

Study accompaniment with E-Assessments

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Abstract— In this paper we present our concept of a virtual classroom for mathematics lectures in the study beginning phase. It describes the two main elements the course uses within our Learning Management System. The first element is the dynamic e-tests-method and the second interactive teaching videos. The tests are already in active use. Therefore, initial experience and feedback are described. The videos are in the prototype status. Therefore here only the evaluation approaches are described.

Index Terms—Educational Video, Training, Distant Learning, Educational technology, Engineering education

I. INTRODUCTION

A virtual classroom with the subject "Mathematik in der Studiengangsphase" was created at BTU as a part of the funded project supported by BMBF (Federal Ministry of Education and Research) for improving the quality of education and blended learning. The course is aimed at beginning students of engineering science at the BTU in Senftenberg.

It's about a free available course within the learning platform Moodle [1] from the university. (See Figure 1)

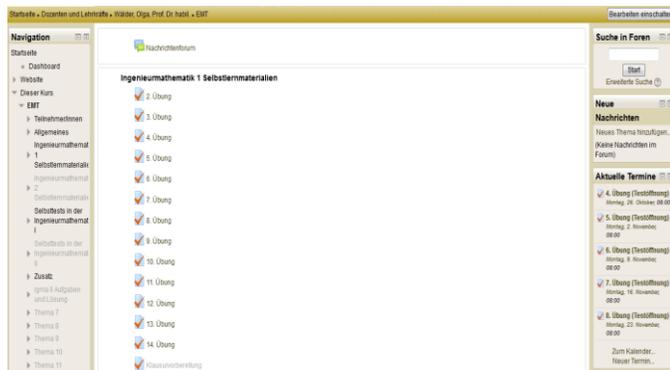


Fig. 1 Free Course

II. E-TESTS

In this course various E-Learning-Scenarios are combined. The main content of the course are the E-Tests created with Moodle.

Weekly there are self-controlling knowledge tests and interactive videos for the students, which are based on the mathematic lessons and tasks. Since the summer semester of 2015, a BETA-version of the course is available for the students. The tests are mainly of multiple choice and "Fill in the blank" tasks. (See Figure 2)

Frage 4
Bisher nicht beantwortet
Erreichbare Punkte: 7,00
Frage markieren
Frage bearbeiten

Gegeben sei die Funktion

$$y = f(x) = 5 + \frac{2}{(x-4)}$$

a) Untersuchen Sie, ob diese Funktion gerade oder ungerade ist.
b) Bestimmen Sie den Definitionsbereich, den Wertebereich der folgenden Funktion und skizzieren Sie diese Funktion!
c) Berechnen Sie die links- bzw. rechtsseitigen Grenzwerte an den Grenzen des Definitionsbereiches! Welche Unstetigkeitsart liegt bei dieser Funktion vor?

Hinweis(1): Brüche ggf. als Dezimalzahl auf 2 Stellen nach dem Komma runden (0 ausgenommen, d.h. NICHT 0,50)!
Hinweis(2): "Strg" + "+" oder "*" zur Bildschirmvergrößerung bzw. -verkleinerung.
Hinweis(3): Bei $\pm\infty$ (falls notwendig) schreiben Sie bitte $\pm\infty$.

a) Die Funktion ist

b) D(f): (Hier die Zahl eintragen.)

W(f):

Fig. 2 Example of a Test

The special thing about the tasks is that they are created with changing variables. In this way, the students can solve the tasks multiple times without knowing the results, because the changing variables are adapting. Students can find out immediately whether they have solved the task correctly. A detailed feedback with a possible solution, which contains the used variables, is shown. (See Figure 3 and 4) Because of the structure of the test, the students are allowed to practice tasks they had problems. They can try again without knowing the exact result before.

Aufgabe 8

Lösen Sie das folgende Lineare Gleichungssystem :

$$-x_1 - x_2 = 7$$

$$4x_1 - 8x_2 = 5$$

$x_1 =$

$x_2 =$

Fig- 3 Example of a dynamical task

$$\begin{array}{r} -x_1 - x_2 = 7 \quad * 8 \\ 4x_1 - 8x_2 = 5 \\ \hline -8x_1 - 8x_2 = 56 \\ - \\ 4x_1 - 8x_2 = -5 \\ \hline 12x_1 = -51 \quad /12 \\ x_1 = -4.25 \\ -4.25 \text{ in eine Ausgangsgleichung einsetzen.} \\ -(-4.25) - x_1 = 7 \quad + x_1 \quad - 7 \\ x_2 = -2.75 \end{array}$$

One possible correct answer is: -4.25, -2.75

Fig- 4 Example of a task with individual solution

To create the tests in the learning platform, an additional module has been integrated. The module is called "Question Types: Formulas". (Figure 5) [2] A LaTeX filter was also needed in order to make the numbers dynamically. For this "MathJax" is used. In addition the TeX-Editor "MathSlate" was implemented. [3] [4] Tasks can so be reproduced optimal on mobile devices. Figure 5 shows how a question is generated. First, the requested variables with corresponding value range are defined. Thereafter the variables are entered with the question in the "Parts Text"-field. Now answer formula is needed with the appropriate variables and the correct syntax. In response field numbers, formulas, and even words can be queried. However, the syntax is different in each case and must be observed.

