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REMARKS ON DIGITAL FINAL EXAMS FOR MANAGEMENT STUDENTS

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Abstract

For a long time question about best students final exam modality is present in teaching. Judging by literature and experience there is no best answer to this question. Oral exam has many advantages, written test has its advantages as well. In recent years digital exams are present. Although this type of exam is more similar to written test, depending on software used for exam, there are many interesting features that can be incorporated in it. This study provides a brief overview of this subject, as well as several practical remarks.

Key Words: *exam, digital test, online test, exam web platform* JEL classification: *I20*

Introduction

From the dawn of humankind education had a key role. Contemporary scientists believe that one of the main advantages in dominance of homo sapiens over the neandertal in early history of humans is ability to transfer the knowledge more adequately (Kadowaki, 2013). Thus in order to be effective by itself education is ever changing. Although this fact was known for a long time, we are witnessing drastic changes in education in last decades due to impact of contemporary information and communication technologies (Kraguljac & Milašinović, 2016; Kraguljac & Milašinović, 2017a).

Judging by the survey from Gartner (2017), higher education chief information officers (CIOs) believe that main priorities are enrollment

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and student success. They miss to use innovations in the field of the top technologies to highlight their organization. A majority of them (59 percent) think that the business model will change due to digital transformation. Despite that higher education CIOs ranked digital transformation as the fifth most strategic business priority, their institutions investing in digitization and digital marketing as only eighth technology. In others industries, this is the second most important technology. This is one of the most important reasons why higher education is among the least digitized industries (Kraguljac & Milašinović, 2017b).

Process of education should not be equated with schools and faculties by default. There is always some form of training and education within corporate organizations. It could either be learning about the job and ways of performing various tasks, or the form of managing relationships between colleagues. Whatever form it takes, it would always influence business environment of the company (Faherty, 2003). Recent studies have shown plan that 60% of all new jobs in the US will require skills that only 20% of the workforce is in possession of (U.S. Chamber of Commerce Foundation's (USCCF) Education and Workforce), and it is known that most of the trends initially developed in the US soon become worldwide accepted. Thus the new business environment has forced companies to recruit, retain and continually work to improve the employees' skills and knowledge. Because of this, employees must provide the ongoing development of these skills and upgrade education to keep up with the changes and competitors in the market. With e-learning and modern technologies as tools to achieve this goal, corporate training can be organized at a higher level than ever before (Marinkovic & Milasinovic, 2013).

The modern teaching must follow the rule "to learn the most in the shortest possible time". One of the best ways to observe this rule is to establish how to apply modern ICTs in the context of subject areas, because only in this way we shall come to the most suitable quality of teaching and effective learning. Of course, with introduction of ICTs in the teaching process it is necessary to consider individual differences, then allow capable individuals and those with more prior knowledge to have faster progress (Vasovic & Milasinovic, 2014).

So the main points of education are the same, but the modalities applied to contemporary learning process differs much from classical one. There is no reason to think that in all aspects of education teachers should change modus operandi, but in many of them modern information and communication technologies are beneficial.

In our teaching practice, for several years at Faculty of hotel management and tourism in Vrnjačka Banja, we incorporated usage of digital exams for students of first and fourth year of academic studies. This type of exam is applied to two academic subjects. For both of these academic subjects students have rich and well defined literature as well as useful teaching practices. There are two colloquiums and one seminar for each of these academic subjects, and the points structure is appropriately made for all of these tasks. Thus students have clear situation, and we have opinion that usage of digital exams for these academic subjects is beneficial. In this study a brief overview of our approach to student final exams is given.

Teaching material and its availability

The main idea behind this study is to give a brief overview of digital exam approach to management students. Beside theoretical viewpoints, this study provides our experiences with this modality of the exam. However very important point in education (and any type of exam) is teaching material.

Informatics from perspective of modern manager is well defined, and list of things in this field that one manager should know and understand is mostly clear. Thus teaching courses on various types of institutions that educate managers are usually very similar (if not the same). Although the this list is well known, and student with ease could use various public Internet sources to learn, students in general have tendency to use books, or other teaching materials that are provided by the teachers. On one hand this is good, because in provided sources all the teaching material is (or at least should be) logically sorted, and hand picked by the teacher, but on the other in that manner students have not much research enthusiasm.

Our viewpoint on above mentioned issues is that students must have all the necessary teaching materials provided by the teachers in paper, as well as online. Thus our students have opportunity to use books and scripts in paper printed form distributed by faculty library. Digital materials that is provided by the teachers is stored in cloud storage (so that we are sure of its availability) and includes presentations, video materials, and online practical education via CMS (eng. content management system) platform.

