Experimental Framework for Evaluation of ICT Impact on the Learning Process

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Abstract: The world today is in a whole new dimension, consisting of new concepts and terms such as social networks, online communities, blogs and microblogs, emails, discussion forums, e-books, and so on. All these instruments needs to be adapted to the learning process as well. The main goal of the paper is to propose the experimental framework for evaluation of ICT impact on the learning process. Two independent studies are provided to determinate the degree of ICT integration in the learning process: evaluation of the degree of knowledge and use of ICT by different target groups in the learning process before ICT integration in the learning process and evaluation of the degree of ICT impact in the learning process after its integration.

Key-Words: education, ICT, learning process, Moodle

1 Introduction

The integration of ICT into education has improved the quality of the learning process. These technologies can generate positive or negative results depending on how they are used. However, every new ICT tool could be used in learning process in two different means: technological and pedagogical [1]. To achieve successful integration of technology requires an effort from three different stakeholders: teachers, students, and school administrators [2].

Some researchers had explain all educational-training roles of ICT for further changes into educational field in order to performing some modifications and innovations resulted into efficiency increase and more effects of education system [3].

Recent studies demonstrated benefits for using ICT in learning as motivation of the students and learners, working collectively, etc. The study [4] found that more than 70% of surveyed teachers expressed in Europe have a positive or very positive opinion about the relevance and positive impact of ICT to support different students' learning processes and objectives. In the other side students are acquiring new skills and new competencies which are closer to the needs of the job market and perhaps leads to worse performance in the curricula [5]. The access to the online resources encourages critical thinking and problem solving ability of the students, and leads to using discussion and collaboration [6].

Other research highlight the importance of an active learning methodology in engineering degrees in Spain as present the outcomes of an experimental study carried out during the academic years 2007/2008 and 2008/2009. The results show ICT have a positive impact on higher education students' learning, active learning facilitates students' responsibility and motivation in learning process, enhance knowledge and skills and give more satisfactory outcomes for the involved roles [7].

There are different approaches to integrate ICT in learning process. In [8] is presented a combination of the learning factories and situated

(on-the-job) ICT-based social learning, as well as the didactics of learning factories and ICT-based situated learning.

The main goal of the paper is to propose experimental framework for evaluation of ICT impact on the learning process. In order to achieve that goal the implementation of Moodle Learning Platform through its set of ICT tools is deployed in High Polytechnical School of Uige in Angola. The integration of such platforms deserves special attention and should be included in educational settings, despite all the limitations and lack of existing at the different levels [9].

Paper is structured as follows: in next section is described methodology of the research and how the experiment is gathered. In third section, called "*Analysis of the results of the conducted experiments*" explains what are major parameters of the experiment with 441 participants from different groups. In the last section there is conclusion about research done on different classes of learners.

2 Methodology of experiments

Two independent studies are provided to determinate the degree of ICT integration in the learning process:

1) Evaluation of the degree of knowledge and use of ICT by different target groups in the learning process before ICT integration in the learning process.

2) Evaluation of the degree of ICT impact in the learning process after its integration.

The general experimental framework can be seen in figure 1.

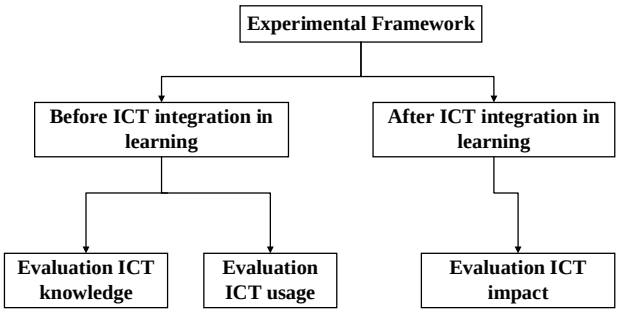

Fig. 1 Experimental Framework

The first study is applied to the various participants in the High Polytechnical School of Uige in Angola. It includes three main target groups: lecturers, administrative workers and students. To achieve this goal, we will use a methodical approach, consisting of answer questions that allow us to make the necessary analysis and conclusions that fit into it.

