



Experiences with EXAM/ONYX exams

J. Hoffmann, A. Brosius

Chair of Forming and Machining Processes, Institute of Manufacturing Science and Engineering, Faculty of Mechanical Engineering, TU Dresden

Abstract

Ein Jahr digitale Lehre bedeutet auch ein Jahr digitale Prüfungen. In diesem Paper sollen dazu einige praktische Erfahrungen aus Sicht der Professur Formgebende Fertigungsverfahren (FF) zusammenfassend vorgestellt werden. Dabei ist der Einsatz der an der TU Dresden zur Verfügung stehenden Softwareplattform EXAM@TUD Schwerpunkt der Betrachtungen. Bei deren Nutzung gibt es neben vieler positiver Ansätze auch einige Schwachpunkte, die noch einer Verbesserung bedürfen. Diese sollen als Erfahrungsbericht aus ca. 60 Online-Klausuren (Probe- und Abschluss) hier näher vorgestellt werden.

One year of digital teaching also means one year of digital exams. This paper will summarise some practical experiences from the perspective of the Chair of Forming and Machining Processes (FF). The main focus is on the use of the EXAM@TUD software platform available at the TU Dresden. In addition to many positive approaches, there are also some weak points in its use that still require improvement. These are to be presented here in more detail as a report of experience from approx. 60 online examinations (trial and final).

*Corresponding author: jens.hoffmann@tu-dresden.de

This article was originally submitted in German.

1. Introduction

One year of digital teaching also means one year of digital exams. This paper will summarise some practical experiences from the perspective of the Chair of Forming and Machining Processes (FF).

1 Klausurarbeit Umformtechnische Verfahrensgestaltung
Umformtechnik, Zerspan- und Abtragtechnik, Oberflächen und
2 Schichttechnik - alte DPO
Umformtechnik, Zerspan- und Abtragtechnik, Oberflächen und
3 Schichttechnik - neue DPO
4 Klausurarbeit Werkstoffherstellung und Fertigungstechnik
5 Klausurarbeit 1 Fertigungstechnik
6 Fertigungstechnik RES MECH
7 Klausurarbeit Abtragtechnik und Werkzeugkonstruktion
8 Produktionstechnik - Produktion und Planung MW-MB-PT-02
9 Produktionsautomatisierung und Logistik
10 Klausurarbeit Fertigungsplanung - Teilefertigung
11 Klausurarbeit Präzisions-, Ultrapräzisions- und Mikrozerspanung
12 Fertigungsplanung WING
Verfahren der Urform- und Umform- und Zerteiltechnik - Werkstück-
13 und Verfahrensgestaltung
14 Klausurarbeit Fertigungsplanung 1
15 Klausurarbeit Fertigungstechnik und Produktion & Logistik
16 Klausurarbeit 2 Fertigungstechnik
17 Fertigungstechnik MW-MB-06
18 Klausurarbeit Werkzeuge der Umform- und Zerteiltechnik
Klausurarbeit Produktionstechnik - Werkzeugmaschinen und
19 Produktionsautomatisierung
20 Klausurarbeit Rapid Product Development
21 Klausurarbeit Mehrachstechnologien

Fig. 1: Online examinations in the 2020/21 winter semester (trial and final examinations in each case)

In teaching, the Chair focuses on the subject areas of casting and forming technology, cutting and abrasive technology as well as produc-

tion automation and production planning in the area of parts manufacturing. The current teaching programme is correspondingly extensive and has been implemented digitally to a large extent since the summer semester 2020, as is the case at the entire TU. Digital teaching also includes the matching range of examinations as proof of teaching and learning success.

Due to the large teaching volume, there were a total of 16 test and final exams at the end of the summer semester 2020 and a total of 41 at the end of the winter semester 2020/21, all of which were carried out digitally online either on the students' own responsibility or in cooperation with other departments. (Fig. 1).

The various examinations were realised with the help of the EXAM@TUD system (Fig. 2). This software was set up by the company BPS Bildungsportal Sachsen GmbH specifically for the TU Dresden. The examinations had between 4 and 400 participants. The duration of the examinations was between 80 and 180 minutes, with a share of 20 to 90 minutes for the FF professorship.

The reason for this high number of examinations is also due to the transitional phase between different diploma examination regulations (DPO) in the field of mechanical engineering as well as the desire of the university and faculty management to allow students to take all examinations in every semester.