Naturally beside given teaching materials students are encouraged to use anything that they found interesting. Only downside of these materials that we found is that in these case they must be aware of its veracity. Usually only the best students have affinity to search for teaching materials on their own, thus interaction with teachers in that issue is recommended.

With this approach to teaching material, and its availability we feel confident to use digital type of exam, because all the necessary data is provided to students as it should be.

Methods of exams

A classic exam is conducted in one of two well-known ways - in oral or written form.

The good side of the oral form is that the complete process is completely under the control of the examiners. He or she leads each student individually through the examination process. This allows the highest degree of customization for an individual student. On the other hand, this also means that objectivity, i.e. the uniformity of criteria for students, inevitably decreases. It is customary for subjectivity to be avoided when choosing a question by the student randomly pulling out several questions from a larger set of questions. The subjectivity of evaluating the answers to these questions is much more difficult to avoid. An additional problem that can arise here is that some students experience this form in a very stressful way.

In written form, all students respond to the same or very similar questions. This mostly leads them to an equal position. Problems occur again during the evaluation of tests, because it is not so easy to maintain a uniform criterion.

Both methods are very demanding as far as teacher engagement is concerned. Engaging resources is minimal - this is especially true for oral examination. In the digital form of the exam, the engagement of teachers is greatest in the preparation phase. Later, the examination process is not particularly demanding. With the selection of the appropriate testing software, a very uniform criterion is achieved for all students. Of course, in this case, the technical preconditions for testing are the most prominent.

Digital exam software

Below we will list several different software. They will include commercial and free ones, those that run on a local computer and those who work online.

Moodle (Moodle)

Moodle is a complete Learning Management System (LMS), which also has a module for testing and automated grading. The teacher is able to design and build exams consisting of a large variety of question types, including multiple choice, true-false, short answer and drag and drop images and text.

Moodle's huge numbers of users across both academic and enterprise level usage makes it the world's most widely used learning platform, which contributes to the absence of linguistic constraints. It's also important that Moodle is provided freely as Open Source software.



Figure 1: A typical look of the Moodle user interface Moodle Demo Course

Source: https://leanpub.com/ (13. March 2018)

Hot Potatoes (Hot Potatoes)

According to the author, The Hot Potatoes suite includes six applications, enabling to create interactive multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises for the World Wide Web. Hot Potatoes is freeware, but it is not open-source.

Figure 2: A typical look of the Hot Potatoes user interface

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Source: https://hotpot.uvic.ca/ (13. March 2018)

Wondershare QuizCreator (Wondershare)

QuizCreator is typical commercial software by Wondershare Technology, a key member of the National Planning Software Enterprises of China. This is commercial product, but there is substantial discount for usage in educational purposes.

This program is full of features - it is possible to choose between 18 question types, including Multiple Choice, Fill in the Blank, Matching, Likert Scale & Short Essay. In addition, there are possibilities to enhance questions with images, Flash video and audio, including voice-over, text-to-speech, etc. and to insert math and science symbols with the equation editor to create quizzes for Math, Physics, and Chemistry. It is very easy to quickly design an assessment and publish it online, and then track the quiz results and receive insightful reports. Special benefit is ability to make a quiz more challenging with time limits, randomization of the questions, and branching quiz takers to different questions based on their responses.

Finally, there are a bunch of options to use quizzes - upload the published Flash quiz to the web, generate a SCORM quiz package for using in some LMS, produce stand-alone EXE file for CD/DVD usage, or export to Word or Excel files for paper-based testing.

Figure 3: A typical look of the Wondershare QuizCreator user interface

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Source: Printscreen from the test in the subject Business Informatics

Google Forms (Google)

We mention Google Forms here as one of all-accessible free solutions. Especially for those who already use other Google products such as Mail, Documents, Drive, YouTube, etc.

Google forms are primarily designed to create classic surveys, but you can easily add an option to automatically evaluate true/false responses. Like in other here mentioned solutions, in Google Forms is possible to select from multiple question types, drag-and-drop to reorder questions and customize values. Responses appear in real time and teacher can also access the raw data and analyze it with Google Sheets or other software.

Real-time collaboration between colleagues helps to create a quiz faster and analyze results together without having to send around multiple versions of the file.



Figure 4: A typical look of the Google Forms user interface

Source: Questionnaire printscreen, the Faculty of Hotel Management and Tourism in Vrnjačka Banja

Edmodo (Edmodo)

Edmodo is the biggest free social learning network in the world which connects teachers, students, and parents. It is designed to touch all aspects of learning in a way that is adapted to the moment in which we live. So it is possible to make digital tests and to perform their automatic evaluation. A special value is the ability to comment on the individual achievement of each student.

