, since Proctorio records the webcam stream and also the desktop of the student computer;
- The browser add-on sends only some video frames instead of a continuous streaming, thus significantly reducing the network bandwidth requirements (and facilitating monitoring of students with poor internet connections);
- The final ai algorithm can be tuned by the teacher in terms of sensitivity of the different kinds of suspected behaviours after receiving the recorded exams; this allows the teacher to emphasize the aspects considered most dangerous and/or more common.

2 EXAM SESSIONS BEFORE AND DURING PANDEMIC

A first analysis is the comparison between a normal academic year (before Covid-19 pandemic) and the Academic year 2020-21, when all exams have been carried on online due to the various limitations imposed by the lockdown rules.

Table 2 reports the numbers of written exam sessions per month in 2018-19 and 2020-21 (August has been omitted, since almost no exams take place during the traditional Italian vacation month).

It is interesting to note that almost in every month the number of sessions decreased during pandemic, with the exception of May. The most likely explanation for that is the suggestion to teachers to substitute written exams with oral ones whenever possible (i.e., when numbers of students were small enough). The 2020 May exception has caused for sure by the fact that only after the first months of pandemic the various scenarios above described became available, and teachers did not have the tools for organising intermediate tests.

Table 2. Exam sessions in 2018-19 and in 2020-21 by month.

Month	***# of 2018-19 sessions***	***# of 2020-21 sessions***	***2020-21 – 2018-19***
January	1201	1021	-180
February	1270	1267	-3
March	316	340	24
April	534	440	-94
May	545	666	121
June	1374	1141	-233
July	1807	1500	-307
September	1553	1364	-189
October	285	252	-33
November	533	419	-114
December	545	492	-53
Total	**9963**	**8902**	**-1061**

Table 3 shows the same data of Table 2 over the various faculties. The numbers of written exam sessions decrease everywhere with the exception of the Humanities faculty. A possible explanation for that is the huge numbers of enrolled students (14878 in 2018-19, almost twice the 8450 students enrolled in the second faculty, Science and Technology) suggesting adoption of software supported proctoring for managing the largest exam sessions.

Table 3. Exam sessions in 2018-19 and in 2020-21 by faculty.

Faculty/School	*# of 2018-19 sessions*	*# of 2020-21 sessions*	*2020-21 – 2018-19*
Agricultural and Food Sciences	900	615	-285
Exercise and Sport Sciences	182	78	-104
Humanities	585	727	142
Language Mediation & Intercultural Communication	622	441	-181
Law	154	127	-27
Medicine	1816	1490	-326
Pharmacy	709	625	-84
Political, Economic and Social Sciences	2087	1958	-129
Science and Technology	2414	2342	-72
Veterinary Medicine	494	499	5
Total	**9963**	**8902**	**-1061**

3 GRADES OBTAINED BY STUDENTS BEFORE AND DURING PANDEMIC

In [8] a comparison between online and onsite proctored exams is reported, showing that there are no significant differences in final grades: this allows authors of that paper to state that the effectiveness of student proctoring can be satisfactory both online and onsite.

To evaluate what happened at the University of Milan, Tables 4 and 5 report the average grades (ranging from 18/30 to 30/30) obtained by students of the various faculties in written exams after and during pandemic, for SMALL and for LARGE exam sessions. It is easy to see that data confirm the correctness of the [8] conclusions: the largest difference between the two years is the 0,6/30 increase in grades obtained in LARGE sessions by students of the Political, Economic and Social Sciences faculty.

Note that the Law faculty did not organise any LARGE session during pandemic.

Table 4. Average grades obtained in 2018-19 and in 2020-21 in SMALL sessions by faculty.

Faculty/School	*2018-19 avg. grades*	*2020-21 avg. grades*	*2020-21 – 2018-19*
Agricultural and Food Sciences	24,4	24,3	-0,1
Exercise and Sport Sciences	26,0	25,7	-0,3
Humanities	25,7	25,5	-0,2
Language Mediation & Intercultural Communication	25,0	25,2	0,3
Law	24,2	24,6	0,4
Medicine	25,6	25,7	0,1
Pharmacy	24,3	24,6	0,3
Political, Economic and Social Sciences	24,8	25,2	0,5
Science and Technology	25,2	25,4	0,2
Veterinary Medicine	24,9	25,2	0,3
Total	**25,0**	**25,3**	**0,2**

Table 5. Average grades obtained in 2018-19 and in 2020-21 in LARGE sessions by faculty.

Faculty/School	*2018-19 avg. grades*	*2020-21 avg. grades*	*2020-21 – 2018-19*
Agricultural and Food Sciences	23,9	23,4	-0,4
Exercise and Sport Sciences	26,9	26,4	-0,5
Humanities	24,5	24,9	0,4
Language Mediation & Intercultural Communication	25,4	25,3	-0,1
Law	26,8	na	na
Medicine	28,5	26,9	-1,6
Pharmacy	24,3	23,9	-0,4
Political, Economic and Social Sciences	24,9	25,5	0,6
Science and Technology	25,0	23,6	-1,5
Veterinary Medicine	24,5	24,4	-0,1
Total	**25,2**	**25,2**	**0,0**

4 CONCLUSIONS

In this paper, some analysis on written exam sessions at the University of Milan has been performed, to assess the efficacy of the proctoring scenarios for online written exams identified during the first lockdown phase of the pandemic. The results of that analysis are definitely satisfactory. Even during pandemic, lots of written exams have been smoothly carried on thanks to the different scenarios proposed to teachers for conducting them. Moreover, grades obtained by students before and during pandemic show very limited differences, confirming what stated in [8] about the significance of online proctored exams. As a conclusion, we can state that we will adopt online exams for particular situations (as, e.g., exams for full-time employed students) even when our University will reopen.

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