Portal for generating cross university didactic self-assessment apps without programming skills

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ABSTRACT

Based on the didactic concept of a school mathematics app, a portal for the automatic creation of interdisciplinary learning apps without programming knowledge is being developed at the Brandenburg University of Technology Cottbus – Senftenberg (BTU). The aim was to develop the conception and implementation of a portal for the creation of universal learning apps as a mobile (online) assessment for the study entry phase on the one hand and the publication of the apps on the other. This article presents the basic concept of the app portal, the structure of the app portal, and initial tests of the prototype with faculty and students at BTU.

Keywords: mobile-assessment, educational technology, distant learning, html5 app development

1. INTRODUCTION

Apps for mathematics and physics were developed at the BTU in the introductory phase of studies, successfully tested over several semesters with (prospective) students and presented in numerous publications. [1] In the meantime, the concept of the mathematics app developed at the BTU since 2012 has been further developed. Even before Corona and now even more intensified by the past two "Corona semesters", it is clear that additional support is needed, especially in the area of self-study. It is not enough to simply download a text and learn. Supplementary small learning units are necessary in order to work out contexts and to deepen what has been learned through repeated solving of tasks.

Furthermore, it is important to mention that students today are faced with the task of choosing a suitable and interesting degree program and ultimately completing it. According to research conducted by the German Centre for Higher Education and Science Research (DZHW), almost one third of the students in Germany drop out of their studies and decide to pursue an apprenticeship, for example. This proportion of students only takes into account those who do not obtain a university degree at all. [2] Thanks to the development of new technologies, it is now possible to offer potential students an overview of various degree programs and to motivate and inspire them to take a deeper look at the subject matter of the relevant degree program before they start their studies, in order to get a real feel for whether this field of study will be the right one for them. Apps are also being developed for students who are already studying at the university to give them the opportunity to prepare themselves independently for exams and small tests. The use of apps and mobile devices has increased significantly in the past decades, which can also be observed in the education sector. A quick glance at the App Store or Google Play Store is enough to notice that there are numerous educational apps in the meantime, which are being developed and used even more often.

Recently, a request was made to apply the concept of the mathematics app to other subject areas and at the same time save time and effort in creating the apps. Previously, the content had to be entered in a time-consuming way, each app had to be re-generated and uploaded to the HTML5 website and the app store, which was only possible for staff with appropriate IT skills. From this requirement and subsequent considerations, it was concluded to develop a portal for the automatic creation of universal learning apps as a mobile (online) assessment for the study entry phase.

Now the idea of a portal for the creation of apps without programming knowledge is not entirely new. There is already a well-known platform [3] that can be used to implement many different assessments. The disadvantage is that basically anyone can create and edit an app there - there is no control over the correctness of the app content. The aim of this platform is to collect reusable building blocks and make them publicly available. For this reason, the building blocks

(called apps) do not contain a specific framework or a concrete learning scenario instead they are limited exclusively to the interactive part. However, our goal is different: we provide small, self-contained learning units according to a repetitive didactic pattern and thus apply the principle of the mathematics app, which has proven itself at the BTU, to various subject areas. We provide the lecturer with a precise framework and limit the maximum number of tasks to be solved so that the learning unit does not become too large, but at the same time a specific subject area can be studied in depth. By testing the app with students and incorporating the results into the app (correction and final statistics) before publication, a second quality control takes place before each app is published on the app portal.

2. CONCEPT AND IMPLEMENTATION

The concept of the portal consists of two parts. First the didactic concept of the app that serves as the basis for all generated apps and second the portal in which the apps are created and published.

2.1 Didactic concept of the app (the app template)

The didactic concept of the mathematics app served as the basis (app template) (Figure 1 and Figure 2), which is largely based on the principles of programmed learning according to Skinner, established in 1958 [4] is based on:

- Each student works at his or her individual pace

- Learning objectives are clearly and objectively formulated

- Each answer receives immediate feedback

- Tasks are set in such a way that there is a high probability of being solved correctly

