THE QUANTIFICATION OF THE TIME SAVED BY THE PROFESSORS THROUGH THE INTRODUCTION OF THE ELECTRONIC EVALUATION

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Abstract: *Technology is evolving with an astonishing speed and because of this fact, more and more high specialized jobs tend to be replaced by different equipment with specialized software and in some cases, even by robots, with the clear purpose of achieving high efficiency, lower costs, and an increase in the customer service level. At supermarket, anyone can scan its products, in the bus, the ticket payment can be made by using the card, without having to buy a ticket sold by a person, a lot of local taxes can be paid online, and the examples can go on. In this context, it's a little bit weird that in education, technology is still a step down behind the normal pace in other fields. That's why, this paper wants to prove that also in education, the technology can have a huge impact in increasing substantially the efficiency of the activities performed by the professors while in the same time increasing the quality of the evaluation process and allowing the professor to have more time for preparation, research, materials writing, or just for relaxing and improving it's mind set for an outstanding performance in front of the students.*

Keywords: *education, technology, evaluation, teacher, efficiency.*

INTRODUCTION

Typically, when somebody is talking about the use of technology in education, the discussion in more than 90% of the cases tend to be related with how technology can help the professors to create more engaging content for the students and how they will be able to have a faster understanding of the knowledge and logically to learn quicker. But the technology is not all about the teaching and learning act. The technology is also about the evaluation process which is a key component for the whole teaching act. Even if it's hard to recognise, we must admit that the evaluation process done by the professors is not so accurate like we would want to be. [1]

If we take the example from the Romania's baccalaureate June session of the current year (2023), then we can find some worrying numbers. We have depicted the situation in Table 1.

Table 1: Romanian baccalaureate summer session, June 2023 [2]

Discipline	Number of candidates registered	Number of candidates present	Number of appeals	Number of papers with changed marks	% of papers with changed marks from total number of appeals	% of papers with changed marks from total number of present candidates
Romanian Language	130522	125352	26184	24981	95.4	19.92
Maternal language	-	24500	488	478	98	0.4
Profile mandatory discipline	130522	125352	13385	12539	93.7	10
Profile choice discipline	130522	125352	14575	13648	93.6	10.88
Total (for columns 4,5 and 7)	-	-	54632	51646	94.53	41.2

It has been calculated as additional statistics, apart from what the Educational Ministry has reported, column #7 which highlights the percentages of wrong marked papers from the total number of papers. And if the Romanian language and literature discipline is way more subjective than an exact science discipline, and the percentage of wrong marks is not too worrying, what really is something to think about is that almost 21% of wrong graded papers at disciplines like mathematics, physics, and chemistry where we should not talk about subjectivism. The sad conclusion is that, at objective disciplines, more than one out of five papers is wrongly graded by the professors. But the paper is not about the causes that leads to these mistakes and is about what we can do to minimize or eliminate these mistakes in the future by using the available technology.

If somebody is having a smartphone and is using it just to make calls, then it can't be said that he's using a smartphone because the same result can be achieved by just using an ordinary mobile phone. The same is valid for the evaluation process too. If the Ministry has decided to scan all the papers and then put the professors to evaluate them on a computer screen, rather than on a physical paper then this doesn't make any difference and the facts prove this aspect.

In the autumn session of the Romanian's baccalaureate, out of 33900 candidates, has been registered a number of 12031 appeals and as a result, 11364 papers had the marks being changed, meaning a percentage of 94.45% compared with the summer session when the percentage was 94.53%, so pretty much the same. [3]
Using the real power of technology means to develop software applications that are capable to automate the evaluation process and to generate marks with 0% chances of error. Luckily, in the higher education at least for the National

University of Science and Technology Politehnica of Bucharest, there is the Moodle platform that allows the professors to write the software that is capable of automatically evaluate the student's work. But being possible and actually writing and using the software are two different things and that's why the main purpose of this paper is to quantify how much time a professor might actually save by using the electronic evaluation instead of applying the old classical method of manually grading the projects, exams, etc in order to convince more professors that this is the right evolution direction, because not just the time will be spared but also the quality of the evaluation will be significantly increased and the student's satisfaction and motivation we also reach higher levels.

EXPERIMENTAL

The experimental has started with the assumptions depicted in Figure 1.

