University’s digital transformation: A case study for providing e-services via Moodle

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ABSTRACT

The evolution of digitization reaches a new stage with a focus on the overall transformation, where the so called “Intelligent Environment” such as “Smart City”, “Smart Campus” is in the heart of the idea. Today’s institutions, which have not yet started the transformation towards a Smart Campus, are capable to exploit untapped ICT resources that could potentially lead to the optimization of the processes and services. In order to verify that a new service can be offered with the available ICT resources, a method of finding a subset satisfying some condition is used. The paper reports an approach where elements of the main set include own resources and their functionalities, while needed resources to provide a new service build the subset elements. This work presents examples of developed e-services by using the open source Learning Management System (LMS) Moodle. The study demonstrates that Moodle and advanced ICTs are just as so an alternative for improving personal management and information systems in the means of e-services offering. The paper analyzes the results and evaluate the benefits from the digital transformation point of view. The conclusion summarizes features of the applications will contribute the way university interacts with students and staff.

Keywords: digital transformation, university management, e-services, IoT

INTRODUCTION

The evolution of digitization reaches a new stage with a focus on the overall transformation, where the so called “Intelligent Environment” such as “Smart city”, “Smart campus” is in the heart of the idea. The effective Information and Communication Technologies (ICT) are a competitive advantage of higher education institutions, and an ability to identify, consume, create and manage complex information in- and outside of the university. In the recent years, Bulgarian universities have invested mainly in ICT related to the educational processes optimization. Popular learning management systems (ILIAS, Moodle) have been used to provide free access to e-learning resources, interactive materials, distance learning. Side-by-side, resource and administrative management, typical for the traditional universities (face-to-face), lag behind in the integration of modern ICT technologies. The causes are not necessarily financial. There is a need of recognition the benefits from the implementation of such technologies as well as utmost applications of the available ICT technologies. Today’s institutions, which have not yet started the transformation
towards a smart campus, are capable to exploit many untapped ICT resources that could potentially lead to the optimization of the processes and services. This work presents examples of developed e-services by combining available ICT resources with free web applications.

**DIGITAL TRANSFORMATION**

Integration of digital technologies is a powerful tool for resource optimization and improved data collection and analysis which creates the conditions for informed decision-making. Regarding the educational field, a number of authors have associated this digital transformation with the establishment of the so-called ‘Smart’ campuses, which is a terminology that dates back to the beginning of 21 century (Kaneko, A., Sugino, N., Suzuki, T., & Ishijima, S., n.d.). Initially, this transformation included the implementation and use of various digital technologies together, such as videoconferencing systems, smart cards usage (Halawani, T., & Mohandes, M., 2003). The idea constantly evolved into an overall concept in which the ‘Smart’ campus enables the community to design, develop and use innovative services (Pistore, M., 2013). ‘Smart’ campus is presented as the intersection point between "Smart Homes" (new experiences for "digital citizens" entering higher education) and "Smart Cities" (new operational efficiency for saving money and improving safety) (Nedwich, R., 2018). Large corporations offer state-of-the-art ICT solutions that address the challenges faced by universities - inefficient management systems, lack of quality of service (QoS) experience, serious resource losses, poor security and high operational costs (Smart Campus Technology - Connected Campus, Digital Campus, Cisco Education., 2019), (Campus Network Solution, n.d.)

The bases of all developments are “Internet of Things” (IoT) as a global infrastructure which connects (physical and virtual) real-time data carriers that provide information for analysis and decision-making. The IoT is about creating an ecosystem that enables experiences more efficiently, and with more intelligence than individual point solutions (Friess, R., & Watt, I., 2016). The concept of building a smart campus implies that the institution will adopt advanced ICT for automatic monitoring and control of every facility in the university (Wang, H., 2013).

