Effect of the Use of Information and Communication Technologies ICT Resources on the Scholastic Performance of Middle School Students in Biology and Geology courses

Abdelghani El Asli*, Abdelaziz Berrado2, Khalid Sendide1, Hassan Darhmaoui1

1* Al Akhawayn University in Ifrane, School of Science & Engineering
2 EMI, Mohammed V University Agdal, Rabat, Morocco Industrial Engineering Equipe de recherche AMIPS

Abstract

The performance in Mathematics and Sciences of a large proportion of Moroccan students in middle and high schools has been ranked recently below expectations. The Center of Information Technology Innovation (CITI) for human development at Al Akhawayn University in Ifrane (AUI) is investigating how IT-based education could improve both motivation and performance of students in middle and high schools. To demonstrate the positive effect of these ICT resources on the scholastic performance of middle school students, CITI experimented the project in two pilot middle schools. The two schools belong to two different socio-economics environments; one is located in Ifrane (small city) and the other in Fez (large city). In each school, two groups, of 20 students each, have been selected randomly at the beginning of the academic year for the three middle school levels. For each level, one of the groups is the experimental group and the other is the control group. In each the three levels in each middle school, both groups were taught the Biology and Geology course by the same teacher.

For each academic level, we developed electronic content matching the intended learning objectives of the Biology and Geology course to be taught using information and communication technologies to the experimental groups in both cities. The control groups in each level learn the same course material from the same instructor using the traditional (non ICT) means. It should be noted that each middle has been equipped with an ICT enabled classroom where experimental groups where taught the Biology and Geology course. For each level, both groups were evaluated using the same tests.

Having designed and run the experiment described above for one semester, we conducted statistical analysis to compare the performance of the experimental and control groups for each level in each middle school. The analysis revealed that the experimental group outperformed the control group for the three levels in the Fez middle school with a 85% confidence. In Ifrane middle school, the performance of the experimental group was superior for the third level but was found to be similar to the control group for the first and second levels with the same confidence level.

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1. Main text

Introduction and Background

Information and communication technologies (ICTs) are a large field that includes radio and television, as well as newer digital technologies such as computers and the Internet. The latter is a potentially powerful tool for educational change and reform. When used appropriately, different ICTs are meant to foster access to education, strengthen the relevance of education to the increasingly digital workplace, and raise educational quality by teaching and learning into an engaging, active process connected to real life (ICT in Education, 2004).

During the last decade, studies showed that Moroccan students did not perform well in middle high school in mathematics and science and therefore couldn’t make it to higher education (Millis, I.VS et al, 2005). Based on these facts, a research grant was allocated by the Korean International Cooperation agency (KOICA) (3) to the Center for Information Technology Innovation (CITI) for Human development at Al Akhawayn University in Ifrane to overcome the mentioned weaknesses by the improvement in the use of Information and Communication Technology that is still very low in the technological usage at the national level.

The project was conducted in 3 phases. Building the IT platform and preparing the middle school instructors to IT environment were the main parts of first phase. The second phase focused on developing IT material to be used in middle school mathematics, physics, biology and geology. The material was developed by the prepared middle school instructors then validated by middle school pedagogic inspectors. After an evaluation of the delivered contents by AUI faculty, the latter was given to CITI technicians for IT implementation. The IT developed material such us power point presentation, simulation and others was presented and then reviewed for improvement by the project members and then added to the platform system. The third phase was about the implementation of the developed material in the applied classroom setting.

Initial results of the project show that the experience gained has allowed accumulating sets of techniques and capabilities that have accelerated progress in supporting development of course materials (Kevin Smith et al, 2008)

This paper covers the approach adapted and results obtained in improving motivation and performance of students in biology and geology courses in middle school.

Structure and Methodology

Hardware

Thanks to KOICA grant, studio and multimedia classrooms were equipped at AUI for the development of the project content. Another two equipped multimedia classrooms established in the two pilote middle school for the implementation of the developed content. The installed AUI studio would be used for recording real classes with instructors from the middle school partners (Collège Al arz in Ifrane and Collège Kassim Amin in Fès). The multimedia classrooms in the partner schools were equipped with computers, server, tables and chairs, a projector, and a screen, a printer, a scanner, air conditioning and wireless connections. The Ministry of Education assured an ADSL connection to each school.
Human resources
The two delegations of Fès and Ifrane have assigned 18 teachers and 6 pedagogic inspectors to work with the KOICA project. Teams consisting of 3 teachers and 1 pedagogic inspector were in charge for the courses content development and to present model courses to be filmed for each the 3 different scientific area: mathematics, physical science and life science.
Workshops were organized on regular basis (weekends) at AUI to train school teachers on the use of the development tools and the e-learning platform. AUI faculty from related disciplines accompanied the development of the project along with CITI engineers and technicians.