The screenshot shows the OPAL Exam@TUD interface. At the top, there is a search bar and user information for 'Jens Hoffmann'. Below the navigation bar, the user is welcomed to the platform. The main content area is divided into two columns. The left column, titled 'Meine Institution', displays the logo and contact details for Technische Universität Dresden, including a phone number (0351) 463-34942 and an email address (exam@tu-dresden.de). It also features a table for exam times during the week of February 22nd to 27th, 2021. The table has columns for each day and rows for time slots: 07:00-11:00, 11:00-15:00, and 15:00-19:00. The right column, titled 'Zuletzt geöffnet', lists several exams with right-pointing arrows, such as '2020-21 MAX Probeklausur' and 'Klausurarbeit Fertigungsplanung - WING (337510)'. A blue banner at the bottom right contains the text 'OPAL Exam@TUD: Die Prüfungsplattform der Technischen Universität Dresden'.

Fig. 2: Start view of the EXAM3 examination platform

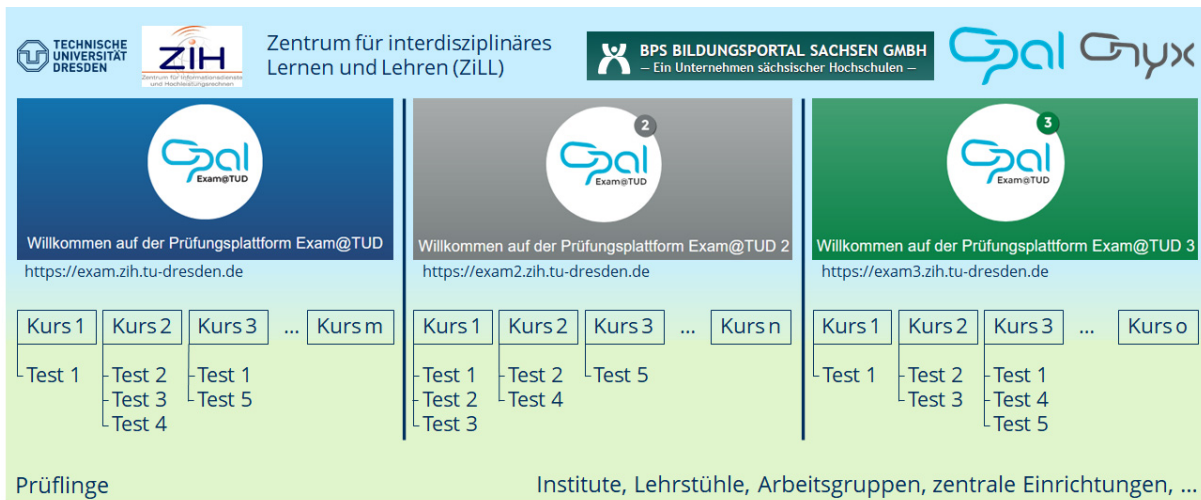


Fig. 3: Structure of the EXAM examination platform in the examination period after the 2020/21 winter semester

2. Software used

As mentioned before, the examination platform EXAM@TUD [1] with the software ONYX from BPS GmbH [2] is used at the TU Dresden. After only the EXAM platform could be used in summer of 2020, EXAM2 and EXAM3 are now also available (Fig. 3). According to information from ZILL (Centre for Interdisciplinary Learning and Teaching) [3], up to 500 participants can be active at any of them at the same time. From previous experience, these platforms under the responsibility of the ZIH can be attested to be highly stable and reliable.

However, the use of three parallel platforms without a software junction quickly makes it difficult for the examiner to keep track of everything, and the effort required for data transfer is relatively high. Currently, a course must be downloaded from one platform as a packed archive and then uploaded to one of the other two platforms. This should be improved in order to be able to use the platforms as parallel drives, as is usual in Windows, and also to enable links between elements (courses, tests) of different platforms.

3. Delimitation

The examinations are conducted on the basis of the valid examination regulations of the respective area. The procedure shown in Fig. 4 is carried out in advance.