Figure 5: A typical	look of the Ed	dmodo user in	nterface
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Source: https://blog.edmodo.com/ (13. March 2018)

Kahoot! (Kahoot)

Kahoot! is a free game-based learning platform and it is not intended for organizing classical exams, but it is very convenient for short tests of understanding of some matter.

Basic type of questions is multiple choice and it is possible to add videos, images and diagrams to amplify engagement. Students answer the questions on their own devices, while questions are displayed on a shared screen. This kind of a social learning promotes discussion and pedagogical impact.

Beside of this usage in classroom, teacher can assign kahoots as homework. Students play kahoots on their phones for revision and reinforcement. In homework challenges, questions and answers will appear on their phone screens.

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Figure 5: A typical look of the Kahoot! user interface

Source: Printscreen from the test in the subject Business Informatics

Open source software - a possible solution?

The question is what type is the most appropriate solution for use in educational institutions. In spite of ongoing technical challenges, digital

exams promise a lot. Open source software offers one of the possible approaches to solving technical problems in providing the optimal way for their realization.

Numerous characteristics of the open source software give it an advantage over the classic closed, ie proprietary, software. Some of the more important are that distribution is not burdened by payment; the program code is available, so the changes that may be needed to adjust to the specific purposes are easily feasible; there are no implementation restrictions, that is, use in any area and for any purpose is possible; there is no obligation for using any other software...

Open source software in education already covers the broadest possible range of levels - from individual learning materials, through established courses and complete portals, to virtual universities.

In addition, according to the already published opinions, the European Commission will further increase the role of open source software for many key ICT services and software solutions. Its latest, expanded strategy places a special emphasis on providing support for wider use of open source software (European Commission).

And UNESCO believes that the free and open source software model provides interesting tools and processes that can be used to effectively pursue the Millennium Development Goals (UNESCO).

On the other hand, there are numerous factors that affect the quality reduction in the use of information and communication technologies in education. Some of them are the lack of financial resources for their acquisition, insufficient level of training of teaching staff for their adequate use, which often additionally entails a lack of motivation.

The use of open source software introduces some additional difficulties. What counts in one of the main advantages of this software can also be one of its flaws. The availability of a source code that, if necessary, allows it to upgrade and adapt to the needs of users simultaneously means that people with evil intentions can easily detect its security vulnerabilities.

With open source software, there are not enough strong guarantees that the development of a particular software will not end before achieving satisfactory functionality. Even if this does not happen, there is no guarantee that there will be support in the future for correcting the detected deficiencies or for developing new features. This possible lack of further support, along with a potential lack of security, is probably one of the biggest problems this movement encounters.

It is important to keep in mind that in case the open source project financing ends, the educational institutions should support its further development in order to preserve the functionality of teaching. They need to quickly turn to other sources of funding, such as various state funds and the like, which is not always possible and easily feasible.

From the perspective of security, it is important to note that open source software is run by trained users who can optimally extract the maximum in all respects. This does not mean that only engineers should use such software, but that it can be used by all educated users at the user or editorial level, but that for the administration is, however, required engagement of the professionals.

Our experiences

After last three and a half years of using digital tests on colloquiums in two IT subjects and two years of their use in final examinations, we can already draw some observations. Observing students' achievements before and after the introduction of digital exams, we concluded that they did not introduce a significant deviation (Table 1 and Table 2).

Academic year	Pre-exam obligations	Final exam
2011/2012	59.19	15.17
2012/2013	56.34	19.55
2013/2014	52.89	20.09
2014/2015	56.61	17.81
2015/2016	50.99	19.27
2016/2017	47.78	20.38
2017/2018	46.50	18.41

Table 1: Results at the academic subject Business Informatics

Source: Results of the colloquiums and the exams for the subject Business Informatics, 2011-2018

Academic year	Pre-exam obligations	Final exam
2014/2015	48.45	21.59
2015/2016	51.37	19.66
2016/2017	47.97	18.53

Table 2: Results at the academic subject Information and CommunicationTechnologies in Hotel Management and Tourism

Testing is done by the professor and teaching assistant independently pass the test with all the questions involved. The goal is to achieve 100% correctness of the response. This way a significantly higher degree of accuracy is achieved than in any written test. Our tests run on a server on the Internet, but we always have a ready-made variant with the server in the local network in case there is a problem with the Internet connection. The results of the test for each individual student are sent to at least two different email addresses, but as an additional level of security, the teaching assistant records the achieved score on the spot.

Since we teach two computer science subjects, we have at our disposal a computer cabinet and complete infrastructure required, so there are no additional costs for the realization of digital testing. Although at first glance it might be expected that the main point for exam, when done in this (digital) way, is that students have good ability for reproduction of learned materials, it is not the case. One portion of the exam questions are definitions, and similar theoretical material and we could classify that portion of exam as a part where students should reproduce what they have learned.