600 students/ semester

1 project with an average of 10 pages

An average of 1 minute reading per page

9600 minutes = 160 hours = 20 working days

1 exam

An average of 6 minutes reading per exam

No time for:

Creating subjects

Making statistics and calculate the final mark

Being present at the exams

Giving feedback and talking with students

Giving consulting hours

As result:

Working extra time with no additional pay

Not sleeping to much

Not eating too much

Not having time for family

Not having time for personal development

Final consequence:
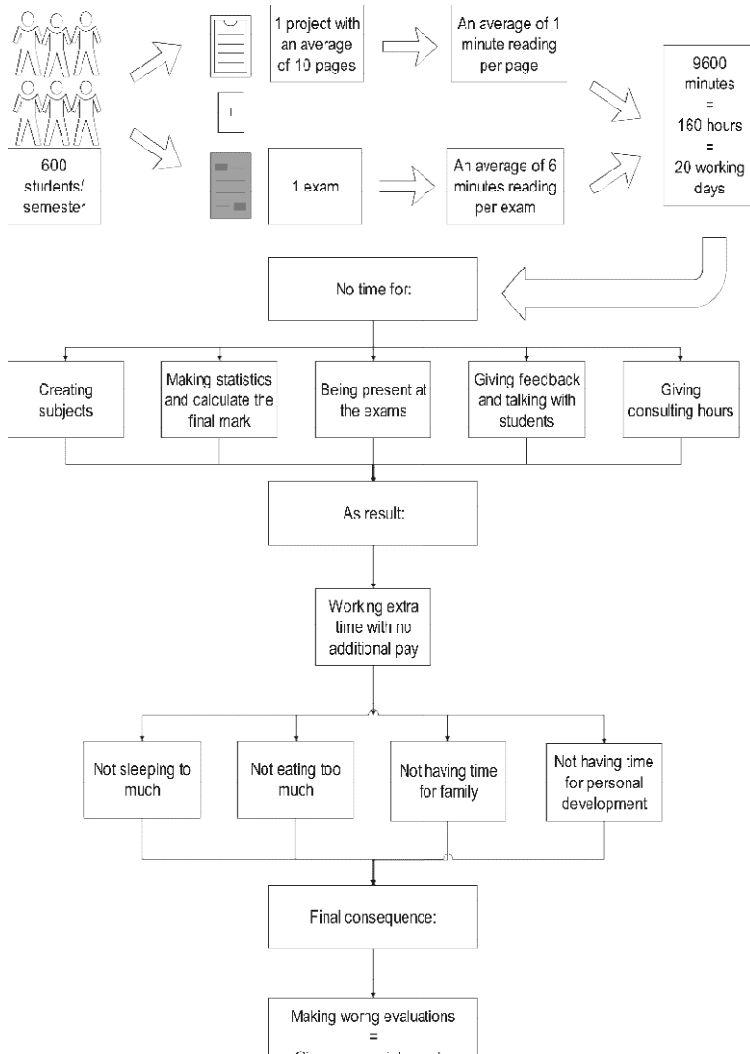
Making wrong evaluations =

Figure 1: The pre-session and session time for a professor in higher education

Accordingly, to that, to make a real and consistent evaluation, a professor during the two-week pre-session period would only have time for the teaching act or supervising the tests 4 hours per day and evaluate the student's papers or projects the other 4 hours, while in the three-week session time just to evaluate the projects and exams 8 hours per day, without having time to do anything else, meaning not preparing the subjects, not being present at the exams, not being able to make statistics, etc and this is valid only if he needs just 6 minutes to evaluate a student's exam and one minute for evaluating each student's page, assuming that the projects or homework are in average no longer than 10 pages.

The first hypothesis (H1) of the research is that the times depicted in figure 1 are unrealistic for a high quality evaluation and either the professor will not be willing to spend extra time on making the evaluation and will cut quality in the evaluation process, or, if he will be willing to work more, than in the end will be so tired, that wrong marks are almost a certainty.

To prove that those times from the figure 1 are unrealistic, and that there is a huge possibility for grading with a wrong mark, a research methodology has been developed and is depicted in figure 2.