Basis: Studienordnungen

- Lehrveranstaltungen im laufenden Semester
zusätzliche Prüfungen laut Festlegungen (Nach-/Wiederholer, DPO-Wechsel, ...)
- Terminplanung durch Prüfungsamt
- Abstimmung Art der Klausur (Online/Präsenz/...)
- Terminfeinplanung und Zuweisung Ort/Plattform durch TU-Verwaltung

- Erstellung Probe-/Abschlussklausur
 - Information Teilnehmer
 - Prüfung der Kurse und Tests durch ZiLL
 - Klausurdurchführung
 - Klausurauswertung/ Notenmeldung
- Gegenstand
dieser Präsentation

Fig. 4: Delimitation of the area of examination preparation, implementation and evaluation considered in this paper

The steps marked accordingly in the illustration will be examined in more detail below. They differ significantly from the usual procedure for classroom examinations.

4. Exam preparation

Digital examinations require a different, usually more labour-intensive technical and information preparation than typical face-to-face examinations.

Generally, an ONYX-based digital examination consists of an OPAL course and one or more test modules, each containing an ONYX test. A test containing the respective tasks can be used in different courses if required.

Within the courses, the control of the examination as well as the administration of the participants takes place. For this purpose, various pre-settings and links have to be set up.

The individual tasks are created and integrated in ONYX. These can be grouped into sections according to certain criteria for instance for different scientific areas.

The administration of the participants and their results is done within the course.

In summary, it can be said that the preparation effort for a digital exam is usually much higher than for a face-to-face exam.

5. Course

The basis for creating an online exam is an OPAL course (Fig. 5). This can be created or reused as a new course or as a copy. In case of a reuse, the user data has to be updated. Old data will be lost. From the point of view of preserving the results of previous online examinations in accordance with the applicable regulations, it is advisable to work with a newly created copy of the course. In the case of sample

examinations, this may well be deviated from, as the aspect of retaining user data does not play a role here.

In connection with this, there is a major problem with the use of ONYX as with OPAL as a whole: The file management (Fig. 6). It is not possible for the user to work with folders or directories on the course level and thus to structure the existing data in a meaningful way. Up to now, a meaningful structuring can only be done via the name of the course (e.g. prefixing the relevant examination period to the course name). With approx. 60 courses, it quickly becomes confusing. There is an urgent need for action here on the part of BPS GmbH.

For our exams, as already mentioned, we use new or copied courses. However, these have to be set up each time, because unfortunately the default settings of the EXAM/ONYX system do not meet the requirements of the TU Dresden or the ZILL (Fig. 7). An adjustment is required especially for the visibility of the evaluation of the tests carried out. Here, too, there is a need for improvement in the further development of the software for the future.



