ADVANTAGES OF BLENDED LEARNING APPLICATIONS WITH MODULAR ARCHITECTURE IN PRIMARY SCHOOLS IN SOUTHEASTERN MEXICO

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Abstract

In the Mexican National Education System the standardized measures like the National Assessment of Academic Achievement in Schools (ENLACE), Quality Exams and Educational Achievement (EXCALE) and PISA (Program for International Student Assessment) have shown that the learning deficit of Mexican students in basic skills such as mathematics and reading comprehension are not adequate for a society with sustainable growth. In view of this, the need arises to create support strategies for the teaching-learning process at the national and state level. In the case of the state of Campeche, located in the Mexican southeast, regardless of the psycho pedagogical strategies, the state government has implemented various projects for the use of Information and communications technology (ICT) in schools. In Mexico, the penetration of ICT is relatively low (less than 30% of the population) but the weight of technology is increasing. These data suggest that students and teachers are permanent users of ICT. It is foreseeable that they handle fixed and mobile devices (computers, video game consoles, tablets, smart phones, etc.), that they consult pages, blogs, podcasts and that they know different platforms. ICT is a broad subject whose concept is evolving. Well used, ICT allow to improve teaching and learning processes. Among the projects implemented by the government of the state of Campeche is PowerChalk. PowerChalk is an interactive system for blended learning whose goal is to provide robust, reliable, usable and sustainable multimedia technology. PowerChalk has a modular programming architecture that allows adapting the system to any hardware configuration and supports collaboration, communication, creativity and different learning styles. This article shows the pedagogical, technological, economic, educational management and infrastructure advantages that PowerChalk can contribute to a primary school in southeastern Mexico.

Keywords: Blended learning, Modular programming, Educational management.

1 INTRODUCTION

Educational Technology is the effective use of technological tools in learning. While Educational Technology centers on facilitating learning and ways of improving learning through technological processes and resources, Information and Communications Technology refers to the hardware, software and the methods used in the management of information and tools to communicate this information. Educational Technology as a concept does not imply the use of machines but in many cases make use of ICT tools.

Well used, ICT allow to improve teaching and learning processes. In Mexico, the penetration of ICT is relatively low (less than 30% of the population) but the weight of technology is increasing. Evidently, a lack of infrastructure is a key issue to understanding the situation. In 2012, just 26% of Mexican households had Internet access and it varied among the States [1]. In general, the data suggest that students and teachers are permanent users of ICT. It is foreseeable that they handle fixed and mobile devices (computers, video game consoles, tablets, smart phones, etc.), that they consult pages, blogs, podcasts and that they know different platforms.

In order to face the learning deficit of Mexican students in basic skills such as mathematics and reading comprehension showed at standardized measures like the National Assessment of Academic Achievement in Schools (ENLACE), Quality Exams and Educational Achievement (EXCALE) and PISA (Program for International Student Assessment); the state government of Campeche, Mexico has implemented various projects for the use of Information and communications technology (ICT) in schools. The purpose of the paper is to report a qualitative study concerning the use of Educational Technology for academic purposes; in particular we will focus on the implementation of the project
called PowerChalk [2,3] in an elementary school of the state of Campeche, located in the Mexican southeast.

2 POWERCHALK

PowerChalk is a collaborative e-learning system, where we can combine the advantages of the traditional chalkboard with the functionality of multimedia, electronic devices and modern distance education tools [2]. PowerChalk transform any working session into a visual and reliable information and communication tool.

![PowerChalk structure](image)

PowerChalk was built through a distributed development model based on modularization (modular architecture). This blended learning system is composed of smaller, separated chunks of code that are well isolated (Figure 1). Those chunks of software can then be developed in separated teams with their own life cycle, their own schedule [3]. Such a modular architecture has the following advantages [4]:

- It simplifies the creation of new features.
- It makes it easy for users to add and remove features.
- It makes it easy to update existing features even to code level.
- Fast application development.

PowerChalk modules helps to preserve the pedagogical benefits of the traditional chalkboard and provides the possibility to show not only results or isolated ideas but the train of thoughts. It combined the advantages of an interactive multimedia tool and the faculty to be easily updated and adapted to different pedagogical environments.

The ultimate goals in education are the need for enhanced teaching-learning experiences from students and teachers and access to quality education.