The professors that have been targeted to evaluate the test, are specialized in very different areas like management, informatics, economics, mechanics, computers and programming, energy, law etc. The second hypothesis (H2) is that more than half of them will not be able to correctly grade the test, while the third hypothesis (H3) is that the average time required for evaluating 1 page written by the student is more than one minute. The 4th hypothesis (H4) is that the evaluation of the test in average is going to be longer than the estimated 6 minutes
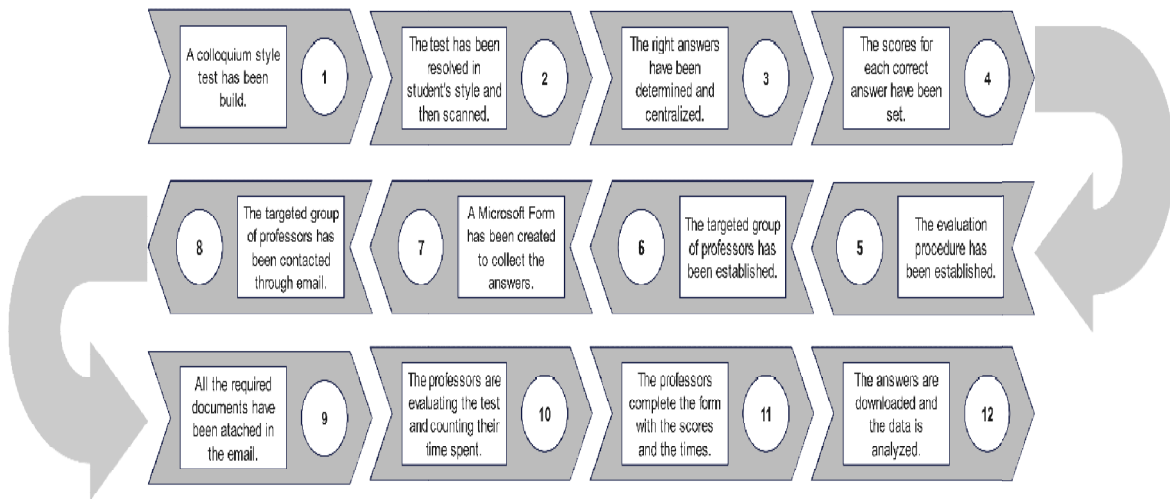
Figure 2: The research methodology

There are other contextual variables apart of the test length that can influence the evaluation time like: the order in which the student responds to the questions (normal or random), if the required answer to a certain question is highlighted or not, the type of test (grid, with numbers or literature), the writing calligraphy of the student, the extra text that the student might put in the paper without being required, etc. It is very hard to quantify all these random variables, but this can be subject for further research. What is important to mention here is that the established test is not a grid one, and not a literature one, so from the perspective of the required time to evaluate it, should not be the shortest but also not the longest.

In the research methodology is also fair to talk about the Moodle platform. The test that has been created and resolved in the classical manner, has also been built on the Moodle platform. Even if there are different books and resources [4] that provide a good framework for learning how to use most of the available functions in Moodle [5], there is still a big lack of information about how to create the most complicated types of questions, meaning the formulas type, as can be seen in figure 3.
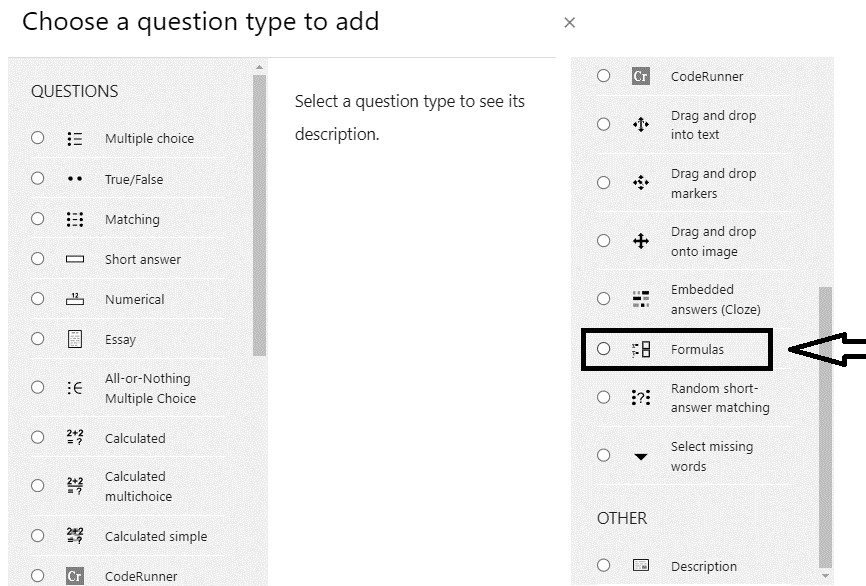

Figure 3: The main types of questions that can be created on the Moodle Platform

To be able to make the platform automatically correct a complex test, some sort of software is required to be written, where have to be specified all the variables, constants, formulas containing all type of relations between constants and variables and "if - else analysis", so that no matter what random values are generated and what answers the students provide, the software can always evaluate correctly the things with 0% chance of mistake.