For the evaluation of the use of ICT in classrooms prior to the implementation of the model, the so-called class approach is used, which is the traditional way of transferring knowledge into a classroom, and in the present context our research is characterized by the following aspects: using of PowerPoint lessons and presenting them on a large screen through a projector.

During the survey, by using the direct monitoring, there were observed the organization and targeted 11 lectures, classified in the following way:

- 4 lessons in the course of Agronomy;
- 3 lessons in the Medical Care course;
- 2 lessons in the Accounting and Management course;
- 2 lessons in the Computer Engineering course.

In the study, a class for evaluating ICT in traditional class conditions is also offered and used. The constituent parts of this form are the following: title, studied reality, area, teacher identification in the classroom, class characteristic, lesson characteristic, learning characteristic, content curriculum characteristics and ICT usage characteristics.

For the evaluation of the ICT impact the methodology used consists in the experimental testing of an implemented MOODLE platform through its effective use during a learning process among groups of students from the IV course to the department Computer Systems in Multimedia Systems and E-Commerce at High Polytechnical School of Uige in Angola.

The main technologies used in the courses are: virtual learning environments, video tutorials, audio and video conferencing, chats, forums and virtual libraries [10].

There are online environments where the students can access using computer to attend classes and carry out learning activities. Students receive a password and enter the "virtual classroom" from anywhere and at any time - just needs Internet connection and computer system. In this environment, course content and other interaction tools such as video tutorials, audio and video conferencing facilities, chats, forums, and virtual libraries are available.

Video tutorials are lessons that student can access at any time. They can combine the teacher's speech with presentations, images, sounds and interactivity. They are usually designed to make course content more attractive by keeping the

student's attention for the time it takes to understand the topic.

Audio and video conferencing is a type of technology that allows students and teachers to establish a two-way connection through communication devices such as a computer. In distance learning, audio conferencing and video conferencing establishes contacts between students and teachers in real time.

Through chat tools and discussion forums students can clarify their doubts directly with teachers or promote group discussions. These conversations are usually stored and available to the learner to access the story at any time.

Virtual libraries are virtual collections where students can download educational and reference material in digital format for free.

In order to measure the real impact of ICT on the learning process, we use a web-based approach. It is an alternative approach where the teacher uses the implemented virtual learning environment to transfer knowledge both in a classroom and beyond the classroom walls. In addition to the traditional class examination, an extra examination is carried out using the embedded platform.

The following dimensions are introduced to measure the impact of ICT on the learning process - the level of successfully passed the training course for students - a percentage of the total number of successfully passed students and the total number of students taking part in a given exam. The degree of unsuccessful course of study students - similarly to the previous magnitude.

From the beginning of the sessions to the first partial exams, regardless of the subject, the traditional class approach is applied without the use of the proposed virtual environment. Next exams assess the knowledge gained by using the web-based approach, using the virtual learning environment and the embedded ICT tools. There is an additional online exam. The results obtained are compared with the results obtained from the previous step.

3 Analysis of the results of the conducted experiments

3.1 Analysis of the results of the evaluation of ICT knowledge before its integration

The survey was attended by 441 participants, as 22 were lecturers, 26 were administrative workers and 393 were students. Students showed the highest interest in the study and represented 89% of the study group.

When researching the Internet devices used in a category by lecturers, first of all is a laptop, and then comes mobile phones. On the third place there is the desktop, the fourth are the tablets and finally the iPads. Of the surveyed 26 workers who participated in the survey, the most used device for accessing the internet is the mobile phone, and then comes the laptop. Third is iPad, fourth in the desktop, and finally tablets.

The fact that the top three most commonly used Internet access devices do not have the desktop location shows mobile nature of the Internet access within this category. One of the possible explanations for this is that either the institution does not have the Internet properly allocated to its domains, or perhaps the fact that the study was done at a time when there was a break in Internet delivery. That is why administrative workers need to opt for more personalized mobile Internet access, leaving desktop computers in their places just for processing other information.

Among the most commonly used Internet access devices in the category of students were mobile phones, then laptops, tablets, iPads and finally desktop desktops (fig. 2).

