AN INTERACTIVE MOBILE LEARNING METHOD TO MEASURE STUDENTS PERFORMANCE

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This work focuses on miscellaneous means to measure students' performance which requires hard work, commitment, collaborative and organizational skills, true communication and engagement. Using Mobile Learning and other technology is often challenging to students' capabilities and sometimes intimidating, especially for those who have never used it before. In this study, we will discuss how students' classroom use of the Mobile Learning can make a significant improvement when it is well integrated and adopted in students personal skills such as; using organization, communication , assuming responsibilities, critical reading and writing, , problem solving, class engagement, increasing learning interest, emphasizing communities contribution and self evaluation. We will also discuss students' struggle which is not academic, but rather a lack of individual and personal skills. We will discuss students' environment, delivery mode and the associated learning process that show a significant improvement in students' way of learning. This study is a sample of U.G.R.U. IT students selected in Fall Semester 2012 by U.A.E.U. Instructors.

Keywords: Technology, Mobile Learning, Inquiry Based Learning, Measuring Success Factors

INTRODUCTION

Learners today can have direct access to information through technology and the internet, can manage their own acquisition of knowledge through informal learning, and are no longer consumers of content but also producers and publishers. Hence, traditional teaching and learning methods are becoming less effective at engaging students and motivating them.

Mobile Learning and its applications and other associated Technology have been used in education especially in classrooms. New and innovative methods of learning through use of tablets, especially Mobile Learning devices are creating a new model teaching and learning. Technology has improved and sharpens our work in various ways. It becomes a part of our ever changing lives. It has made our lives simpler, more relaxed, and a lot easier. Mobile learning provides a comprehensive experience due to learning can occur anytime, anywhere and at a pace [1]. It is important part of mobile computing to create relationship involving Technology, contents and pedagogy in learning/teaching environment. We mean by Mobile Learning concept, a learning environment where students take control of their learning and optimize it in the learning area classroom and outside.

To improve learning responsibilities new pedagogies were implemented such as the inquiry based model, as flexibility of the content, self and independent learning, and foster creativity. A challenge and project based learning model as students challenged a research question, formulate opinion and share finding. Also, an interest-based learning and open content model as students take academic and citizen responsibilities to define their future learning interest and improve lifelong skills.

In Mobile learning environment new learning units, modules and activities were designed to support students in the new learning process as individual and in a collaborative environment; individually to empower students study and lifelong skills and in groups to expose to challenge a project to improve the collaboration, communication, problem solving and critical thinking skills.

We conclude by this experience, that learning in a mobile learning environment, when well integrated and adopted can make a significant improvement in students personal skills such as organizations, communications, importance of responsibilities, problem solving, class engagement, learning interest, self evolution, and abilities to reach their potential. We learnt also that students who struggle is not academic rather it is the lack of individual and personal skills. In this study we considered as a factors that may affect students' performance and success, the Creativity and innovation skills, Technology

used, Collaboration Team Work, Better Thinking Skills, Time Management and organization skills, and Communication Skills.

Students' performance is enhanced whenever it involves interaction between learners and technology. Teacher's careful lesson preparation, together with follow-up staff development, and technical support are essential components for efficient technology applications. Indeed, careful inclusion of technology in the field of education and teacher's expertise allow students to engage in fruitful tasks and offers more time for individualized learning opportunities.

The encouragement of national research and the technology application development in the field of instruction is crucial to keep up to-date with upcoming technologies. Nevertheless, the government budget allocated for technology research and development is very small. Many unsolved issues about educational technology uses, so there is an urgent need to ask software developers and instructors about effective technology uses.

To show the significance of this success, two separate investigations are carried out at the United Arab Emirates University Campus. A survey questions for Experiment: 65 sections (1253 students), 15 teachers, and Control: two sections (30 students), one teacher. A comprehensive experience applied to one foundation course (iTechnology)

WHY THIS EXPERIENCE?

There are many motives behind the implementation of the above mobile learning experience. In the last two years, reforming our current learning process under the theme of "Re-think how students should learn or how learning should happen in the 21st Century" become a necessary condition.