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To achieve the 0% mistake target in the evaluation process, two additional things must be done: one is to make sure that the appropriate tolerance margins for the right answer are established and second, to perform a lot of simulations so that possible bugs or mall functions can be identified and then treated in the appropriate manner or removed, so that they won't negatively influence the final evaluation of the answers. The total amount of code required to be written is approximately of three-to-four-word pages depending on the setup. An example of the code is provided in Figure 4.

```
S1={100:199};S2={200:299};S3={300:399};
S4={1000:1099};S5={1100:1199};S6={1200:1299};
P=(14*CF)/(CI-CV);
Sorting=sort([S1,S2,S3,S4,S5,S6,S7,S8,S9,S10,S11,S12,S13,S14]);
xp=P+0.4999;
xpp=round(xp,0);
Invers=14+1-xpp;
Index=14-xpp;
Optim=sort([S1,S2,S3,S4,S5,S6,S7,S8,S9,S10,S11,S12,S13,S14])[Index];
xm1=Optim-1;
xp1=Optim+1;
cfxm1=14*CF*xm1;
min1xm1=min(S1,xm1);min2xm1=min(S2,xm1);min3xm1=min(S3,xm1);
min4xm1=min(S4,xm1);min5xm1=min(S5,xm1);min6xm1=min(S6,xm1);
min7xm1=min(S7,xm1);min8xm1=min(S8,xm1);min9xm1=min(S9,xm1);
min10xm1=min(S10,xm1);min11xm1=min(S11,xm1);min12xm1=min(S12,xm1);
min13xm1=min(S13,xm1); min14xm1=min(S14,xm1);
sumaminxm1=sum([min1xm1+min2xm1+min3xm1+min4xm1+min5xm1+min6xm1+min7xm1+min8xm1+min9xm1+min10xm1+min11xm1+min12xm1+min13xm1+ min14xm1]);
cvxm1=CV*sumaminxm1;
rezdifs1xm1=S1-xm1;rezdifs2xm1=S2-xm1;rezdifs3xm1=S3-xm1;
rezdifs4xm1=S4-xm1;rezdifs5xm1=S5-xm1;rezdifs6xm1=S6-xm1;
rezdifs7xm1=S7-xm1;rezdifs8xm1=S8-xm1;rezdifs9xm1=S9-xm1;
rezdifs10xm1=S10-xm1;rezdifs11xm1=S11-xm1;rezdifs12xm1=S12-xm1;
rezdifs13xm1=S13-xm1; rezdifs14xm1=S14-xm1;
hires1xm1=(rezdifs1xm1>0)?rezdifs1xm1:0;
hires2xm1=(rezdifs2xm1>0)?rezdifs2xm1:0;
hires3xm1=(rezdifs3xm1>0)?rezdifs3xm1:0;
hires4xm1=(rezdifs4xm1>0)?rezdifs4xm1:0;
..............................................
```

Variables

Mathematical calculations

If - else analysis

Figure 4: The required code for automatic evaluation of the complex tests in Moodle [6]

Since the author has a lot of experience on working with the Moodle platform, to write such a software from zero will require approximately 8 hours. Of course, for a person who will start to work with this for the first time, the time will be significantly greater (maybe days), but after will get the required experience is not going to be so difficult anymore and the working time will significantly drop. The whole point here, is that by creating this kind of software on the Moodle platform, a professor will be able to break the vicious loop from Figure 1 and practically will only have to write the software once, and then will be able to use it forever with zero time consuming, since will not have to write the software again and also will not have to manually grade the students tests anymore.

RESULTS

After gathering all the answers received in Microsoft forms from the professors that have evaluated the test, the results might be a little bit surprising for anyone who analyse them, but they are validating 100% the above hypothesis. The professors had a very objective test to evaluate, meaning that they only had to compare the numbers that were provided as correct answers with the numbers being present in the test as answers and nothing else. If the numbers were the same, then they had to give the established number of points, while if they were different, then they should have graded those answers with zero points. The results are presented in Table 2.