Fig. 5 Module View "Question Types: Formulas"

III. STUDENTS FEEDBACK ON E-TESTS

The overall feedback from the students about the tests is rather positive. Here is another example. This year, the e-learning team adopted the technical, accompanied by the preliminary mathematics course in mathematics in Senftenberg. The preparation course itself has been offered by the College of the BTU. [5] Many of the tasks of the freely accessible course were also offered here. Almost all students were active in the created specifically Course area in the Moodle learning platform. The adoption of the e-learning team that dynamically created e-tests are used more often than static ones, it could be verified on the basis of the course. On average, each student performed every dynamic test four to five times by frequent repetitions also a learning curve could be demonstrated. This is evidenced by the safe release of the duties and on average shorter processing times for each task type. Figure 6 shows anonymous sample data within the learning platform.

Vorname / Nachname	E-Mail-Adresse	Status	Begonnen am	Beendet	Verbrauchte Zeit	Bewertung/10,00	F 1 /10,00
Versuch erneut ansehen		In Bearbeitung	3. September 2015 11:08				
Versuch erneut ansehen		Beendet	3. Oktober 2015 14:18	3. Oktober 2015 14:18	18 Sekunden	10,00	✓ 10,00
Versuch erneut ansehen		Beendet	2. September 2015 11:28	2. September 2015 11:28	29 Sekunden	10,00	✓ 10,00
Versuch erneut ansehen		Beendet	2. September 2015 10:55	2. September 2015 10:55	35 Sekunden	10,00	✓ 10,00
Versuch erneut ansehen		Beendet	2. September 2015 11:06	2. September 2015 11:07	38 Sekunden	0,00	✗ 0,00
Versuch erneut ansehen		Beendet	1. September 2015 20:12	1. September 2015 20:12	45 Sekunden	0,00	✗ 0,00
Versuch erneut ansehen		Beendet	3. September 2015 10:57	3. September 2015 10:58	45 Sekunden	10,00	✓ 10,00
Versuch erneut ansehen		Beendet	2. September 2015 11:22	2. September 2015 11:23	47 Sekunden	0,00	✗ 0,00
Versuch erneut ansehen		Beendet	2. September 2015 11:25	2. September 2015 11:26	47 Sekunden	10,00	✓ 10,00

Fig- 6 Anonymous sample Data for measuring learning success in Moodle

Moodle also allows a CSV export of data. In this way, the data can also be processed with other programs such as Microsoft Excel or Matlab (MathWorks). A project student wrote a VBA code, which processed the exported CSV files in Microsoft Excel. Further evaluations are possible. (See Figure 7)

Name	Status	Begonnen am	Minuten	Sekunden	Bewertung/10,00	F 1 /10,00
Student_1	Beendet	1. September 2015 17:29	15	54	0,00	0,00
Student_1	Beendet	1. September 2015 17:47	15	32	10,00	10,00
Student_2	Beendet	1. September 2015 20:12	45		0,00	-
Student_3	Beendet	1. September 2015 20:21	19	8	0,00	0,00
Student_3	Beendet	1. September 2015 21:03	6	17	0,00	0,00
Student_3	Beendet	1. September 2015 21:10	2	57	0,00	0,00
Student_3	Beendet	1. September 2015 21:14	2	16	0,00	0,00
Student_3	Beendet	1. September 2015 21:17	8	23	10,00	10,00
Student_4	Beendet	1. September 2015 22:28	2	59	0,00	0,00
Student_4	Beendet	1. September 2015 22:33	3	12	10,00	10,00
Student_3	Beendet	2. September 2015 08:53	4	40	10,00	10,00
Student_5	Beendet	2. September 2015 10:51	7	55	10,00	10,00
Student_6	Beendet	2. September 2015 10:54	55		0,00	0,00

Fig- 7 Anonymous sample Data for measuring learning success in Microsoft Excel

IV. INTERACTIVE LEARNING VIDEOS

The interactive learning videos are screencasts, created with Camtasia Studio. [6] (See Figure 8)