3 METHODOLOGY

The aforementioned study was carried out at the elementary school “Presidente Ávila Camacho” in the state of Campeche, Mexico, as a part of a Ph.D. research program in a period comprising from May 2016 to March 2019. It drew from the premise that creating today's schools for tomorrow's students
requires adaptability and flexibility [5] and the main goal was to analyze the impact of Technological Adaptability on Educational Management.

PowerChalk is a platform that solves many of the limitations of current systems in order to support diversity, easy development, adaptability and to improve human-computer interaction for the management of different types of information. To measurably prove the advantages of PowerChalk in terms of adaptability, we implemented the system in an elementary school.

![Learning session with PowerChalk.](image1)

With the students from first grade until sixth grade (610 students), the objective of this implementation of PowerChalk was (Figure 2):

- Promote the protagonism of the student in a learning session.
- Increase accessibility to ICT tools and flexibility to use it within several projects of the school.
- Encourage cooperative work among students and teachers (Figure 3).
- Improve the presentation and understanding of information.

![Encourage cooperative work using PowerChalk advantages.](image2)

Powerchalk was implemented for teachers (13 female teachers and 5 male teachers with a age range from 25 to 50 years) based on a clear and evident pedagogical goal: to be a program adaptable to the needs of infrastructure and teachers’ requirements and to increase the productivity tools with which the facilitator will be able to obtain the greatest benefits for his class. Having digitalized classes, as well as the exercises that the students solve and that they interactively create mental maps or summaries of their activities allowed to open the world to many significant experiences that
strengthened their learning. Training for 12-hour teachers was required and follow-up with the help of the TCI teacher.

4 RESULTS

Teachers and students in the elementary school "Presidente Ávila Camacho" have different backgrounds and come from different socio-economic environments. These conditions were a good challenge to test the PowerChalk system from the perspective of technological adaptability.

We implemented PowerChalk in a classroom with different computers regardless of their physical infrastructure and diversity of computers. The minimum requirement was that the institution has electricity, a computer and display system information (projector, monitor, TV, etc.)

We accomplish:

- Increase the number of teachers using educational technology in their classes (100% of teachers); and increase the number of classes in which digital media are used (579 hours of learning sessions).
- Increase the number of students using digital content generated by teachers in class (from 152 to 610 students).
- Increase the number of teachers involved in the generation of educational content for the institution (100% of teachers with 453 digital files of learning sessions).
- Average error correction time in Powerchalk program: 1 day.

As complementary information, we present the following statistics (Table 1-5):

Table 1. Schooling of teachers.

<table>
<thead>
<tr>
<th>Bachelor's Degree</th>
<th>Master's degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 2. Opinion survey results.

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>More or Less</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you found the POWERCHALK program useful?</td>
<td>16</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Does the POWERCHALK program seem right for what you need at your school?</td>
<td>16</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Did you have problems when the POWERCHALK program was installed?</td>
<td>3</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td>Do you know what the main purpose of the POWERCHALK program is?</td>
<td>14</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Has the teaching work been facilitated thanks to the POWERCHALK program?</td>
<td>16</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Do you think that the POWERCHALK program will improve the quality of teaching at your school?</td>
<td>17</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Do you think that the tools of the POWERCHALK program should be improved for what you need in the classroom?</td>
<td>17</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Can you use POWERCHALK in the plan and study program that you work with?</td>
<td>17</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Is it difficult to use the POWERCHALK program?</td>
<td>4</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Do you think that students learn better with the POWERCHALK program?</td>
<td>14</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

5 CONCLUSIONS AND FUTURE WORK

PowerChalk preserves the pedagogical benefits of the traditional chalkboard and provides the possibility to show not only results or isolated ideas but the train of thoughts with different kind of didactic material. Combining the advantages of an interactive multimedia system and the faculty to be
installed on different hardware allows it to be a useful and efficient system to be included into any personal computer or a complete working space.

In general, these utilities functions are the means that allow educators adopting the system to express their preferences towards learning. After the implementation of PowerChalk on the institutions, we found a major participation of teachers on ICT activities even the development or implementation of new ICT activities to build computational thinking. Also, several end-users (teachers, students and developers) has been involved in the development of new modules or improving modules.

As future work we set the following goals:
- Test technological adaptability of PowerChalk with different learning methodologies.
- We are increasing the efficient of every module.
- Measure the participation of teachers in the development of new modules and educational content.
- Increase the modules available for teachers and students.

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REFERENCES