We believe that we reached a tipping point where making changes to the current learning process is inevitable for many reasons; today learners have instant access to information through technology and the web, manage their own acquisition of knowledge through informal learning. As a result, traditional teaching and learning methods are becoming less effective at engaging students. Students do not rely on the teacher as the only source of knowledge, when asked, 90% of the students use internet as the knowledge repository, therefore, the teacher role should be redefined to active and creative teacher. The teacher should play the role of a facilitator, guide and help students not only to locate information but question the information, reflect and formulate an opinion.

Another reason is the advent of the mobile learning technology; our institution did not hesitate to integrate the MLD Mobile Learning Device as a primary learning and teaching tool. It was a great opportunity for us to transform the current learning process under the MLC Mobile Learning Concept.

The integration of the MLA into the curriculum raised several questions by instructors, curriculum designer and administrators; from the infrastructure to classroom and assessment; does the current IT infrastructure support this integration? What to teach and how to teach? What is an effective pedagogy? How content should be delivered? How learning should be assessed? What is the direct effect of the MLA on students' performance?

We recommend that all these questions should be taken in considerations when designing a new learning process under the MLA, we mean by the learning process the learner, instructor, content, pedagogy, technology and assessment (fig.1). In this experience, we focused only on the implementation of new learning outcomes, how they are infusing into the curriculum and how they are assessed?

The ultimate objective of implementing a new learning process is to design a curriculum and a creative pedagogy oriented toward the cultivation of the creative person and the discovery and exploration of the creative idea. The above objective leads us to design a comprehensive learning experience with new learning outcomes where we deliberately infused new practical skills called the 4Cs, Critical thinking and Problem Solving, Creativity and Innovation, Communication and Collaboration. Others skills are implicitly infused into the curriculum such as, self-learning, interdependence, lifelong learning, flexibility and adaptability, and taking academic responsibilities.

In this Study, we will focus on the 4Cs practical skills (creativity, critical thinking, collaborative and communication), how the mobile learning directly impact these skills and how do we measure this impact? An empirical approach is adopted to investigate these questions.

Mobile learning is defined as learning using mobile and wireless computing technologies in a way to promote learners mobility and nomadicity nature [Shon 2008]. We define mobile learning as making content knowledge accessible anytime, anywhere at the learner pace using a mobile device.

In the following paragraph, we define each component of the learning process as presented in (fig.1)

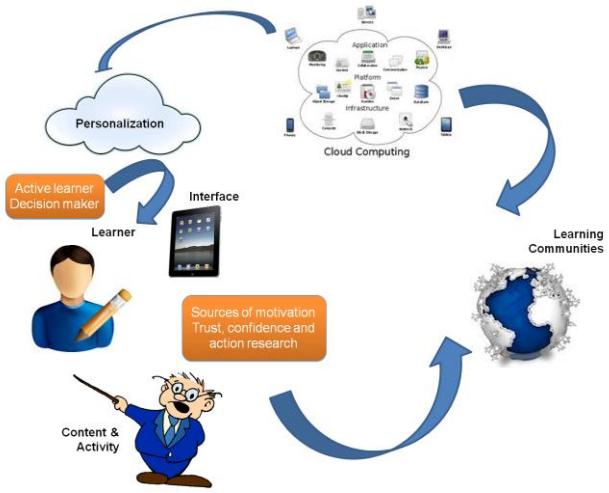


Fig. 1: MLA Mobile Learning Approach

Active Instructor: the one who facilitate learning inside and outside the classroom, engage students in the learning process, allow students to participate in designing their own content and contributing to design learning assessment.

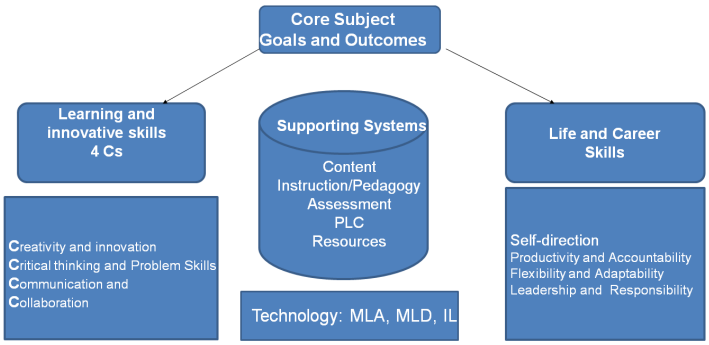
Active learner: personalize learning, access content anytime, self assess, engage with others in a collaborative environment, formulate opinions, continuously learning, interact with other learning communities, communicate effectively, share and publish findings.