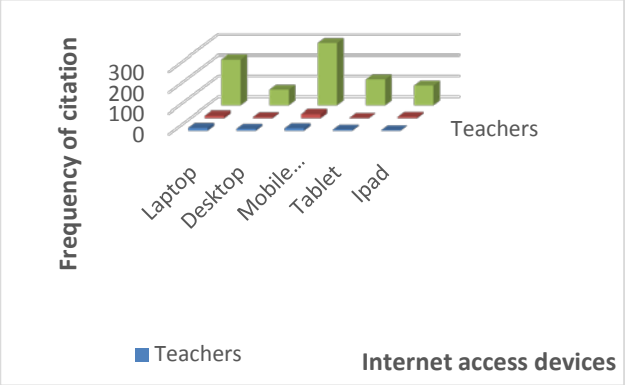

Fig. 2 The most common used devices for Internet access

Finally, in High Polytechnical School of Uige in Angola, the three most commonly used devices for Internet access are mobile phones, laptops and tablets. Last but not least, desktops are Internet access devices in the same institution.

The second question, "*What are the ICT tools that the participants has already used?*" This question aims to determine the effective use of ICT by respondents in the learning process. The percentage of respondents to this question in the different groups of respondents is different: 82% of

the teachers answered, 57.7% of the administrative workers, and 64% of the students.

Social networks (Facebook, Instagram and WhatsApp) and file sharing tools are the most widely used among teachers, followed by wiki tools and blogs. There is no mention of the use of training management systems and video lesson tools.

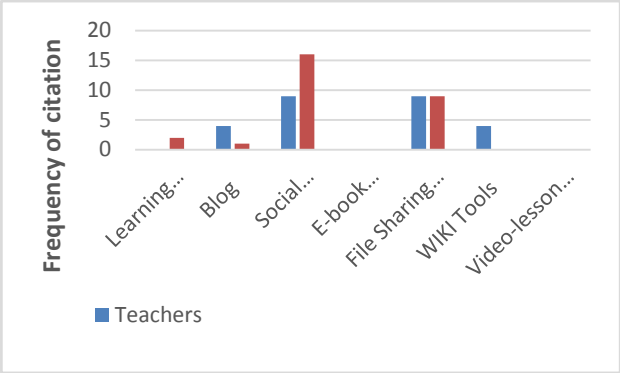

Fig. 3 The most common used ICT tools from teachers and administrators

For administrative workers, the percentage of social network users is higher than teachers, followed by file sharing tools, blogging, and learning management systems. Tools for creating books, video tutorials, and wiki tools there are no answers listed (fig. 3).

According the students, social networks are the most widely used, followed by file sharing tools, wiki tools, learning management systems and blogs (fig. 4).

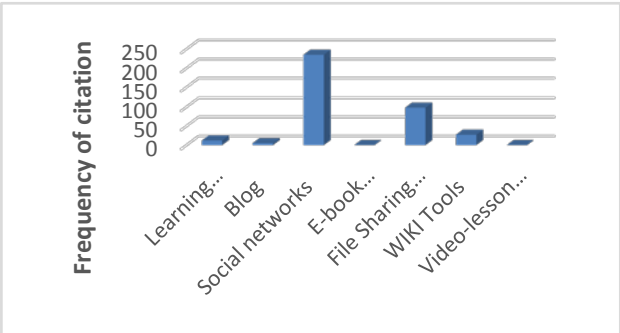

Fig. 4 The most common used ICT tools from students

When providing a list of listed tools, all 26 surveyed administrative workers and all 393 students surveyed were able to identify at least one tool. On the teachers' side - 96% of teachers had at least one tool.

Lecturers and administrators have listed Moodle and Claroline as the tools they know, with the Moodle (60%) percentage highest compared to other tools. Students, on the other hand, have identified all content management platforms as familiar but the highest is Moodle's percentage (63%), which is significantly higher than the Atutor system (9%). Other systems have significantly lower percentages of 2% to 5% of recognition.

