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Metrics for Evaluating the Use of Smart Solutions in Educational Systems

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Abstract

This paper presents the necessity and the benefits of using smart solutions in educational systems. The current stage of our society involves the development of educational systems through a collaborative learning environmentthat includes mobile devices, wireless technologies, cloud computing, and other smart solutions. The continuous improvement of the quality and performance of education is essential and requires the efficient use of smart solutions. Therefore, it is essential to define a set of metrics to assess the use of smart solutions in educational systems. These metrics represent a starting point in formulating objectives and strategies for improved educational systems.

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1. Introduction

The evolution of our society, known as a knowledge-based society, involves the development of higher education through a collaborative learning environment with mobile devices, wireless technologies, cloud computing, and other smart solutions used to motivate student learning in different contexts and in a very active manner. This paper highlights the benefits of using smart solutions in higher education systems.

The paper is structured in four sections. The first section presents the most pressing and complex challenges of the last century in the area of educational systems. Secondly, the paper describes theoretical elements about smart solutions and what these mean for an educational system. The third section identifies a set of metrics to highlight the use of computing infrastructure or intelligent communication solutions. Last but not least, the paper emphasizes the benefits of using computing infrastructure in different areas of higher education. Moreover, the paper aims to analyze the impact of smart solutions on the development of educational systems. To characterize and prioritize various educational areas, a set of indicators is to be used. This represents a starting point in formulating objectives and strategies for enhanced educational systems.

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2. Most pressing and complex challenges of the last century in the area of educational systems

In the knowledge-based society, human resources are considered a key factor in the development of any kind of organization and in the maximization of its profit. On the background of the transition from an information society to a knowledge-based society, organizations have undergone various changes, depending on their nature. In a higher education institution, such as a university, the main objective is to meet the educational needs of its students (Pocatilu, 2001).

The knowledge-based society has evolved at the same pace with the development of computers and informatics technology. In the last years, many changes appeared in the people's level of education, producing an intellectualization of work processes. In recent years, a reversal of social and moral values took place in our society. People with a high level of education and qualifications are underestimated and did not find their appropriate role in the society, while people with money and low educational level are encountered in key positions in different companies. An important factor in the recruitment process for a certain job is represented by recommendations and not by abilities, competences and qualifications. Because we are living in a society where people should collaborate in order to achieve their personal and group objectives, we can talk about collaborative educational systems, which are applied in the educational field and have as objective the assessment and the improvement of educational process performances.

There are many criteria to classify collaborative systems existing in the knowledge-based society. The field of application allows classifying the collaborative systems as depicted in Figure 1. The classification is based on (Ivan, 2011). The Figure 1 presents the collaborative systems classification by field of application and highlights the importance of collaborative educational systems.

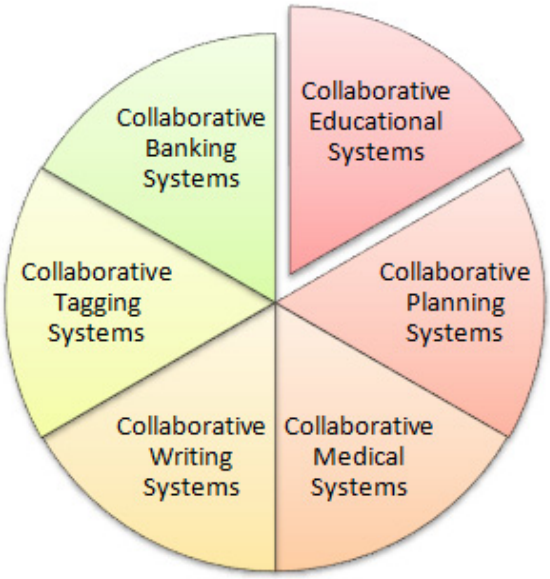

Figure 1. Classification of collaborative systems

The educational process is a collaborative one, because all teaching and learning activities take place in a collaborative manner and involve multiple participants. Even in the online educational process there are forums, chat, and portals that ensure communication, coordination and cooperation between participants.

In a university, the comparison between classical education and online education reveals that the process of assimilating knowledge is made more efficient in the case of online education, due to the process of collaborative learning within the teams (Ciurea, 2011).

3. Theoretical elements about smart solutions and their significance for an educational system

Smart solutions involve using new technologies to improve all aspects of our life or to make everything work better. The researcher (Naphade et. al., 2011) defines the concept of "smart planet" like new solutions for a better management of infrastructure and resources to cater to the existing and modernity needs of people.

Education is one of the core components of our society that generate solutions to economy problems (Sam, 2008). Because of this we must implement smart solutions in this area. Well educated and skilled students are the key elements for creating, sharing, disseminating, and using knowledge effectively. The improvement of the efficiency of educational systems requires the use of all new technologies. Over the last years, the trend in the field of educational systems is for them to become smarter.