Creative pedagogy: both instructor and learners decide on what to learn and how it should be learned. It's designed to promote an inquiry and challenge based learning models where teachers and students work together to learn about compelling issues, propose solutions to real problems, and take action. The approach asks students to reflect on their learning, on the impact of their actions and publish their solutions to a worldwide audience.

Flexible curriculum: a core curriculum is designed, but the facilitator has a freedom to innovate and customize content accordingly up to the aspiration of the learners; this means that the learner's knowledge of the material will come mainly from his own investigation (formal and informal content), creativity and collaboration with others (team work).

Communities outreach: allow group of students to formulate real-world context research question, connect students with their local learning and large communities to find creative solutions to their problems. Create opportunities to connect students with international communities. These opportunities will foster students social and leadership skills.

The following figure (Fig.2) represents the building blocks of the learning process. After defining the learning outcomes and core content, many questions were raised, how to teach? How to assess learning? And what is expected from this learning experience?



Therefore, a comprehensive approach should be adopted to ensure a correct implementation of the new learning process, new pedagogy is adopted based on Inquiry and challenge based learning, a new assessment system is designed a FAS Formative Assessment System where teacher involve students to design their own tests and give them regular feedback on their work. All teachers were involved in an intensive training to simulate their class delivery, video typed and feedback was given to each teacher, research action communities were established to share best practices, lesson plans and rubrics were delivered to teachers and students.

According to teachers' observation 97% of teachers found that the mobile learning device (iPad) boost students' interest, engagement and motivation, 90 % of teachers used multimedia and apps as interactive tools to engage students in class discussion such as Nearpod and Socrative. 97% of students were engaged in presenting and sharing a five minutes presentation to their classmates, write a reflective essay on their experience, involved in a collaborative project (interest based learning project), 97% of students contributed in the self and peer assessments, and 90% interacted using online management systems. Students were also encouraged to interact with their peers using iPad apps, 70% of students delivered their work on time.

For the purpose of the study, we infused several assessments components both individual and groups work. For the individual work; each student was required to make an individual presentation on any subject of his own interest, write a reflective essay, self assessment, class peer assessment, midterm, and final exams. For the collaborative work, students were assigned teams, each individual should contribute to the project, bi-weekly deliverables, final presentation and final project.

Rubrics were designed, all students were well educated to use the rubrics, teachers were trained to monitor and facilitate the experience. Most of the data was collected through mobile apps, such as Google docs, Edmodo, and internal learning management systems such as Blackboard and Computer Generated Exams.

Several evaluations systems were used, class observations, teacher observation, teachers focus groups, outcomes and course observations.

We have noticed how students were eager to be engaged in this experience, one the strategies in the project, was to engage students with UAEU faculties, staff and professionals. We have seen students conducted interviews and making questionnaires to collect data for their projects. Others students, outreached other learning communities outside the institution to implement their own experiences in primary and middle schools.

The subsequent fig 3 shows the feedback loop of content mapping of factors and their relationships in relation to students' performance and intake. The first feedback loop begins at the node called "Team/Students". The second one begins at the node entitled "Coach Teacher". There are two major positive feedback loops. For instance, a good team improves co-operation and creativity which increase team experience. Setting clear goals and interactive strategies will enhance learning and performance results. The learning process and the project outcome are influenced by technology use.

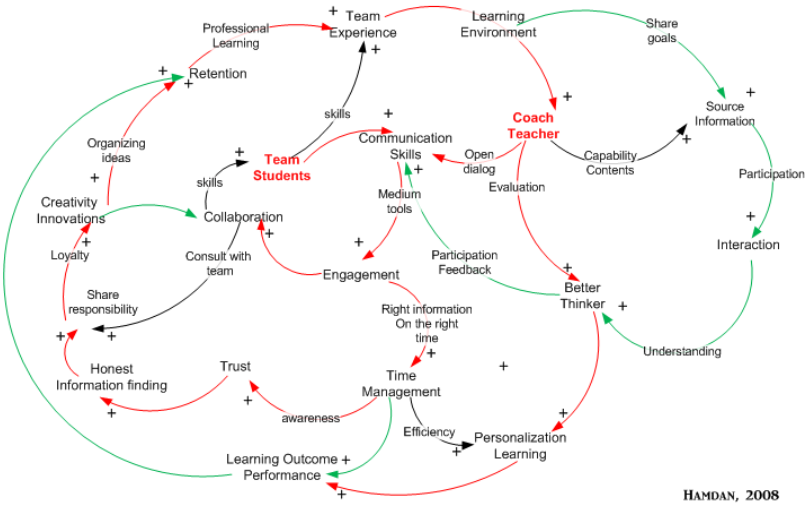


Fig 3: Conceptual model of students' learning environment Parameters [4]

