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Universidad del Zulia
Facultad Experimental de Ciencias
Departamento de Ciencias Humanas
Maracaibo - Venezuela

Promoting teaching and learning performance in mathematics classroom through e-learning

Salman Sahud Alotaibi¹

¹ College of Education, Prince Sattam Bin Abdulaziz University,
Al Kharj Kingdom of Saudi Arabia
ss.alotaibi@psau.edu.sa

Tribhuwan Kumar²

² College of Science and Humanities in Sulail, Prince Sattam Bin
Abdulaziz University, Al Kharj Kingdom of Saudi Arabia
t.kumar@psau.edu.sa

Abstract

This delectable research project studies the practice of e-learning in Mathematics classroom. It propagates the wide concept of e-learning, its dimensions, advantages and applications in Mathematics. The innovation of the Information Communication Technology (ICT) in modern teaching is powerful approach which has brought magical response across the globe. E-learning has various implications like digital Technology. In traditional Mathematics class it may be used as buttress of the traditional face to face lecture. However, e-learning shall be integrated cautiously without completely abandoning old methods.

Key Words: learning, Information communication technology (ICT), blended learning, Educational technology tools, e-learning technologies and resources, Virtual classroom and space, Virtual technology or platforms, and Mathematical Software or Applications.

Promoción del enseñanza y aprendizaje del aprendizaje en el aula de matemáticas a través del aprendizaje electrónico

Resumen

Este delicioso proyecto de investigación estudia la práctica del e-learning en el aula de Matemáticas. Propaga el amplio concepto de e-learning, sus dimensiones, ventajas y aplicaciones en Matemáticas. La innovación de la tecnología de comunicación de la información (TIC) en la enseñanza moderna es un enfoque poderoso que ha generado una respuesta mágica en todo el mundo. El e-learning tiene varias implicaciones como la tecnología digital. En la clase de Matemáticas tradicionales, se puede utilizar como refuerzo de la clase tradicional cara a cara. Sin embargo, el aprendizaje electrónico debe integrarse con cautela sin abandonar por completo los métodos antiguos.

Palabras clave: aprendizaje electrónico, tecnología de comunicación de la información (TIC), aprendizaje combinado, herramientas de tecnología educativa, recursos y tecnologías de aprendizaje electrónico, aula y espacio virtual, tecnología o plataformas virtuales y aplicaciones o software matemático.

1. INTRODUCTION

Mathematics has been considered a difficult subject for most of the students in the world. The success of the students largely depends on the continuous and rigorous practice under the tutelage of an expert teacher. Unfortunately, the availability of teacher for twenty-four hours is not a practical idea. Due to that reason, most of the students find mathematics boring and tough subject. However, with the advent and emergence of e-learning, Mathematics leaning has become easy and comfortable.

The objectives of mathematics education reflect the perspective of educational philosophy, the desire to achieve a comprehensive and balanced growth in the scientific and abstract aspects, while facilitating the employment of what students learned in attitudes and living applications, informed by recent trends and experiences that raise the value of what has been learned and instilled in the minds of learners.

The researchers such as Bitter and Pierson (2005) and Wiske, Franz, and Breit (2005) believe that the use of instructional technology in class enhances learning so that students can learn more effectively. The other researchers such as Smaldino, Russell, Heinich & Molenda (2005) in their book *Instructional Technology and Media for Learning* discuss the importance of technologies and innovations in teaching and learning. According to them, in technology-implemented classes, because of the involvement of the students in interactive and dynamic learning process, learning becomes more fun and more attractive for the students. It is an undying fact that the classroom where educational technology is integrated into instruction, both teachers and learners experience benefits from using it and improve their performance.

2. METHODOLOGY

Now before discussing the various dimensions of the uses of educational technology i.e. e-learning in mathematics classroom, it is imperative to understand the concept of e-learning precisely. The term

e-learning can be understood in multifarious ways. E-learning or virtual education is new learning concept, which is about using electronic media and Information and Communication Technologies (ICT) to expand access to education and to enhance and transform teaching and learning. The word in e-learning specifies electronic. This means that e-learning is learning with the use of electronic devices or technology especially by the means of computer or laptop and internet. It uses information and communication technology for the purpose of learning. It uses a wide range of tools or resources such as numerous types of media that deliver text, audio, images, animation, and streaming video. It also includes digital technology applications and mediums such as audio or video tape, CD-ROM, DVD, satellite TV, and computer-based learning such as video lecture, smart class, as well as local intranet and web-based learning such as virtual classroom, teleconferencing, video conferencing, and e-books. The concept of e-learning by the European E-learning Action Plan is worth quoting here:

E-learning is ‘the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration’ (Commission of the European Communities, 2011 p.2).