- Subject matter broken down into frames

- Learners are encouraged to be active

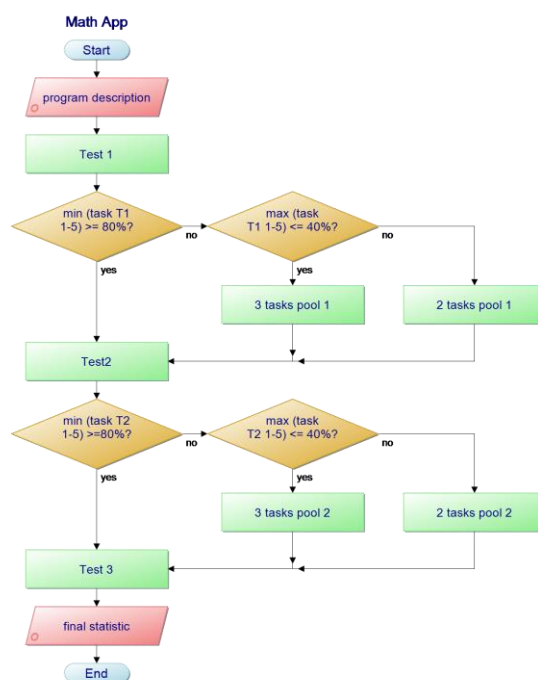- Persistent and good work leads to additional reward

Figure 1. App Template, Introduction and Statistics (Example HTML5 Math and Physics App)

The app is particularly suitable for short breaks or when on the move to refresh and deepen the learning material. Intuitive operation of the app and a final statistic makes the learning success quickly noticeable. In addition to courses in the Moodle Learning Management Systems (LMS), the app serves as a useful supplement, a kind of learning to a useful supplement to lectures and tutorials at the BTU, a kind of "learning to go" especially for students in the introductory phase of their studies.
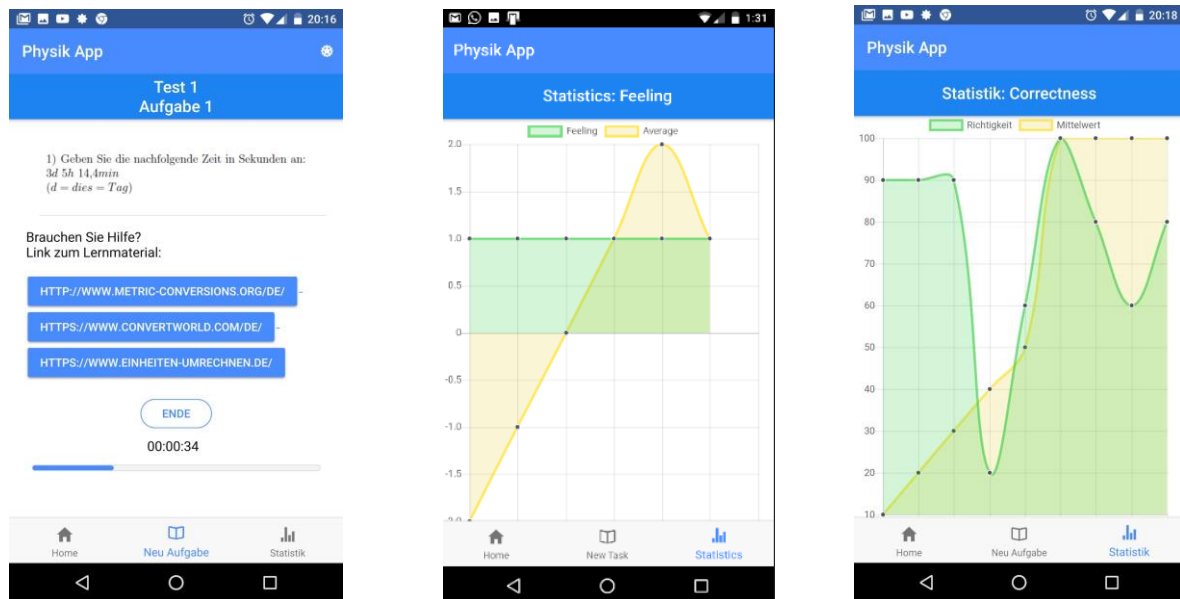

Figure 2. Physics Application (Mobile Version)

2.2 Concept of the App Portal

The developed App Portal for the creation of mobile and web applications for future students' self-assessments apps at BTU Cottbus-Senftenberg, is basically divided into three parts. Firstly, the authentication of the user, then the homepage where users can see all the apps that already exist, and finally the page for building apps. (Figure 3) Only registered users have access to the self-assessment application creation page and only they have the rights to create new applications, update and change their content at any time. In general, the creation of user accounts is only available to professors and lecturers at the BTU Cottbus-Senftenberg.