METHODOLOGY

We studied impact of Mobile Learning technology in classrooms and the effect of performance factors on students learning behavior and student achievement. The study is applied on a sample of 1253 students collected from the enrolment of UGRU students in Fall 2012, at United Arab Emirates University. The survey covers 6 aspects with 5 items for each aspect to rate how important it is in affecting learning. Other methodologies were used to assess. They include class observation, teacher surveys and focus groups, students learning outcomes assessment, testing (assessing prior and post knowledge) and quantitative research (MLA vs. Conventional). The findings of that survey are discussed below. The analysis of study was performed using the statistical package SPSS. A descriptive statistics were obtained to summarize the sample characteristics and performance variables. Pearson Correlation was used to evaluate the association between the learning outcomes dimensions. Independent Samples t-test was used to compare the mean overall performance of the MLA and CMM groups. Shopiro-Wilk test was used to test the normal distribution assumption of quantitative variables. Linear Regression was used to determine the impact of the learning characteristics (Critical thinking, Creativity, Communication and Collaboration) on the overall performance score. Factor Analysis was used to study the interrelationships among the learning characteristics and compare the MLA and CMM methods.

RESULTS AND ANALYSES:

Students learning performance data was processed and presented. The six characteristic attributes were identified. Each characteristic was divided into further sub-items that were rated 1 to 5 by the respondent. Then for each of the six main characteristics the average of the sub-items rating was calculated.

The box-plot (see Fig 4) shows in details the distribution of each response. This was made of the results, comparing the responses given to the different factors affecting learning. The result shows the teachers rating of the effect of MLA on the following. For example: 50% of teachers think that 70% of students improved their creativity skills.

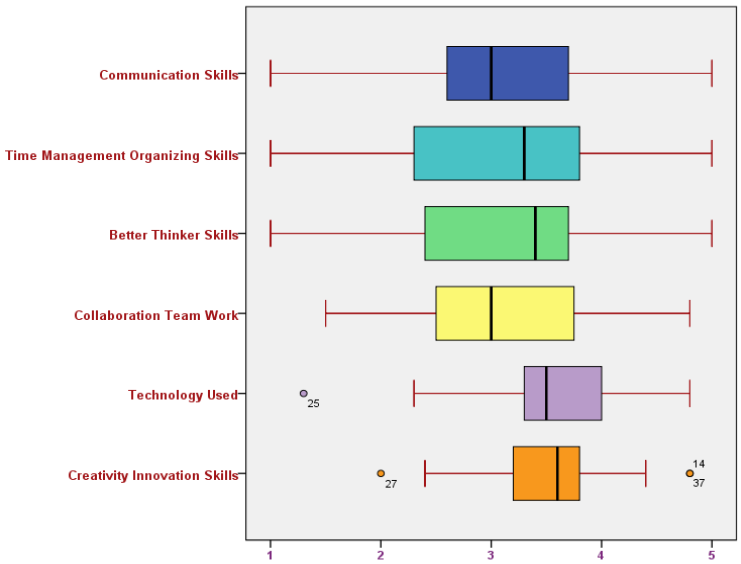


Fig 4: Using Mobile Learning in general in the classroom

Descriptive statistics for the learning variables are shown below (See Table 1). In general, the mean and median of all the characteristics are quite high, around 3.5.