**METHOD FOR EXPLORING THE POSSIBILITIES OF NEW SERVICES PROVIDING**

The optimization of the working processes and set up of new quality services are priorities of the Technical University of Varna. Furthermore, these concerns are the basis of the integrated quality management system EN ISO 9001: 2015 (Quality management systems. Guidelines for the application of ISO 9001:2015., n.d.). Migration to a Smart Campus infrastructure is a costly process, hence the stage ICT integration is an option for universities with budget limitations. Therefore, a method to gain greater benefits from available ICT and scenarios for new services providing is urgently needed. The aim of this work is to present alternative options to enrich the university’s e-services using the available ICT resources.

In order to find the solution two sets of distinct objects has been considered. The available ICT resources at the university (the infrastructure, the available software, etc.) collectively form the first set $A$ and the necessary ICT resources for establishment of a system for e-services- set $B$. The comparison of the two sets shows that $B$ is a proper subset of $A$ ($B \subset A$) and most elements of set $B$ are existent tools and functionalities integrated into the Moodle platform.

**NEW E-SERVICES THROUGH MOODLE**

Moodle is a web-based open source learning management system (LMS) with multiple tools and functionalities, making it a preferred platform among a number of universities. The LMS is mainly used for educational purposes, such as uploading teaching materials, e-learning courses,
Research in this field has shown that LMS have not been used for facilitating the administrative work at university organizations in Bulgaria. There are possibilities that integrated tools may become a useful asset for providing such e-services. With appropriate settings, Moodle's learning activities can create solutions used in students status management. The proposed 3 cases are aimed at shortening the time consuming processing of paper applications shown in Figure 1.

**Case 1. Moodle Tools**

"Feedback" is a Moodle tool that allows survey creation. Request forms have been generated with the tool and added to the newly created "E-services" section, accessible for students by username and password. The tool functionality to create relations between questions is an advantage. Thus, there is no need to compose multiple applications, but only one form in which the logically related questions are loaded. The following code shows part of the feedback form building:

```html
<div class="box feedback_item_box_left"><div class="box box generalbox boxalign_left"><div class="feedback_item_label_left">Считано от предстоящия:<span class="feedback_required_mark">*</span></div><div class="feedback_item_presentation_left"><ul><li class="feedback_item_radio_v_left">
<input type="radio" name="multichoice_19[]" id="multichoice_19_1" value="1" />
<label for="multichoice_19_1"> зимен семестър</label>
</li></ul></div></div></div>
```

Figure 1. Processing a paper application.
Staffs processing the students’ requests are granted role and permissions as a “lecturer”, giving them access to the requests received. The tool has no features such as form printing, autoresponder, downloading data in excel, CSV or other convenient for processing format. Possible actions are visualization of the requests received and generation of statistics.

**Case 2. Moodle with external tool**

The web application “Google forms” has been used to create university’s request forms. When designing forms, limitations have been set to minimize errors while completing application. Forms have been added as URL resources in the newly created “E-services” section. When select an application, the relevant fill form with required fields is invoked (Figure 3). For applicants' convenience, the major part of the forms is pre-filled, as only check mark and drop-down menu choices are required for selection. If the form is correctly filled the message "Your application is accepted" is displayed. In case of an error, entered data must be corrected.
Requests are submitted to the form creator’s Google Drive. There are two options for visualization - either individually or in summary. The first review choice visualizes the form as it is filled out by the applicant and could be printed. The second one - summary, provides statistical data regarding answers with selection (Figure 4). The ability to examine the situation objectively is a must for a flexible management style. The analytics favour persons running the organization in decision-making in order to increase students’ satisfaction.

In addition, table with received applications data can be shared with a link (Figure 5), avoiding the need of having a Google Account. The information is updated in real time. Each column has a filter that allows selections by variety criteria.
Figure 5. Screenshots of the table with received applications data.

In the proposed case, the applications cannot be electronically signed by authorized person, so the need to maintain a paper archive (for the purpose of tracking the process) is not eliminated.