From blogging tools, lecturers and administrators have first pointed out WordPress (38%), followed by Live Journal (19%) for teachers and Blogger (23%) for administrative, and followed by Blog, BlogSpot, and Tumblr. For the student group, the highest recognition rate is the Blog tool (29.70%), followed by WordPress (21.12%), Blogger (15.51%) and BlogSpot (15.18%).

The widespread overlapping of social networks in our daily lives can be seen in the reporting of results in the category of social networks. In the social networking category, all systems are well known by both teachers, administrative staff and the students. The most popular social network remains Facebook, followed by Google+, Instagram and WhatsApp. Among teachers, it is significantly higher to refer to the LinkedIn Professional Social Network.

From the wiki category, teachers' tools have indicated Wikipedia in the first place with the highest percentage - 80%. Significantly lower is the percentage of wikispaces (13.33%) and Wetpaint (6.67%). Students are similar to the familiar distributed widgets: Wikipedia (82.55%), wikispaces (12.76%) and Wetpaint (3.65%).

In the eBooks category, teachers have listed My E-book Builder, Papyrus, 3D Pack, Youblisher, and Book Builder, and video tutorial tools are: Camtasia, Camtasia Studio, Camstudio, Koyote, Screem Flow. Administrative workers have considerably less recognition of eBooks tools, which can be explained by the fact that this is not an inherent feature of their professional activity, unlike teachers. From listed tools, they listed only three of them: My Ebook Maker, 3Dpack, and Book Builder.

Only a small number of students have identified the following tools for creating eBooks: My EBook Maker, 3D Pack, Youblisher, and Book Builder. In the video tutorial category, these are: Camtasia (35%), Camtasia Studio (30%), Camstudio (20). The other tools are also mentioned, but they are within 3 to 5 percent cognition.

File Sharing and Teachers, as well as Administrative Workers, are most often referred to as Youtube, Google Doc / Drive, Dropbox, and Slide Share as familiar platforms. Half of the administrative workers are Youtube, while 28% are teachers. However, teachers are significantly higher at Google Doc / Drive recognition (25%) and

Dropbox (21%). The 4-Shared (10%) and Flicky (3%) tools are the other systems that are known but with a significantly lower recognition rate.

More than half of the students said they knew Youtube (54.41%), compared with Google Doc / Drive and Slide Share by 13%. Dropbox is indicated by 12% and 4-Shared of only 5.73%.

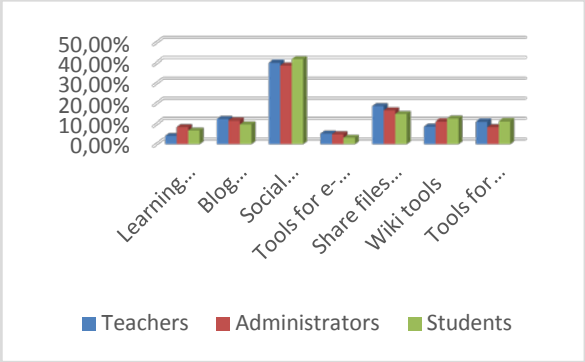

Fig. 5 The most common used ICT tools

In order to determine the effective use of ICT tools during educational activities, we summarize the data obtained in the software tools group (Figure 5).

3.2 Analysis of the results of the evaluation of ICT usage before its integration

In order to characterize the lesson and the learning content, the following variables were selected and used: discipline, lesson of the day, goals, methods and techniques and finally didactical resources used.

In all lessons, the text format prevails, which is 91% of the media used. Of the 11 lessons that were surveyed, the images are listed 7 times, which is 64%. In three of the lessons, a video like multimedia was used, which is 27%. Audio multimedia is not used in any of the tutorials provided for viewing.

In conclusion that one of the most widely used multimedia formats, referring to the content provided to students during the learning process, is texts.

Here are the images from different formats and the third is the video. This shows the poor implementation of ICT tools by teachers in creating learning content for their students. Since teachers are models that students are always trying to imitate, this situation will also negatively impact them on the regular use of ICT tools.

Three of the four ICT tools used to develop learning content are part of the Microsoft office suite, and the fourth is the Acrobat Reader that allows us to read the PDF file. These formats are to some extent textual. The lack of audio and video formats shows the poor multimedia nature of the content taught at the school.