Table 1: Learning Characteristics

Statistics

Learning Aspects	Mean	Median	Std. Deviation	Minimum	Maximum	Mean Score %
Creativity Innovation Skills	3.5	3.6	.6223	2.0	4.8	70%
Technology Used	3.6	3.5	.7459	1.3	4.8	72%
Collaboration Team Work	3.0	3.0	.8981	1.5	4.8	61%
Better Thinker Skills	3.2	3.4	.8984	1.0	5.0	63%
Time Management	3.1	3.3	1.0144	1.0	5.0	61%
Communication Skills	3.2	3.0	.9020	1.0	5.0	63%

Regarding correlations between learning parameters, the results show that that almost all characteristics are highly inter-correlated ($p < 0.001$) (See Table 2).

Table 2: Learning Characteristics

Correlations

		Creativity Innovation Skills	Technology Used	Collaboration Team Work	Better Thinker Skills	Time Management Organizing Skills	Communication Skills
Creativity Innovation Skills	Pearson Correlation	1	.393*	.685**	.767**	.659**	.653**
	Sig. (2-tailed)		.019	.000	.000	.000	.000
Technology Used	Pearson Correlation	.393*	1	.632**	.599**	.575**	.543**
	Sig. (2-tailed)	.019		.000	.000	.000	.001
Collaboration Team Work	Pearson Correlation	.685**	.632**	1	.845**	.773**	.836**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
Better Thinker Skills	Pearson Correlation	.767**	.599**	.845**	1	.862**	.897**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
Time Management Organizing Skills	Pearson Correlation	.659**	.575**	.773**	.862**	1	.796**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
Communication Skills	Pearson Correlation	.653**	.543**	.836**	.897**	.796**	1
	Sig. (2-tailed)	.000	.001	.000	.000	.000	

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).

Students' feedback on the course outcome is shown in (See Table 3). This summary of students' outcomes assessment on what they agree and strongly agree the course helped them to effectively use iPad and empowered them to take responsibilities and explore knowledge.

Table 3: Students' course outcome

Aspect	%Yes
Operational Skills	89%
Use of Mobile Technology	90%
Communications Skills	69%
Problem Solving	69%
Formulate Opinions/Critical thinker	79%
Evaluate information	84%
Collaboration	88%
Sharing findings and ideas	86%
Taking academic responsibilities	88%

Linear regression was used to evaluate the learning model. The student scores is a dependent variable with one or more predictors learning characteristics. The model summary for learning systems shows the strength of the relationship between the learning aspects results and the dependent variable with a coefficient of determination (r-square = 0.89) which implies that the model explains 89% of the variability of the dependent variable students scores. The F-test of the model validity is significant (p-value <0.005), the coefficients are presented for learning summary Model:

Learning (MLA & CMM) summary Model = - 9.939 + 0.861 C1 + 2.228 C2
+ 1.322 C3 + 1.035 C4
+ 19.46 Treatment - 0.192 C1_MLA
- 1.669 C2_MLA + 0.755 C3_MLA -0.47 C4_MLA

The independent-Sample statistic test provides a comparison of the mean scores Y between the two groups MLA and CMM variables. This test indicates that there are no significant differences in both means (p-value =0.88).

The dependent variable scores was used for the construction of a linear regression model for MLA group. After the entrance and removal of the learning characteristics independent variables, the following predictors were selected:

Learning characteristics MLA:

- Critical Thinking Innovation (C1)
- Communication (C2)
- Creativity (C3)
- Collaboration (C4)

The MLA model explains 88.3 percent of the variability of the dependent variable Scores (sig<0.000), whereas the coefficients are presented in MLA Model (see Fig 5).

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
MLA	.941[a]	.885	.883	2.4314

a. Predictors: (Constant), Collaboration (C4), Critical Thinking Innovation (C1), Creativity (C3), Communication (C2)
b. Dependent Variable: Score (Y)

ANOVA[b]

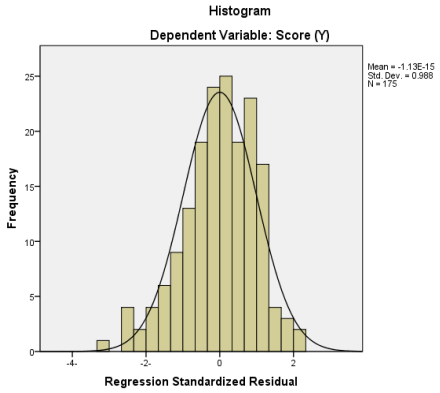
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7763.986	4	1940.997	328.334	.000[a]
	Residual	1004.982	170	5.912		
	Total	8768.969	174			

a. Predictors: (Constant), Collaboration (C4), Critical Thinking Innovation (C1), Creativity (C3), Communication (C2)
b. Dependent Variable: Score (Y)