Case 3. Plugin

The interoperable design of Moodle allows creating plugins and integrating external applications tailored to individual needs. Plugins enable inclusion of additional features and functionality to Moodle, such as new activities, new quiz question types, new reports, integrations with other systems and many more (Moodle plugins directory., n.d.). The authors of this paper has found approximately 1,600 plugins in the Moodle plugins database, which plugins although categorized suggest that they are designed for improving teaching and learning environment. This large amount of plugins is impossible to fully investigate, therefore with no claim for originality, this work suggests development of plugin for administrative e-services. The goal is to automate most of the administrative services related to student status verification and application processing in real-time by linking Moodle to the university database. The abstract model of communication is presented in Figure 6.

![Figure 6. Abstract model of communication.](image)

To log in and submitting a request form from the students, they only need user names (their faculty numbers) for access to the Moodle platform. Created plugin searches require information in the university database by username and set criteria for executing the request. For each request, different criteria for acceptance have been set. Some criteria require documents attachment, a
feature unavailable in the first two cases, but with the third. For instance, transferring application from external form of education to regular education, which process’ block diagram is shown in Figure 7.

![Figure 7. Block diagram of the process.](image-url)

The plugin provides system processing of a standard request and electronic signature of the document. The authentication of the applicant and the person who accepted / rejected the application is verified by log in the platform with username and password. Embedded reports allow traceability of the entire process – by whom, from where and when a particular activity has been performed. Automated processing is not applicable in the case of applications with attachments.

A comparison of the proposed three cases has been made and the result is shown in Table 1. The evaluation criteria determine to what extent the proposed case: reduces the processing time of the application; creates the possibility of automatic processing; provides statistics for analysis.
Table 1: Advantages and disadvantages of the three cases

| Case 1 | Advantages | Disadvantages |
|--------|------------|---------------|
| From face-to-face to e-services | Use of available ICT (Moodle) | Not provided files attachment |
| Use of available ICT (Moodle) | Statistical data | No connection with university’s database |
| Sending message to user's profile | Familiar environment | Manual processing |
| Familiar environment | | Application processing requires staff, working with two databases |
| | | Does not allow downloading data in a database-friendly format |
| | | Applicable to standard applications only |

| Case 2 | Advantages | Disadvantages |
|--------|------------|---------------|
| From face-to-face to e-services | Use of available ICT (Moodle) | Not provided files attachment |
| Use of available ICT (Moodle) | Statistical data | No connection with university’s database |
| Familiar environment | Extracting information in suitable format | Manual processing |
| | | Applicable to standard applications only |

| Case 3 | Advantages | Disadvantages |
|--------|------------|---------------|
| From face-to-face to e-services | Use of available ICT (Moodle) | System processing is applicable to standard requests only |
| Use of available ICT (Moodle) | Statistical data | |
| Familiar environment | Provided files attachment | |
| | Requests system processing | |
| | Electronic signature | |
| | Traceability of activities | |
| | Applicant automatic notification | |
| | Data store in the Moodle database | |

The three cases offer an administrative service of varying degree of digitization. The second case requires self-authentication of the applicant by filling in known personal data that does not meet the conditions for secure electronic identification. Both first and second cases require manual processing even for standard request, while the third case performs system processing. The attachment of additional documents is a feature applicable only in the third case.

**CONCLUSION**

The study demonstrated that Moodle open source software and advanced ICTs are just as so an alternative for improving the management and administrative environment. Therefore, future work will be expanded to increase the platform applications in the means of e-services offering. Digital transformation in higher educational institutions is associated with integration of technologies for establishment of Smart Campus. Technological corporations bring solutions for rapid migration to digitization, but they are costly and not always easy to adapt to the institutional specific needs. Enhancing performance of own ICT resources along with stage transformation is an accessible approach for university’s growth.

The benefits of deploying e-services through Moodle are: enhancing student satisfaction; relieving document turnover in the administration; implementing a new service request channel; shortening the deadline for the provision of an administrative service; enhancing employee satisfaction.
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