To generate an app, users should give it a name and upload the images with the corresponding tasks and their solutions. The upload of task and solution images is specifically structured, whereby all requirements must be fulfilled. As can be seen in the template for the app (Figure 3), the app is divided into 3 tests and 2 pools with a total of 25 tasks, which the app portal basically follows and guides the user through the corresponding input menus. On the generation page there are exactly ten input fields for uploading images. Five of these are for the tasks and these are divided into categories, which means that exactly five pictures for the tasks for test 1 need to be added. The remaining five are for the corresponding solution pictures. The second thing to note is that the pictures also have exact names, as this is the only way to divide them correctly into categories and to store them in order to create a new app. For this reason, for example, the image for task 1 in category pool 1 should be named "pool1task1" and for the solution of this task should also be named "pool1loesung1".

In general, each generated app has three sections - the introduction page, the task page and the statistics page. On the introductory page, the user is given instructions on how to solve all the questions. Then on the task page, they should enter their time, their intuition of how difficult or easy a task was, and at the end, the correctness of their answers. In addition, there are two to five help links for each question, which the user can use to solve the tasks. After completing the tasks, a statistical chart is displayed showing the average time, feeling and correctness of the answers. [5]
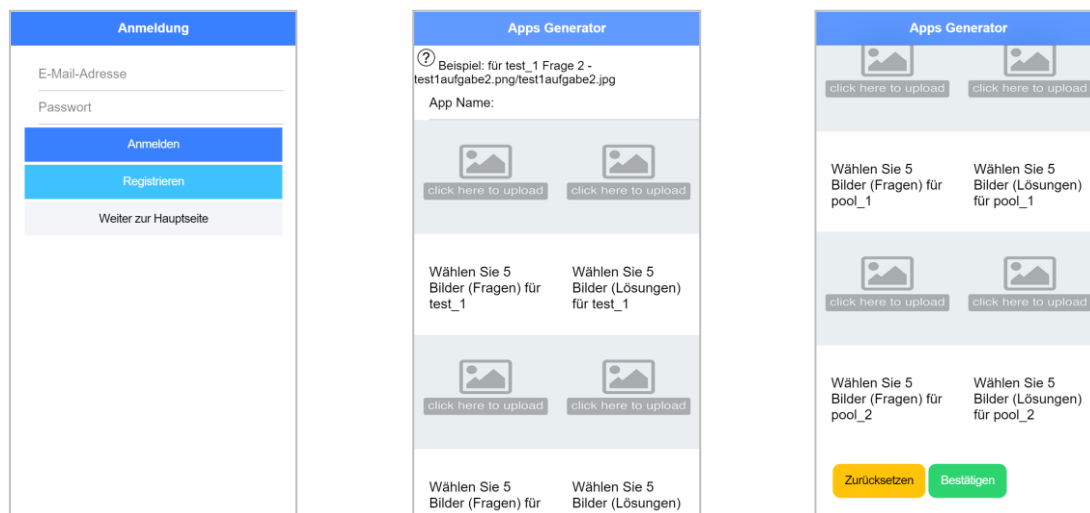
Figure 3. Login and Apps-Generator Page (Mobile Version) [5]

Once the app has been created and tested, it can be published for the students with the appropriate subject area. Currently, the first step is to generate the browser persona (HTML5 app) and to upload it to the Universal Self-learning app portal website to make it available for the students. (Figure 4) [6] In a further development, it is also planned to automatically generate an app for the corresponding stores while publishing it as an HTML5 app.

Figure 4. Frontend App Portal Student BTU [6]

3. TEST

We conducted a first test of an app for physics based on the concept of the mathematics app with students from the Physics 1 course of Dr. rer. nat. Bodo Wolf at BTU. He requested an app for learning conversions of physical units. The app was tested fundamentally and in the meantime the data for the app's statistics was collected.

Example of the test procedure for an app created on the principle of the mathematics app for the Physics 1 course by Dr. Bodo Wolf in 5 steps:

1. call up the Physics 1 course on the learning platform

2. install the app from the store or call it up on the website

3. solve the tasks (3 groups test 1 ... 3, feedback in 14 days)

4. filling in the feedback in the Physics 1 course on the learning platform

5. summary of the feedback, adaptation of the app and creation of statistics based on the test results

Based on this principle, the Physics App was tested with students of the Physics 1 course at the BTU. The feedback (Figure 5 and Figure 6) took place in the course on the learning platform and served as the basis for the final adjustments to the app as well as the final statistics. Afterwards, the app was released for the students in the App Portal.