MLA Model[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	14.319	2.054		6.971	.000
	Critical Thinking Innovation (C1)	.614	.050	.352	12.280	.000
	Communication (C2)	.516	.096	.190	5.401	.000
	Creativity (C3)	1.996	.114	.500	17.493	.000
	Collaboration (C4)	.511	.068	.256	7.525	.000

a. Dependent Variable: Score (Y)



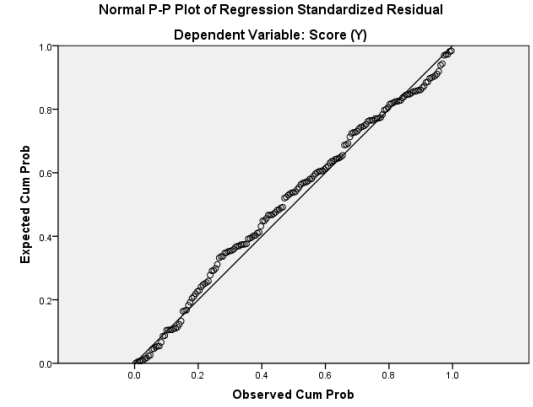


Fig 5: MLA Model grades distribution

The model summary for CMM Model shows the strength of the relationship between the learning aspects results and the dependent variable with a coefficient of determination (r-square = 0.88) which implies that the model explains 88% of the variability of the dependent variable students scores. The F-test of the model validity is significant (p-value <0.005), the coefficients are presented for Control Model.

CMM Control Model = 10.01 + 0.689 C1 + 0.587 C2 + 1.998 C3 + 0.582 C4

MLA and Conventional Scores Variation

Based on the independent samples t-test, the two groups differ significantly in their mean scores of Creativity (C3) and Collaboration (C4) with MLA having a higher mean score in Creativity (C3) and the Conventional Group having a higher mean score in Collaboration (C4). There are no significant differences between the two groups in their mean scores of (Y), Critical Thinking Innovation (C1) and Communication (C2).

The median scores of Creativity (C3) and Collaboration (C4) appear to be different with MLA having higher scores in Creativity (C3) and Conventional having higher scores in Collaboration (C4). Variations of scores appear to be similar in both groups. The box-plot clearly shows the detailed distribution of each response. Collaboration between students and Creativity clearly indicates students adopted the MLA (See Fig 6).

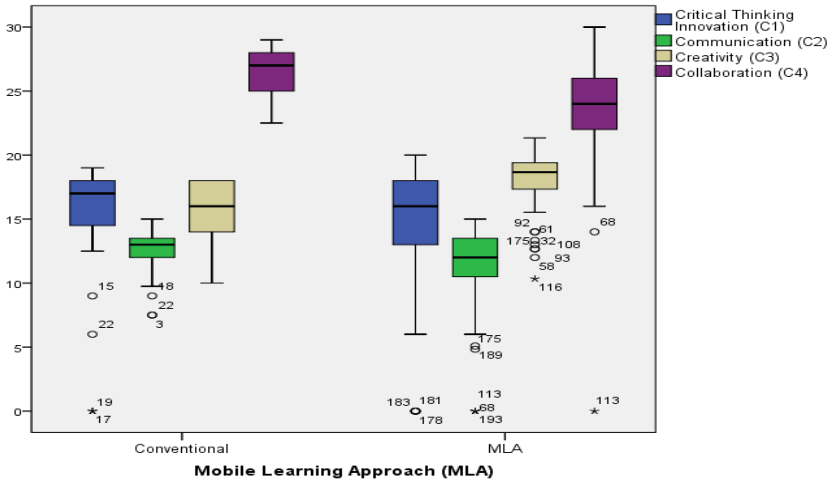


Fig 6: Control Model (CMM)

The One way analysis of variance compares means of the MLA and CMM on learning variables. Collaboration is the only variable that is non significant different between the two groups (See Table 4).