Table 2: The main statistics of the research

Number of questioned professors	% of correct graded tests	% of wrong graded tests	Lowest time to complete	Highest time to complete	Average time to complete	Most frequent time to complete	Correct graded tests from most frequent time to complete
33	33	67	5 minutes	26 minutes	14 minutes	11 minutes	0

What is interesting to mention here, is that correct grades have come both from lowest time to complete and from highest time to complete while from the most frequent time to complete, there are zero tests correctly graded. It can be said that hypothesis H2 has been fully confirmed, with more than 50% wrong grades, more precisely, 67%. Regarding hypothesis H3, since the test had eight pages, it results an average grading time per page of 14/8=1.75, or 1 minute and 45 seconds, which is 75% more than the initial estimation. The 4th hypothesis has been also demonstrated since

initially has been considered an average of six minutes time per test, while in reality, the average has been 2.33 times higher, meaning 14 minutes. Finally, the first hypothesis has also been proved, showing that the initial estimated times are not very realistic and that 67% of the professors have wrongly graded the tests, illustrating that it is impossible not to make mistakes. By contrary, using the Moodle platform, there is the double zero: instant grading meaning 0 evaluation time and no mistakes meaning 0 wrong graded tests. In the negative side of the research, can be said that not a single professor from the ones that have graded the tests, is currently using the Moodle platform with formulas type questions, illustrating the fact that there is a huge unexploited potential and that there is a high probability for wrongly grading the tests.

DISCUSSION

The big discussion is about answering to the paper's title. How much time can be saved by using the Moodle platform in the way that has been described earlier. That's why, there will be different scenarios to be able to cover a bigger variety of cases. In total, there will be 108 different cases for analysing and quantification. All these cases are illustrated in table 3.

Table 3: Total required time to evaluate the tests/projects/exams in minutes, hours, and days, for one semester

Number of students per semester	Total required time to grade expressed in	Professor grading just the exam (1 document)				Professor grading projects plus exam (2 documents)				Professor grading colloquiums plus projects plus exam (3 documents)			
		4 minutes per doc to grade	6 minutes per doc to grade	10 minutes per doc to grade	14 minutes per doc to grade	4 minutes per doc to grade	6 minutes per doc to grade	10 minutes per doc to grade	14 minutes per doc to grade	4 minutes per doc to grade	6 minutes per doc to grade	10 minutes per doc to grade	14 minutes per doc to grade
300	Minutes	1200	1800	3000	4200	2400	3600	6000	8400	3600	5400	9000	12600
	Hours	20	30	50	70	40	60	100	140	60	90	150	210
	Days	2.5	3.75	6.25	8.75	5	7.5	12.5	17.5	7.5	11.25	18.75	26.25
600	Minutes	2400	3600	6000	8400	4800	7200	12000	16800	7200	10800	18000	25200
	Hours	40	60	100	140	80	120	200	280	120	180	300	420
	Days	5	7.5	12.5	17.5	10	15	25	35	15	22.5	37.5	52.5
900	Minutes	3600	5400	9000	12600	7200	10800	18000	25200	10800	16200	27000	37800
	Hours	60	90	150	210	120	180	300	420	180	270	450	630
	Days	7.5	11.25	18.75	26.25	15	22.5	37.5	52.5	22.5	33.75	56.25	78.75

Even if the average required time for grading a test, accordingly to the research is 14 minutes per evaluation, this has been considered way to big and that's why is taken just as the worst case scenario, because it might be said that each professor knows very well his discipline and that's why he could be way more efficient in evaluating a test, compared with the case in which he had to grade a test at a discipline with which is not familiar. Is important to be mentioned that at this test, such an aspect is not so relevant, because the professor had to compare only some numbers, but still has been considered that the professor has been taken out from his comfort and efficiency environment. On the other hand, there will be tests in which the answers will not be highlighted, where the calligraphy might be worse, so that's why the four variants with 4, 6, 10 and respectively 14 minutes are feasible. Again, the reader must consider that the tests are not grid type and thus 1-2 minutes evaluation per test in not possible.

Also have been considered the cases in which the professor has an assistant and that's why he only must grade the exams (meaning 1 document), or the cases in which he has to evaluate the exams plus the projects (two documents), or the cases in which he works alone without an assistant, and that's why he has to grade everything (three documents). Finally, the scenarios have been divided in 300, 600 or 900 students per semester. The results are expressed in minutes hours and days.

If we take into consideration also the fact that for creating a test on the Moodle platform, will be needed, in average one day for each type of activity, meaning 1 day for creating colloquiums, 1 day for creating projects and another day for creating exams, table 4 is quantifying the total time that can be saved for each one of the analysed cases in one semester, one year, 5 years, 10 years and 20 years, having all the values expressed in days (assuming that the professor is working 8 hours per day).