Fig. 5: Start view of an online examination course

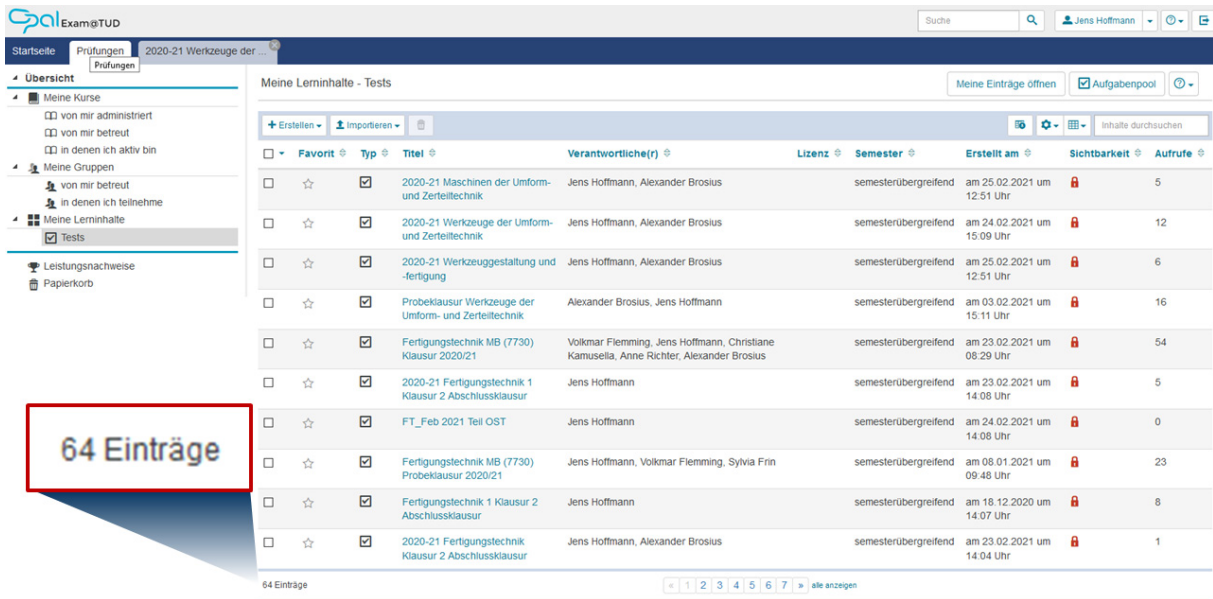


Fig. 6: "Course management" in EXAM/ONYX

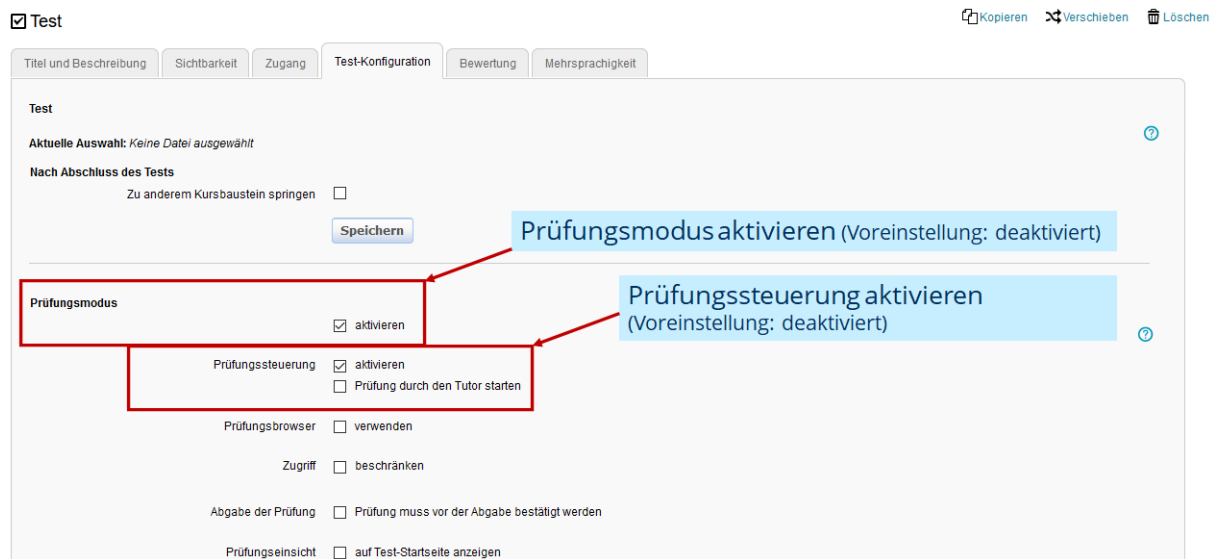


Fig. 7: Settings in the test configuration (example)

Participants of the examinations can be invited according to the specifications of the system or enrol independently. At the chair, the latter variant is generally preferred in conjunction with a confirmation of the conditions of partic-

ipation for the examination. It should be noted that participants cannot unsubscribe independently (unfortunately no default setting in the system, must be set up manually, Fig. 8).