3. RESULTS AND DISCUSSION

The above elucidation about e-learning connotes the complexity and multiple dimension of the term. Then what does it exactly mean?

The term e-learning can be precisely understood in terms of continuum. The following graphic helps to understand e-learning:

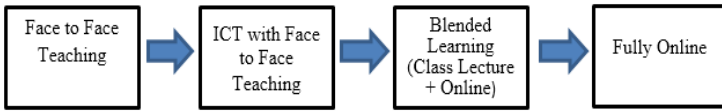


Figure 1: A diagram illustrating the concept of e-learning

The beginning of the flow chart is face to face teaching, which is considered the traditional teaching method. More and more technology is used to replace face to face elements. Initially this has very little impact on how teaching is organized and how learning occurs because technology is used primarily to enhance face to face teaching. The subsequent aspect of e-learning is blended learning. In the blended environment, only a few faces to face sessions are held. Technology is used increasingly to deliver the teaching and facilitate the learning and the nature of face to face session changes. Instead of coming to class regularly, they listen to a teacher through his e-learning resources. Students come to discuss and to work and collaborate in small group. The last one is fully online or distance learning mode. In this type of learning, students can get education to any place which is convenient to them through the use of e-learning resources. Discussing more elaborately, it can be said that e-learning has three major categories: synchronous e-learning, asynchronous e-learning and the blended method. In asynchronous e-learning, there is

no need of a live interaction in between the teacher and the students. Embedded learning is a popular method of this category. In this method, the students have the access to the information which they require all the time. The information in electronic form is sent to the user. The learner is free to use the sent information irrespective of the restriction of time and place. The advantage of this is that they can continue their course at a pace which suits them unlike the classrooms in which the students have to learn at a predefined pace of the teacher. Another category is synchronous e-learning, in which the student and the teacher have to interact at the same time using the facility of internet. They have to be connected in real time classroom through virtual environment. In virtual classroom, the students and the teacher enter into the conversation using the internet. They may enter into conversation via chatting, messaging, calling and video conferencing etc. the third is blended method. In this method, features of both synchronous and asynchronous, are included.

Relevance of Information Communication Technology to the present world is immense. E-learning is highly useful to the students and teachers. Teachers are facing highly advanced generations in their classroom. Students today are hyper-sensitive and curious. They have various sources for accumulating information. Moreover, at school level, they are highly destructive. It is great challenge for a teacher to control the class. Students seek out information in very different way than 5 or 10 years ago.

There are certain math skills, which are a complex task to be achieved. The Organisation for Economic Co-operation and Development (OCDE) supported PISA 2012 Results survey confirms seven mathematical capacities or skills. They are as follows:

- **Communication:** in this skill, identify and understand the situation described in a problem is included, as well as the subsequent presentation of solutions.
- **Mathematization:** this term makes reference to the description of the main mathematical activities involved in a problem. What makes that a defined problem in the real world becomes into a strictly mathematical way.
- **Representation:** charts, tables, diagrams, images, equations, formulas, and specific materials.
- **Reasoning and mathematical argument.**
- **Use of operations and symbolic, formal and technical language in a mathematical context.**
- **Strategy design to solve problems:** selection or design of a plan to use mathematics to solve problems.
- **Use of mathematical tools.** (OECD, 2012 p.9)

These mathematical skills are not easy to understand. E-learning can play significant role in simplifying these skills. E-learning can use various e-learning technologies and resources to bring innovation in teaching and learning process.

The use of computer and internet offers a significant substitute of traditional lecture method. The use of technology and other resources for mathematical learning in classroom enriches not only the learning competencies of students but also boosts up their motivation level. As a result, students are more involved and focused in the learning process. The words of Barron, Ivers, Lilavois, and Wells (2006) are worth quoted here: “Technology provides an excellent avenue for student motivation, exploration, and instruction” (p.17). Simultaneously, e-learning helps miraculously in attitude building in the learners. Attitude is actually “a learned predisposition to respond positively or negatively to a specific object, situation, institution, or person” (Aiken, 2000 p.248). As Mathematics is considered a tough subject so students start losing interest in the subject and avoiding the lecture. A student with a negative attitude towards Mathematics doesn't pay attention. Studies have shown that positive motivation and attitude is a strong predictor of performance. In teaching and learning of any subject, students' attitudes and preferences are the great parameters for motivation and achievement. Because of inappropriate teaching methods and styles, most of the students start losing interest in the Mathematics subject. A Mathematics teacher should be qualified enough to maintain the legacy of Mathematics in the heart from the formative years to matured years. Students in the middle and