It's worth mentioning that even if somebody is the most efficient teacher and is managing to correctly grade a document in just 4 minutes, in the case that is working alone at that discipline, and has in average, a number of 600 students per semester, then will be able to save in a 20-year Academy career, approximately 1.3 years of his life.

Of course, at the calculations from tables 3 and 4 has been assumed that for grading an exam and respectively a project, it will require approximately the same amount of time like in the colloquium test case that has been the subject of this research.

Table 4: The quantification of total time saved by a professor in different periods, expressed in days.

Number of students per semester	Period	Professor grading just the exam (1 document)				Professor grading projects plus exam (2 documents)				Professor grading colloquiums plus projects plus exam (3 documents)			
		4 minutes per doc to grade	6 minutes per doc to grade	10 minutes per doc to grade	14 minutes per doc to grade	4 minutes per doc to grade	6 minutes per doc to grade	10 minutes per doc to grade	14 minutes per doc to grade	4 minutes per doc to grade	6 minutes per doc to grade	10 minutes per doc to grade	14 minutes per doc to grade
300	Semester	1.5	2.75	5.25	7.75	3	5.5	10.5	15.5	4.5	8.25	15.75	23.25
	1 Year	3	5.5	10.5	15.5	6	11	21	31	9	16.5	31.5	46.5
	5 Years	15	27.5	52.5	77.5	30	55	105	155	45	82.5	157.5	232.5
	10 Years	30	55	105	155	60	110	210	310	90	165	315	465
	20 Years	60	110	210	310	120	220	420	620	180	330	630	930
600	Semester	4	6.5	11.5	16.5	8	13	23	33	12	19.5	34.5	49.5
	1 Year	8	13	23	33	16	26	46	66	24	39	69	99
	5 Years	40	65	115	165	80	130	230	330	120	195	345	495
	10 Years	80	130	230	330	160	260	460	660	240	390	690	990
	20 Years	160	260	460	660	320	520	920	1320	480	780	1380	1980
900	Semester	6.5	10.25	17.75	25.25	13	20.5	35.5	50.5	19.5	30.75	53.25	75.75
	1 Year	13	20.5	35.5	50.5	26	41	71	101	39	61.5	106.5	151.5
	5 Years	65	102.5	177.5	252.5	130	205	355	505	195	307.5	532.5	757.5
	10 Years	130	205	355	505	260	410	710	1010	390	615	1065	1515
	20 Years	260	410	710	1010	520	820	1420	2020	780	1230	2130	3030

In reality, to grade an exam, it could take longer, while if the projects are quite long and are having a lot of text, then again, the grading times might be much higher. In this paper have been considered similar times because otherwise, the calculated values for the saved time, might have appear too unrealistic. Finally, if we take into consideration the average research time and 900 students per semester and a professor working alone, in a 20-year period, it could be saved more than 8 years of work.

CONCLUSIONS

The implications of this study are quite significant because they not only reveal how much time a professor could save, but also reveal the huge potential for improving the educational process if the professor will use this time to do something else. He could simply: create new and more engaging materials for the students instead of wasting the time on manually grading; create other questions on Moodle platform to make the evaluation process way more objective, due to the fact that in this way, every student receive his own variant of subject and thus the professor will not have to be preoccupied anymore about the fact that the students might copy the information from other colleagues; might read or might research other things to increase furthermore his level of knowledge and the last but not the least might spend more time to relax and have a better mindset.

From the student's perspective, a more objective evaluation means a better motivation for the study and a new challenge that can reignite the passion for the education that for the moment in many cases seems to be lost. Furthermore, these new way of evaluating the students using the Moodle platform allows the professor to ask the students to deliver the results that are expected. Unfortunately, in today's society there are still a lot of professors that don't recognise the fact that information is now available in any time at every place and thus, the emphasis should not be put any more on just learning something, but instead to be preoccupied on how the students are capable to use the available information and to deliver the required results, because in real life they are not asked theory, they're asked to deliver. When more professors will acknowledge these things, then better the students will be prepared for the real word tasks and activity.

And even if there is a big resistance to the change, and many professors are not willing to try and use the new technology at its full potential, considering it too difficult, maybe the times quantified in this paper will be the required excavator that will start to dig into the walls of conservatism and finally will open a small window that will allow the light to make their minds more open to the available technology and will convince them to give it a try and in this way the students, teachers, employers, and the entire society will have only to win and everybody will be able to even spend extra time to enjoy his favourite coffee.

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