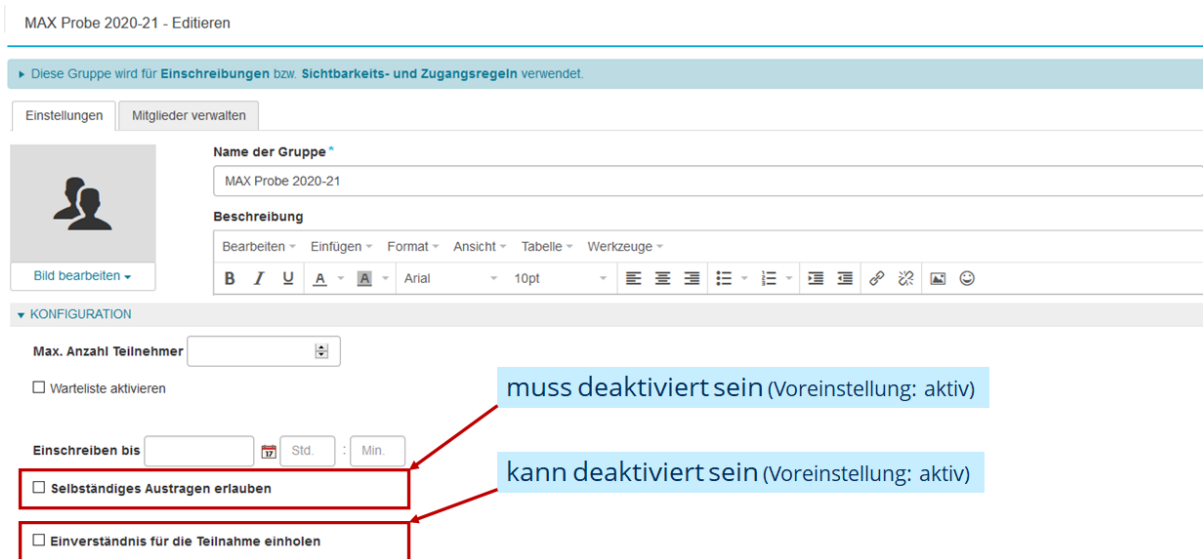


Fig. 8: Settings for member administration

Please note that certain settings for exam control have to be realised in the OPAL course (e.g. number of solution attempts in the test module) or in the ONYX test (e.g. exam duration). In the case of the number of solution attempts, it is also possible to specify a setting in both places, but the setting in the ONYX test has no influence on the exam procedure. At this point a synchronisation of the settings between OPAL and ONYX is absolutely necessary.

6. Test

The ONYX test contains the various tasks of a written exam. As already mentioned, one or more tests can be used for an examination. Each individual ONYX test must be integrated in the course via a test module. The use of an ONYX test in different test modules or OPAL courses is possible and can reduce the workload.

Within an ONYX test, tasks can be grouped into sections (Fig. 9). Here, a separate determination of the achieved points is possible. Unfortunately, so far these are only displayed in the test evaluation, but cannot be saved for further processing, e.g. as an Excel file. The only option is to export the data manually - the lack of this functionality is not comprehensible for the user.

In the test, as already mentioned, various spec-

ifications can be made for exam control. These include, for example, the selection of tasks, their sequence and the way in which the examinee works through them (linear/free).

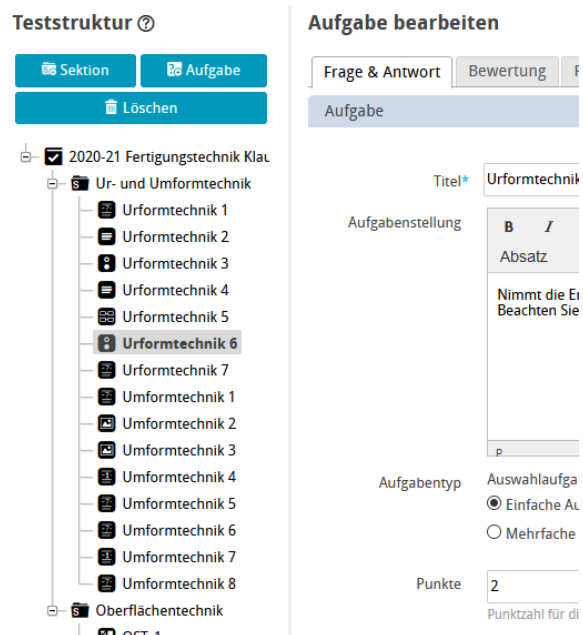


Fig. 9: Structure of a test with sections

These definitions require sound knowledge of the effect of and content of the parameters, experience and concentration when setting them. It would be desirable to have a better pre-setting of the parameters specifically according to the TU's specifications as well as a better description of the functionalities.

7. Task types and associated difficulties

Various types of tasks are available for use (Fig. 10). These are naturally different from those known from face-to-face examinations. The exception is the so-called free text. The other task types are easy to use. A corresponding explanation is stored in the ONYX editor and available via ZILL. Our department has some special experience in this area, which we will now discuss.