The existence of a smart educational system - focused on the efficient use of existing infrastructure and on its upgrading if necessary – is considered crucial in our times when funds are scarce. But most importantly, an educational system should focus the learning process on two key components: student and teacher.

We are living in a world in constant change, where technologies are evolving every day, thus making life easier and better. Every field of the economy has supported many improvements, depending on the development of each country. In the education field from Romania, many changes occurred in order to find the best solutions for a complete educational direction. Now, it is necessary to apply smart solutions to find the optimal route.

For a successful educational system in universities, teachers and technology developers should consider the following significant challenges of our age: mobility, information and accessibility. Smart solutions mean a big opportunity for educational systems to become interconnected and open. Around the world, a strong emphasis is put on the potential of the efficient use of smart solutions to facilitate development, growth and societal progress.

4. Metrics to highlight the use of computing infrastructure or intelligent communication solutions

The economic higher education is moving towards a new stage in its development. In the knowledge-based society, the educational process takes place both in a classical way and in the virtual campus.

The e-learning platform of the virtual campus contains a knowledge database that is constantly updated with the help of participants to various educational activities, respectively by teachers and students. The e-learning platform of the virtual campus allows the distribution of lectures in text graphics and multimedia formats, and contains elements of synchronous and asynchronous communication, as well as advanced testing systems of these elements.

An indicator for evaluating the level of students' education inside a virtual campus is the efficiency of educational activities.

The *efficiency of educational activities*, *EEA*, is determined based on the relation:

$$EEA = \frac{NTC}{NGP} \times 100 \qquad (1)$$

where:

NTC – the total number of lectures sent by the university inside the virtual campus over two years.

NGP – the number of graduates over two years.

The indicator for *evaluating the efficiency of a student in the virtual campus*, *EPS*, is calculated as follows:

$$EPS = \frac{NSE}{TPE + TOE} \qquad (2)$$

where:

TPE – the average time spent on preparing an examination in the virtual campus;

TOE – the average time of rest between two examinations in the virtual campus;

NSE – the average of grades obtained by a student following the undertaken examinations in the virtual campus.

The *degree of satisfaction for a course*, DS, can be computed as:

$$DS = \frac{\sum_{i=1}^{n} DSR_i}{n} \quad (3)$$

where:

DSR_i – the degree of satisfaction of the student *i* for the lecture presentation

n – total number of students.

The degree of satisfaction of a student related to a lecture has a value from 0 (no satisfaction) to 1 (fully satisfied) or is assessed using a similar scale. This metric relates to the use of modern presentation techniques.

In order to validate these metrics, data has to be collected. This represents a future research direction consisting in the development of a system of metrics related to this field.

5. Benefits of using computing infrastructure in different areas of higher education

Nowadays, when mobile technologies are encountered everywhere, it is necessary to apply and extend their use in the educational field, too. Using mobile technologies in the learning process requires access to educational resources through mobile devices and dedicated mobile applications.

A modern solution for assessing the knowledge level of students is undertaking the examinations on online testing platforms, such as Moodle, Blackboard or Sakai.

The first page of the Sakai platform, seen from an Android device, .

Even if specialists consider that the Moodle platform is still under construction and there was never a real lecture to demonstrate its feasibility, many universities use it in different bachelor and master programs, because it is free and open-source and offers the advantage to be customized.

The benefits of using smart solutions in educational systems are significant. We can identify six main reasons in supporting the investment in smart educational systems: flexibility, communication, accessibility, low cost, low time, collaboration and ease of implementation (Table 1).

Table 1. The benefits of using computing infrastructure in educational systems

Low cost	Smart solutions can reduce costs within educational systems, as payment is made only for the services used.
Accessibility	Everyone from the educational system can access information and applications from a wider range of locations and services.
Low time for access	The smart educational system is accessible very fast virtually from anywhere and provides access to all available learning materials and services.
Ease of implementation	To implement smart solutions, one does not need to purchase hardware nor software licenses.
Communication	The smart solutions can connect entities from within the educational system and create virtual groups that bring them together in the same virtual space.
Collaboration	Everyone from the educational system can collaborate with the group having the same interests.

Education is the fundamental part of evolution and innovation. Well educated and skilled people are the key for creating, sharing disseminating and using knowledge effectively. Society requires a smart education system which is flexible, adaptable and encourages creative, critical, and innovative thinking.

6. Conclusions

The use of smart solutions in educational systems is a mandatory condition to increase their efficiency and to contribute to the development of the educational field. Smart solutions refer to advanced technologies and smart applications, where students and teachers can carry out together their activities. It's about collaboration that implies a very good communication, coordination and cooperation.

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