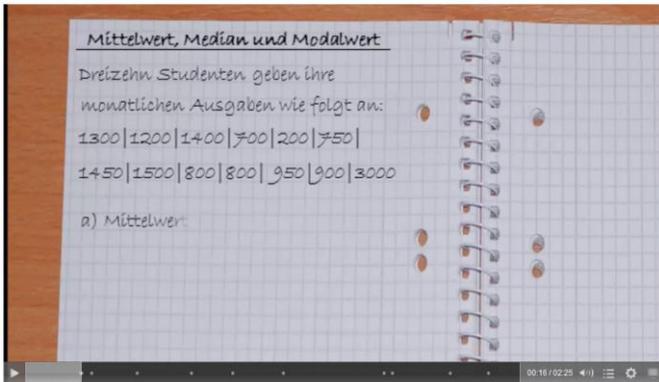


Fig. 8 Example of a descriptive screencast

In these videos, basic and mathematic connections but also further contents are audiovisual reconsidered. Camtasia Studio allows the integration of quizzes in the videos. Multiple-choice-questions, “fill-in-the-blank”-tasks and also free word tasks can be used. Students may participate in the derivation of solutions. (See Figure 9)



Fig. 9 Video with integrated quiz

V. VIDEO EVALUATION

At the moment are currently about 20 prototypes that are not yet actively used. Before they are used, the videos need to be evaluated. The evaluation takes place with two survey groups. The first group is subject teacher. They rate the videos on professional correctness. The second group comprises the potential users. For the survey, a simplified set of criteria by M. Danish is used. [7] The survey takes place within the learning platform Moodle. The videos were also implemented in order to test them under the later operating conditions. (See Figure 10) The data can be similar as described in point 3 exported as a CSV file and then evaluated and improved.

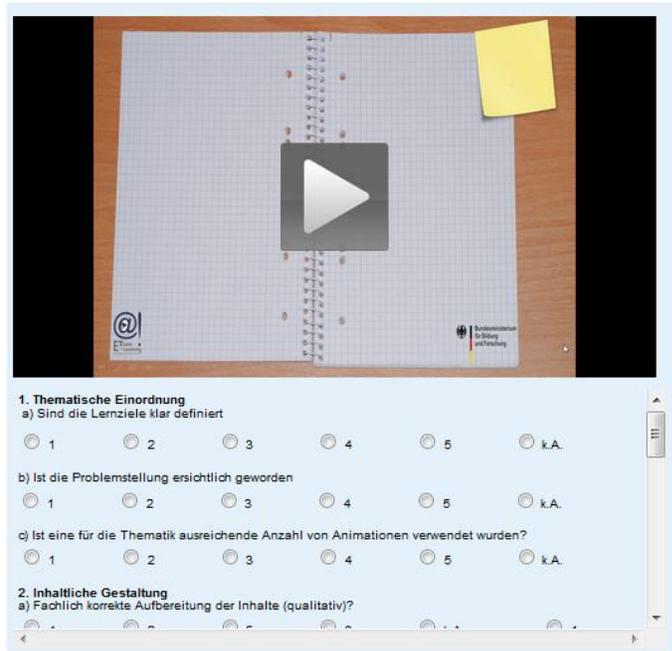


Fig. 10 Evaluation tool in Moodle for videos

VI. CONCLUSION

Both described E-Teaching Scenarios can increase the learning success. The dynamic E-tests are already in use and the first positive feedback from teachers and students are already available. The dynamic tests are used more often than static. Accordingly, this learn-process is more sustainable with these tests in that scenario. Consequently, the time-intensive preparation makes sense.

The video tutorials are not yet in use. Since poorly created videos can also have negative effects on learning success, a high quality standard is defined by the double evaluation. By interactivity the benefits of self-assessment and instructional videos are combined. The creation, however, is time-consuming. Nevertheless, these videos have a great potential.

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CHRISTIAN STEINERT is engaged in the Project „Blended Learning Anfangshürden erkennen zur Unterstützung der fachspezifischen Studienvorbereitung und des Lernerfolges im ersten Studienjahr“ since September 2014. His activities include creating and designing E-Assessments in mathematics. Since the beginning of his employment within the project, he already lectured at several conferences on different deployment scenarios of modern learning scenarios, which have a high E-Learning-Proportion.



TOBIAS KUTZNER received the B.Sc. degree in 2009 in Computer Science at University of Applied Science HS Lausitz, Germany, and his M.Sc. degree in 2012 at the same University. Parts of his Master Thesis he wrote at University of Las Palmas de Gran Canaria (ULPGC). His research fields are client server solutions, mobile programming, web services, artificial intelligence and eLearning. Since 2012 he is working as administrator and developer for the eLearning platform at University of Applied Science HS Lausitz and since 2013 for eLearning platform at BTU Cottbus – Senftenberg too. In 2014 he started Ph.D. at ULPGC in research topic handwriting verification systems.