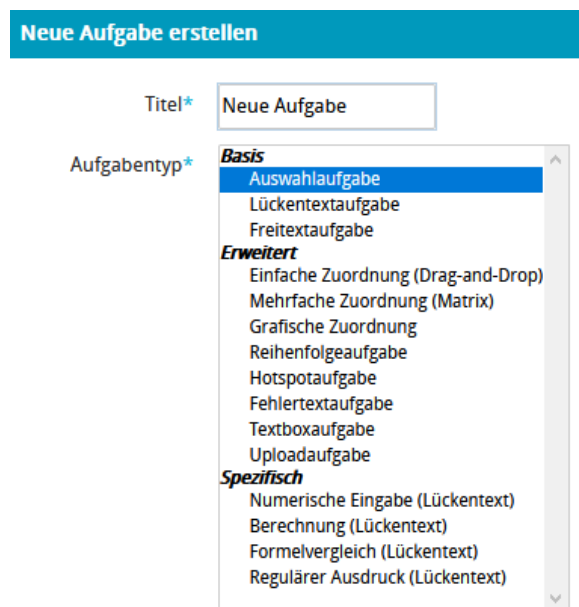


Fig. 10: Available task types

Questions can be copied or moved between different tests. This can be done using the "extract" function and subsequent import. If this is to be done between different EXAM@TUD platforms, a down- and upload is also required, as already described for the courses. This can certainly be done more easily and in a more modern way, and is thus another wish for future developments.

7.1 Problematic selection task "Multiple Choice"

For choice tasks, the variants single and multiple choice are available. While there are no major problems in creating a correct solution (single choice), the situation is different with multiple choice. Here, the specifications of the MC guideline of the TU Dresden must be observed

[4]. This requires a number of settings in the assessment that do not necessarily seem logical at first. The question is why these university-specific requirements are not better addressed by default settings in the ONYX system. In our view, there is a need for improvement here.

7.2 Problematic "Cloze Text"

One possible form of task is the cloze text. In this case, a word or a group of words or a number is replaced by a gap in a text. The examinee has to enter the corresponding solution in this gap. This input is compared by the system with a default and possibly defined alternatives. Despite the possibility of programming a "fuzziness" (letter deviation, upper/lower case), it is difficult to record all possible correct answer options. This leads to frequently necessary manual corrections and thus increases the effort. The gap is useful for exact values (e.g. numbers), otherwise rather impractical.

7.3 Problems with "Free Text"

The question type "free text" is very similar to the familiar question type in presence exams. Here, the participant can enter corresponding explanations to a question in a text field. These must be assessed manually by the examiner after the examination. Automating the assessment is almost impossible with this type of task.

Aufgabe bearbeiten

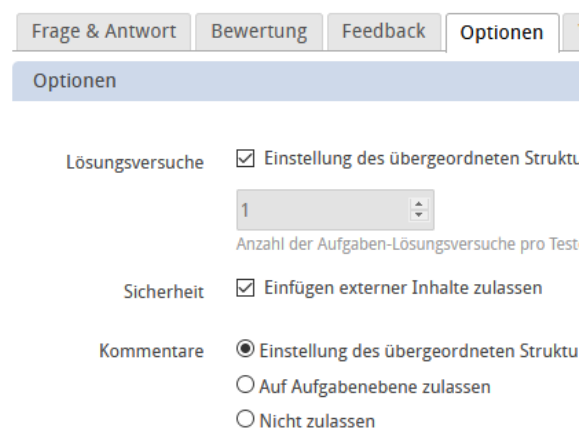


Fig. 11: Display of the section results

When creating a task of this type, the examiner should prevent the participant from simply copying texts from other applications (pdf files, internet, ...) by means of copy & paste, which is not allowed and constitutes an attempt to cheat. This can be done by setting an appropriate option. However, this is also a little hidden ("Allow insertion of external content", Fig. 11).

In contrast to the other task types, the preparation effort for free-text tasks is very low, but more time has to be invested in the evaluation. Especially with a number of participants of more than 20 ... 50, this effort has to be questioned individually.

7.4 Uploading files

In addition to free-text tasks, it is currently also possible to upload files as part of an examination. In this way, for example, solution paths or sketches can be recorded by the examinees and made available for assessment. This makes it possible to better understand the processing path and to take subsequent errors into account.

Depending on the file size and the available internet connection, however, this method can become problematic. The assessment effort is similar to that of free-text tasks.

8. Preparation for implementation

First of all, before the examination date, do not forget to make the created OPAL courses (not ONYX tests) public (setting in EXAM@TUD) and to set the visibility and access rules for the course correctly. Especially the time and the affiliation to certain participant groups have to be considered.

After the creation of the courses and tests, the problem arises of passing on information to potential participants about modalities and the link to the course. Unfortunately, there is no active support from the examinations office and the study office for online examinations with regard to informing participants.

The ZILL staff will kindly check prepared examinations before the examination date. Necessary corrections should be made before the exam. The fact that there is sometimes not much time available for this is something that

the people responsible for the courses generally have to criticise themselves for, as the completion of the required courses and tests is sometimes done very "promptly", leaving hardly any time for checking by the ZiLL.