Table 4: One-way analysis of variance of MLA

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Critical Thinking Innovation (C1)	Between Groups	3025.835	146	20.725	2.022	.002
	Within Groups	543.133	53	10.248		
	Total	3568.969	199			
Communication (C2)	Between Groups	1062.227	146	7.276	1.570	.030
	Within Groups	245.558	53	4.633		
	Total	1307.785	199			
Creativity (C3)	Between Groups	776.154	146	5.316	3.161	.000
	Within Groups	89.125	53	1.682		
	Total	865.278	199			
Collaboration (C4)	Between Groups	1970.748	146	13.498	1.296	.140
	Within Groups	552.190	53	10.419		
	Total	2522.938	199			
Mobile Learning Approach (MLA)	Between Groups	18.992	146	.130	2.391	.000
	Within Groups	2.883	53	.054		
	Total	21.875	199			

A Principal Components Analysis (PCA) of C1-C4 is performed to see how the groups of students differ. When summarizing the scores in C1-C4 according to the directions of highest variation in scores (PCA Factors), the Varimax rotated Factors had the following correlations (loadings) with C1-C4 (see Fig 7).

Rotated Component Matrix[a]

	Component	
	1	2
C1	.363	.649
C2	.795	.321
C3	.017	.892
C4	.895	.029

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Fig 7: Factor Analysis for learning factors

The first Component (Factor) represents the average performance in Communications and Collaboration/Problem Solving while the second Component represents the average performance in Critical Thinking and Creativity.

When computing the scores for each student of the two groups and plotting them we get the graph below which shows that students from the Conventional group are distributed in the lower right corner of the graph, that is, they have lower scores in the second Component (Critical Thinking and Creativity) and relatively higher scores in the first Component (Communications and Collaboration/Problem Solving) (See Fig 8).

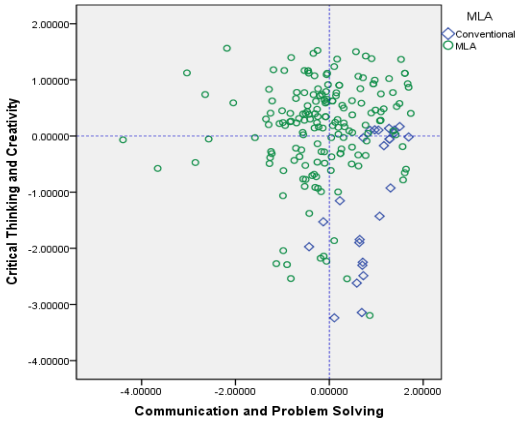


Fig 8: Factor Group plot Conventional vs. MLA Models

Conclusion

Teachers' observation revealed the positive impact of the MLA on students' performance. Students were more engaged in the learning process than before. Students are taking more responsibilities, contributed and participated in designing assessments and personalizing their learning. MLA helped in elevating the time and space constraints of the learning process. MLA has a direct impact on creative and critical thinking skills, the experience showed a significant difference between the two groups. In the MLA group, we did not see a significant improvement in the collaborative skills. MLA helped students to effectively communicate their findings and share their ideas.

The implemented pedagogy (action research and active learner) had a positive impact in improving the expected skills. The Professional Learning Communities PLC (teachers sharing their best practices) has a positive impact on the success of the experience implementation. Students were more optimistic than the teachers; students think that the MLA helped them to achieve more skills (outcomes evaluations). Teachers and students evaluations, and the study results are compatible, C2 and C3 scored high in all cases. MLA if not correctly implemented might lead to isolation. From the study, the conventional group scored high in collaboration compared to MLA group. Deliberately infusing critical thinking, creative, collaborative and communication skills in the curriculum did not affect the core subject mastery, we have seen a significant and positive implications of these skills on the overall students' scores.

The experience revealed that introducing a new technology such as the MLA will not have more impact without reconsidering the delivery mode, content redesign, new assessment system and professional development. An appealing pedagogy and content are the most important sources of learning motivation. According to students' evaluation, students are mostly inspired by their teacher and how content is presented. Teachers are not anymore the only source of information, according to the students' information literacy survey; their main sources are Google, YouTube and other online sources. Didactic teaching style is not anymore effective.

RECOMMENDATION

This experience should be extended to other programs to study the implications of MLA on different subjects. Re-assess the collaborative components of the learning process. Integrate student personal development capabilities to improve their academic skills. Promote the 21st century educational framework outcomes. Develop Professional learning communities to share their best practices.

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