Fragebogen Auswertung

	1. Die Zeit zum Lösen der Aufgaben war ausreichend	2. Der Lösungsweg war verständlich	3. Die vorgeschlagenen Hilfen beim Lösen der Aufgaben haben geholfen	4. Der Anforderungsgrad der Aufgaben war zu schwer
■ 1 Trifft zu	6	4	1	0
■ 2	4	6	3	1
■ 3	2	3	3	2
■ 4	1	1	2	6
■ 5 Trifft nicht zu	1	0	3	5
■ k.A.	0	0	2	0

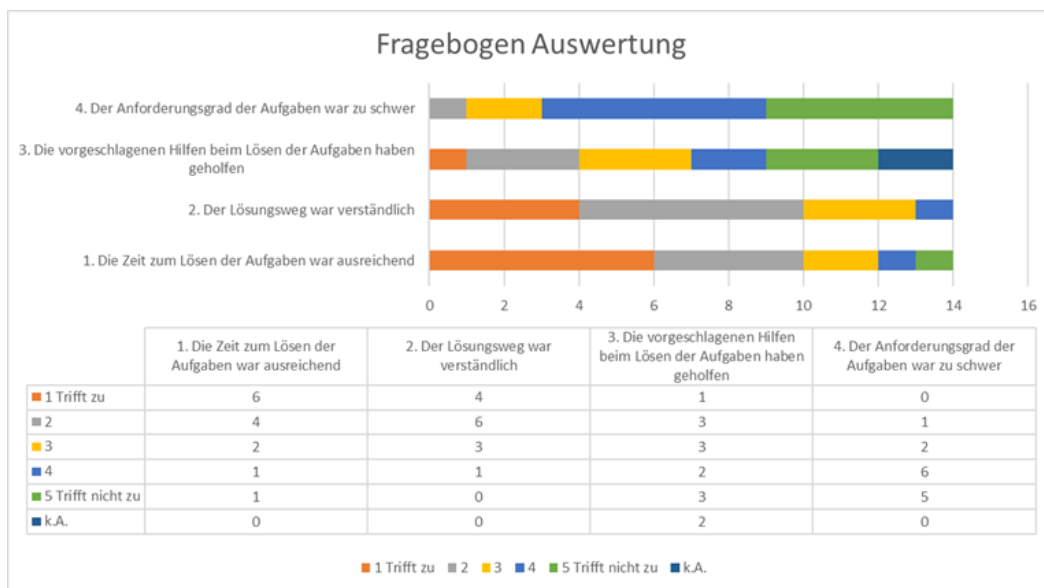■ 1 Trifft zu   ■ 2   ■ 3   ■ 4   ■ 5 Trifft nicht zu   ■ k.A.

Figure 5. Feedback Physics 1 course Dr. Bodo Wolf evaluation results of the tests with students
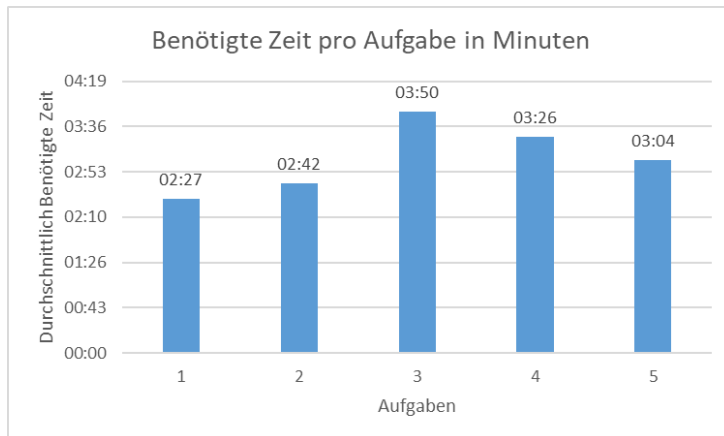

Figure 6. Feedback of the average time per question

We conducted a second test with the application platform by creating a brand-new E-Business App to monitor the knowledge of the E-Business students in the introductory phase of their studies. All the questions and their answers as well as the help links were provided by Prof. Dr. oec. Andreas Freytag for the subject E-Business and developed by Jacqueline Bothe and relate to the main aspects and specific character of the subject E-Business itself. Targeted statistics with students from the field of E-Business are to be compiled in order to provide a picture of the precognition of the