9. Participant management

One point in the implementation of online examinations that has not yet been looked at in detail is the changing topicality of the participants. First of all, the already mentioned settings in the user administration must be ensured.

There are two possibilities for recording the active participants.

- a) If the complete current participant lists are available in advance via Hisqis or Selma (administration systems for student services at the TU Dresden), these can be used for an invitation and the subsequent participation in the examination. This data is to be recorded in the participant administration and only these participants are to be granted access. Unfortunately, this is not always possible due to the variety of participants from other areas and the resulting incompleteness and confusion of the data.
- b) Alternatively, automatic enrolment can be defined when accessing the course. This allows anyone who has the access data (link and password) to take the test. It is possible to link the automatic enrolment with an agreement to the current examination conditions (module "Enrolment for the examination"). However, there is a risk that unauthorised persons may also gain access.

After the examination, the results of the participants have to be assigned to the various Hisqis and Selma data sets, which is sometimes very labour-intensive.

10. Performance of the online exam

The implementation of the online exams proved to be largely problem-free in the winter semester 2020/21. Unless human errors (wrong test included, wrong settings, ...) lead to problems, the three platforms have run stably.

The person in charge has few possibilities to intervene (restart test, end test, add time), but none at all in case of disturbances of the internet connection. It is also almost impossible to monitor the way the participants work (attempts at cheating).

In rare cases, the number of examination attempts (which normally should not exceed one) had to be reset manually via the assessment tool when the examination was cancelled.

The timing of the exam is currently unclear. There is a time-defined access to the OPAL course as well as a limitation of the processing time of the ONYX test. Does the access period only mean the limitation of the start time of the exam by the student or does it also limit the processing time to the total time window? How is this to be reconciled with the allocated time slot for the online exam? This requires clarification on the part of the examination board.

11. Evaluation of the online examinations

After the online examinations have been completed, the evaluation is required. Various tools are available for this. First, the manual evaluations (free text, cloze text, file upload) should be carried out. These are administered in the system together with all others after manual entry. Then the result data is available for evaluation in the system. In the case of a continuous test (e.g. without using sections for separate sub-tests), the result export can be done via the download in the evaluation tool. If different sub-tests are to be evaluated separately and sections were used in a test, the file archiving function must be used. This creates a very extensive file with all information. However, this is currently only available in csv format and must first be transformed into Excel. The partial results are displayed on the screen (Fig. 12), but unfortunately not saved. Here, too, an improvement in user-friendliness would be desirable.

Test:	Produktion und F
Abgabedatum:	19.02.21, 11:50
Anzahl Fragen:	58
Erreichte Punkte:	86,83 / 137
Punkte der Sektion S1 - Arbeitswissenschaft (10 Punkte):	18 / 32
Punkte der Sektion S2-Fertigungsplanung - Montage:	8,34 / 20
Punkte der Sektion S3 - Fertigungsplanung - Teilefertigung:	22 / 26,5
Punkte der Sektion S4 - Produktion und Logistik:	38,5 / 58,5
Benötigte Zeit:	1:19:59

Fig. 12: Display of the section results

12. Conflict DPO - ONYX

In addition to other essential specifications, the DPO assigns the individual courses to modules. The criteria for the corresponding examinations are defined for these. One or more courses can belong to a module. One example is production technology in the 1st semester (Fig. 13).

The module MW-MB-PT-03 contains the two courses Machine Tools and Production Automation, whose time scope is identical. The total examination time is 180 min. The two parts are provided by different professors. It makes sense to conduct two partial examinations with separate content and then offset the partial grades. How would it be possible to implement this in EXAM@TUD?

Variante 1 would be the use of two separate tests and correspondingly two test modules. The examination results are then also determined separately. However, an overall examination time cannot be defined, but only the times for each sub-area, which is not legal according to the DPO.

Variante 2 would be a test with two corresponding sections. A total test time is defined and the examinee divides it up himself. The problem here is that no separate results can be determined for the two sections. Only a very large, unclear file can be generated for manual evaluation via file archiving.

As already mentioned, section results are displayed but not saved.