On the other hand there are many questions that are related to first group, but are given in such manner that students must use their knowledge and creativity to provide correct answer. Usually those are some sort of problem situations. One example would be that student should pick the computer with IP address that is not in their local subnet from given list of computers (IP addresses), and given subnet mask. So for this question student should show his/hers knowledge and (well organized) understanding of several portions of teaching materials concerning basic computer networks (Milašinović & Kraguljac, 2016).

Source: Results of the colloquiums and the exams for the subject ICT in Hotel Management and Tourism, 2014-2017

At the end of this section, we also need to look at the measures we take to prevent cheating on the exam. To begin with, the set of questions consists of three groups of 30-40 questions from three different areas of teaching material. Each student receives ten randomly selected questions from each of these groups. For questions that have the answers offered, these answers appear for each student in a different way, i.e. in the random order. So, students get a little bit different questions in random order, and when they get the same question, the offered answers are mixed up. An additional measure to reduce the chances of cheating is that the test is time-limited. We set the time allowed for testing so that after passing through all the tasks, students do not have much time to use for trying to communicate and cheat. Of course, the teaching assistant is present during the course of the test and he takes care that the students do not communicate with each other and do not use some other forbidden means.

We also examined the average number of points earned at the final exam according to the time that students need to take the test. The results are shown in Figure 7.



Figure 7: Average number of points earned at the final exam according to the time that students need to take the test

Source: Results of the exams for the subject Business Informatics, january/february 2018

According to these data, we can notice that there is no clear correlation between the points and the time spent. It is interesting to note that students who are best prepared and who achieve the best results generally need the least time. From this we conclude that the questions are well selected and that the teaching field is adequately covered by lectures, exercises and available teaching materials.

On the other hand, students who achieve the worst results need the most time. This could mean that the total testing time is well adjusted, because according to the graph shown, similar achievement would be that the total time was set to 23 minutes instead of the current 25.

Several advantages and downsides of digital exam

By no means there is no ideal formula when student exams are issue. There are good and bad points in any type of exam. Although the absence of oral exam means that there is no way that teacher can use his/hers intuition to pick the questions and check student's knowledge, and (more importantly) understanding - and that is the main downside of this system for sure, there are several important advantages that can be very versatile if used adequately:

- Due to involvement of technology, rather than teacher digital tests and exams can be performed often. In that manner students can be driven to learn in continuity rather than to learn to pass final exam. Even with tests that are not hard, in this case students must constantly refresh learned materials during the teaching course.
- Time consumption for digital tests is minimal. If tuned adequately teacher can perform these tests on weekly basis, as a standard part of regular teaching classes. That is because students have limited time for test (and can be very short and effective enough), and computer check all the tests by itself, so instantly students and the teacher is informed about the points (so no time is spend for verification of the test).
- For each digital test, teacher has all the data for each student. In that way teacher is able very easily to track every single student while the teaching course last, and to timely act if any student needs intervention or suggestion.
- If digital exams are performed, all failures that may be caused by human (teacher) are avoided. Thus there is no subjectiveness of a teacher, with large number of given questions effect of luck (in picking questions) is minimised, and even in case of student any

psychological stress that can be caused directly/indirectly by the teacher is avoided.

- In general contemporary students seems to be more familiar with digital devices overall, thus their reaction to digital exam is usually positive. We have opinion that this attitude of the students is boosted by the fact that in primary and high school they constantly had oral and written exams.
- In case of informatics digital exam often is considered to be more natural than the classic one by the students. This is probably due to the fact that many digital tools informatics teacher and his/hers students employes in education in general.

Conclusion

It seems that no matter of aspirations and intentions of one person or his/hers attitudes towards work and development - time goes on by itself. Information and communication technologies influenced all spheres of our work and everyday life for several decades, thus digitalization seems to be inevitable in various fields. If that is the case - and it seems that it is, the best approach would be to adapt to contemporary methods. In that manner teachers should take advantage on this digital development, rather than to let their modus operandi suffer its consequences.

If we try to be objective as much as possible, it seems that there is bad and the good side of the coin in this case. Although for several years we tried to find enough reasons to dismiss idea of digitalization of final exams at our Faculty, for each downside we found an advantage. All in all we have no formula ideale, so as a conclusion in this case we have to treat legitimate digital exam in the same way as classical one. This conclusion derives from the fact that in this study we tried to observe effects of digital exam in teaching subjects that are in field of informatics and that our students are future managers (so all informatics education is adjusted to suit their profile.

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