3.3 Analysis of the results of the evaluation of ICT impact after its integration

The evaluation of ICT impact after its integration is applied to students who are in a training cycle in two major disciplines: "Multimedia Systems" and "E-Commerce" using the two approaches: Classroom and Web-based.

In the web-based approach, groups of students are formed, with each group having at least one student successfully passing the exam in the class approach. The training is conducted through a strong interaction between students during the building of knowledge in the respective virtual rooms created for the purpose.

The total number of trainees in the training for Multimedia Systems 62 students, of which 59 are the total number of successful students. As can be summed up by the study, it is clear that the success rate of students' education has increased by about 30% to 50% after using the MOODLE platform, through a web-based approach aimed at strengthening classroom traditional approach of the learning process.

Similar of the first course, E-Commerce has 72 approved students out of a total of 76 in the classroom. This study revealed a rebound in the success rate of student education (an average of 12%).

4 Conclusion

Based on the research done on different classes of learners and their results, we can argue that the implementation of ICT in education requires a holistic project approach.

Its proper implementation has led to the provision of important and effective tools to help and improve the quality of the learning process, such as high interactivity during lessons between the different participants, a rich multimedia character of both the content used and the lesson itself, a great deal of interest and understanding by students towards the whole process.

The use of ICT in the teaching and learning process does not always shorten the learning time, because it depends on the trainee and his interest. Through the web approach, the student can explore and deepen deeper into a particular topic that needs to be learned. On the other hand, the physical absence of the teacher during the web-based

approach motivates the student to make decisions and seek communication with other participants in the learning process.

The research conducted on the impact of the ICT implementation in the learning process leads to the fact that, when implemented with predetermined objectives and methods, the results obtained prove to be very positive. One factor in improving the quality of the learning process is due to the increased interest of experienced students in both the content and the innovative teaching methods to which they are applied. The other registered positive result is the increase of successful students in the disciplines.

Acknowledgements

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References:

[1] Viseu, Floriano, and João Pedro da Ponte. "The role of ICT in supporting the development of professional knowledge during teaching practice."Mathematics Teacher Education and Development 14.2, pp.137-158, 2012.

[2] Jo Shan Fu. "ICT in Education: A Critical Literature Review and Its Implications", International Journal of Education and Development using Information and Communication Technology (IJEDICT), 2013, Vol. 9, Issue 1, pp. 112-125

[3] Bidarian, S., & Davoudi, A. M. (2011). A Model for application of ICT in the process of teaching and learning. *Procedia-Social and Behavioral Sciences*, *29*, 1032-1041.

[4] Wastiau, Patricia, et al. "The Use of ICT in Education: a survey of schools in E urope." European Journal of Education 48.1 (2013): 11-27.

[5] Youssef, Adel Ben, and Mounir Dahmani. "The impact of ICT on student performance in higher education: Direct effects, indirect effects and organisational change." *RUSC. Universities and Knowledge Society Journal* 5.1 (2008): 45-56.

[6] Molnar, Gyongyver. "New ICT Tools in Education–Classroom of the Future Project." *Proceedings of The Fourth International Conference on Informatics, Educational Technology and New Media in Education*. 2007.

[7] GonzáLez, A. B., RodríGuez, M. J., Olmos, S., Borham, M., & García, F. (2013). Experimental evaluation of the impact of b-learning methodologies on engineering students in Spain. *Computers in Human Behavior*, *29*(2), 370-377.

[8] Tvenge, N., Martinsen, K., & Kolla, S. S. V. K. (2016). Combining learning factories and ICT-based situated learning. *Procedia CIRP*, *54*, 101-106.

[9] Lopes, Ana Paula. "Teaching with Moodle in higher education." INTED 2011 (2011).

[10] Amoussou Dorothee, Impact of ICT Implementation in the Learning Process at the High Polytechnical School of Uige in Angola, 8th International Scientific Conference COMPUTER SCIENCE'2018, Eastern Macedonia and Thrace Institute of Technology, Kavala, Greece, ISBN: 978-619-167-177-9