- Beispiel: Fertigungstechnik 1. Semester MW-MB-06, knapp 400 Teilnehmer
 - 4 Haupt-Teilgebiete: Ur- und Umformtechnik, Zerspan- und Abtragtechnik, Fügetechnik, Oberflächen- und Schichttechnik, „Sonstige“
3 ... 4 Professuren fachlich beteiligt → getrennte Aufgaben und Auswertung
 - Prüfungsdauer laut DPO: 180 min (keine Aufteilung auf Teilgebiete genannt)
- Umsetzung mit EXAM
 - ein Testbaustein pro Teilgebiet
 - Aufgabenstellung und Auswertung unkritisch (je Testbaustein ein Test)
 - Zeitbegrenzung kritisch (Zeit je Test bedeutet Aufteilung der 180 min)
 - ein Testbaustein für alle, Arbeit mit Sektionen im Test
 - Aufgabenstellung unkritisch
 - Auswertung äußerst aufwändig
(keine Ausgabe der Ergebnisse je Sektion, Arbeit mit Excel-Datei aus Datenarchivierung „schwierig“)
 - Zeitbegrenzung unkritisch (Gesamtzeit 180 min für Gesamttest)

Fig. 13: Problematic different sub-areas in one test

13. Problem cases Hisqis / Selma

A major problem is the lack of interfaces to the software platforms Hisqis and Selma used in the examination office and the study office. All systems work with the input and output of data in Excel format, but unfortunately that is where the similarities end. The structure and content differ considerably, which means that a more or less large amount of manual work is required for the corresponding data transformation.

14. Summary

Overall, the results of the current examination period show that the online examinations are secure and stable. More time has to be spent on preparing the exams compared to face-to-face exams, and the questions have to be adapted to the possibilities of the software. Whether this is positive or negative for the students depends on the subject and the subject matter.

The effort required for the evaluation of the examinations can vary from very small to extensive. The reasons for this were explained in detail in the previous sections. The question of the legally secure detection of attempted cheating remains open. These can be limited by appropriate measures in the design of the examinations, but not completely excluded. It must be assumed that all documents (scripts, books, internet, ...) are available to the participants during the examination. This must be

taken into account when designing the tasks and exam management.

For the EXAM@TUD platform used, here is a summary of what we consider to be the most important changes and development requests:

User systems EXAM / EXAM2 / EXAM3

- Use of the courses / test across platform boundaries or use of a uniform platform
- Simplify transfer of courses / tests between platforms (no longer via download/upload with local storage).
- Creation of a folder structure for courses to increase clarity (analogous to task pool)

OPAL Courses / ONYX Tests

- Customise default settings
 - User management with blocking of independent unsubscribing and deactivating the sending of information about enrolment
 - Limit examination attempts
 - Deactivate test evaluation display
 - Activate examination control
- Coordinate settings between course and test (time for access, number of accesses, ...)
- End of access time means end of processing time of the test
- MC tasks: Adapt default settings to TU Dresden MC guideline

- Enable direct output of section results to file
- Adapt assessment tool to reality / make it more flexible
- Enable output of task/part/section results to file
- Coordination / implementation of study regulations with the corresponding software options
- Simplify transfer of tasks between tests

Examination organisation, administration

- Information for students also via examination office (link, deadline)
- Provision of contact details from Hisqis / Selma
- Uniform data formats or direct interfaces Hisqis - Selma - ONYX

These wishes should be collected by the faculty and transmitted via the TU or directly to BPS GmbH.

Finally, we would like to thank our colleagues at the Examinations Office for Mechanical Engineering for their flexible support in clarifying a wide range of problems in the organisation and administration of the examinations, the staff at ZILL for their active support in preparing and conducting the online examinations by providing training, documents and a critical look at the courses, and also the ZIH for the stable computing technology.

Literature

- [1] <https://exam.zih.tu-dresden.de>,
<https://exam2.zih.tu-dresden.de>,
<https://exam3.zih.tu-dresden.de>
- [2] <https://www.bps-system.de/>
- [3] <https://tu-dresden.de/tu-dresden/organisation/rektorat/prorektor-bildung/ZiLL>
- [4] <https://tu-dresden.de/tu-dresden/organisation/rektorat/prorektor-bildung/zill/e-learning/corona/digitale-pruefungen/bewertung-von-mc-aufgaben>
- [5] https://tu-dresden.de/ing/maschinenwesen/ressourcen/dateien/studium/pruefungsamt/folder-2015-05-26-9353339805/mbpt_19_2601.pdf?lang=de ;
retrieval: 26.02.2021, 07:00 a.m.