Development of digital content
After series of workshops, best practices from IT-based education literatures were identified such us power point presentation, simulations, interactive evaluation…Teams consisting of teachers, pedagogic inspectors prepared the content using Microsoft Word format for the three years programs in the middle. CITI engineers and technician along with AUI faculty revised the content and then converted it to adequate format. The IT developed material is returned to the teachers for validation and then the AUI team placed it through a distance education platform.

Course offerings
To study the material using the developed ICT materials each middle school has selected randomly a pilot class of twenty students and another class with the same size to be used as a control. The latter class and in parallel will use the same material using traditional methods. The two classes are taught by the same instructor in the same discipline. For the three disciplines we had 120 students using the ICT resources and 120 students using the traditional methodology.
Both traditional and IT resources classes were evaluated the same tests that include subject area exams, polls and survey. The obtained grades are used as variable to quantify the impact of IT-based education.

Results and interpretation
We took into consideration the learning curve of the human resources involved in the experiment and made appropriate adjustments to digital contents developed before collecting and analyzing data and drawing conclusions. For each student involved in the experiment, we computed his grade point average in the biology and geology course. For instance, the data collected of the experimental group in Grade 1 in Fes middle school, consist of 20 data points each one representing the grade point average of a student in the course under study from that group.
Having collected data, we tested the experimental hypothesis of our experiment. The data analysis that we conducted consists of a simple comparison, for each grade in each middle school, of the performance of the experimental and control groups using t-tests (Montgomery, D.C, 2007) and the results are given below.
The data analysis consists of comparing the mean of the experimental and control groups in each grade in each middle school. The null hypothesis states that the means for both groups are the same and the alternate hypothesis states that the mean of the experimental group is higher than the mean of the control group. The T-test was conducted at an 85% confidence level. We made a decision based on the p-value of the test as follows; tests, whose p-value is less than 15%, reject the null hypothesis which means that the experimental group outperforms the control group for the discipline tested. The results of this analysis are summarized in Table 1 for the middle school in Fes and Table 2 for the middle school in Ifrane.
Table 1. Results of the 85% confidence level one sided T-test comparing the performance of the experimental and control groups in the biology and geology course for the three grades, in Fes Middle School

<table>
<thead>
<tr>
<th>Fes Middle School</th>
<th>First Grade</th>
<th>Second Grade</th>
<th>Third Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-value</td>
<td>0.013</td>
<td>0.013</td>
<td>0.031</td>
</tr>
<tr>
<td>Test result</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
</tr>
</tbody>
</table>

The results summarized in Table 1 which concern Fes Middle school indicate that using ICT had a positive impact in enhancing student’s learning and their performance in the biology and geology course in the three grades.

Table 2. Results of the 85% confidence level one sided T-test comparing the performance of the experimental and control groups in the biology and geology course for the three grades in Ifrane Middle School

<table>
<thead>
<tr>
<th>Ifrane Middle School</th>
<th>First Grade</th>
<th>Second Grade</th>
<th>Third Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-value</td>
<td>0.499</td>
<td>0.26</td>
<td>0.091</td>
</tr>
<tr>
<td>Test result</td>
<td>No</td>
<td>No</td>
<td>Reject</td>
</tr>
</tbody>
</table>

The results of the comparison did not show a similar success of the use of ICT in Ifrane. At the same 85% confidence level, we noted a positive impact only for the third grade. The positive impact could not be confirmed for the first and second grades in Ifrane. The obtained results concerning the use of IT tools in life science are consistent with the work of Berrado et al (A. Berrado, 2009).

Conclusion
There is a positive impact of ICT based education in biology and geology in Moroccan middle school; In general it was confirmed that the impact was not consistent across middle school representing different socio-economic environment.
References:
- ICT in Education by Victoria L. Tinio 2004