future students of the BTU, as it was done with the Physics App. During the app creation process it is visible that the questions and answers are uploaded from the desktop and inserted into the app. (Figure 7)
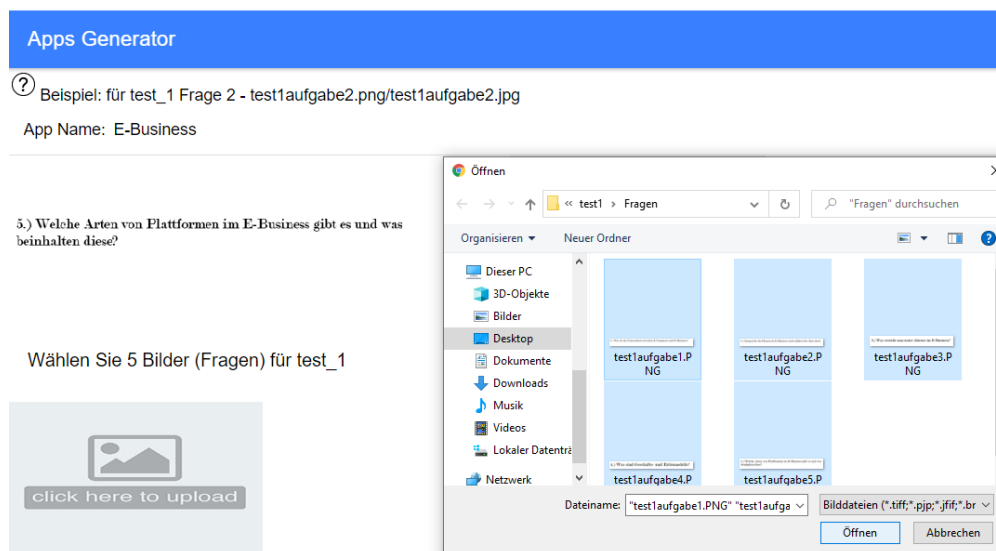

Figure 7. Images upload and creation of a new E-Business App

Once the building process of the app is completed, the finished HTML5 app is ready for testing in the app generator and once it has been successfully tested, it will be available to all BTU students in the app portal. In Figure 8, it can be seen that on the left side, the first task in the first test of the app has help links and on the right side, there is the solution to the task indicating the correctness and the time after the student solved the task.
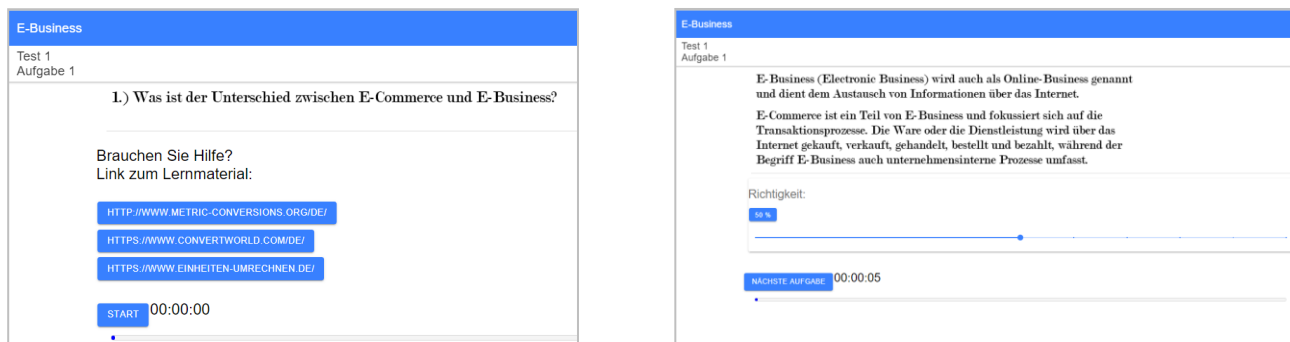

Figure 8. Screenshots of the E-Business App

4. CONCLUSION AND OUTLOOK

In this paper we presented the portal for generating learning apps, which is based on the didactic concept of the mathematics app by Prof. Dr. rer. nat. habil. Olga Wälder. Simplifying the creation of apps for lecturers at the BTU is the core benefit of the development. Previously, it was very time-consuming to create a new app, in several steps the lecturers had to provide us with the task and the solution, then the app was implemented, verified and tested by the lecturers and students and then later released. The process is now significantly simpler and faster, and lecturers can create apps themselves very quickly. Initial tests with lecturers and students have shown that it is possible to create apps on various topics via the portal without any problems. Thus, we have achieved the goal of creating a tool for generating

learning apps based on a didactic concept. In the future, the App Portal will be further expanded. For instance, the automatic transfer of HTML5 apps to the app stores has not been realized yet and graphical and functional improvements are to be developed so that the prototype becomes a ready-to-use portal for all lecturers at our university. Furthermore, it is planned to add additional language packages to the app portal as well as every generated application to offer additional languages for our lecturers and students.

5. ACKNOWLEDGEMENT

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