secondary grades experience determining crossroads in their mathematical education. They are “forming conclusions about their mathematical abilities, interest, and motivation that will influence how they approach mathematics in later years” (Protheroe, 2007 p.52). In early years, teachers can use animated video, rhyme on numbers and colorful web materials with pictures to involve the tiny tots. Small children can learn addition, subtraction, multiplication, division and other mathematical applications easily and effortlessly if a picture is. Hence, for the initial phase, concepts are pictorially depicted by providing illustrations, so that a given concept can be easily captured by these kids. Further, in higher classes, the lesson may be delivered to learners via subscribed Youtube videos, subscribed web interfaces, social media websites, live skype lectures, DVDs, etc. Certainly e-learning teaching aids succors the positive attitude toward Mathematics. Because of the many positive aspects that are promoted in e-learning stages in educational environments, which increase the direction towards them, through which to diversify interactions and improve outputs, it is an interactive system with diverse objectives. E-learning contributes to creating diverse learning environments, the interaction of students, and raises the possibility of exchange of knowledge and values and experiences. It also provides educational tasks and experiences commensurate with the characteristics of the learners and their personalities and preparations, so as to ensure the observance of individual differences.

Mathematics is basically a numerical ability subject, which describes an unreal world. Due to these complicated features, the students fail to visualize and understand the concept in mathematics. In case of traditional lecture, learning is done by the means of conversation between the teacher and the students. The practice of sensible technology is incredibly less in traditional lecture. But in case of e-learning, there is a generous use of digital resources included presentations, multimedia that includes images and videos etc. With the use of Smart/Interactive Board, PowerPoint presentation, e-learning management system, electronic course content which is the best complement of the textbook through the editor website and DBS Smart system, teachers can enhance learning process of the students immensely.

The concept of e-learning has made many teaching components easier. Both the students and the teachers can use online sample papers and assignment to improve their performance. E-learning has successfully invented a paperless and environment friendly world. Now-a-days, tests are taken through online quizzes or some pre-designed software which first conduct the test and then evaluate them. This reduces the work of the teacher. Also, the result is obtained in a short while, in some cases, it is obtained just after the test finishes. Needless to say, the e-learning saves the time in the evaluation of the students. Moreover, evaluation of the examination paper is accurate. This helps in enhancing the performance of the students.

Technology can be helpful in classroom settings by encouraging inquiry, helping communication, constructing teaching products, and assisting students' self-expression (Baek, 2008 p.1).

Bates and Poole (2003) rightly put their views:

...technology does not reduce the need for imaginative, creative thinking about teaching and learning; indeed, it increases the need. Technology opens up a vast range of opportunities for imaginative, creative teaching ... (p.178).

The introduction in the classrooms of the ICT and especially of Internet has created the learning virtual spaces, that are online platforms where the process of teaching-learning can be developed using the cooperative and / or collaborative learning (Pérez, 2010; Yuspin & Absori, 2019).

Technology promotes an individualistic and self-teaching style of learning. Today almost all world-class universities have their own specialized online e-learning systems such as Moodle, Blackboard, iClickers, SAKAI, MUMIE, PROJECT DESCARTES, MOISA and many more. These specific or nonspecific virtual technology platforms for mathematics have e-learning modules. These modules are strictly based on the curriculum of the respective university, which students can use for their benefits after the classroom lecture. The tools have an online web-based and app-based interface for wider reachability. They

are developed in correlation with curriculum and are considered as a formal setup of learning. These platforms and websites provide online mathematics learning for teachers and students. Moodle and Blackboard are well known free virtual learning environment platforms through which they facilitate and encourage the development of educational innovation. SAKAI is a joint venture of the University of Michigan, Indiana University, the Massachusetts Institute of Technology and Stanford University. It is used as Open Knowledge Initiative (OKI) and uPortal consortium. MOISA stands for ‘Mathematics Online in Saudi Arabia’ and it is a project of Saudi Arabia to boost up e-learning in this country. Apart from these, today there are many independent paid or free online classes or spaces are available. These virtual platforms not only helps in providing supplement teaching materials and exercises but also test modules through which the learners can test their subject knowledge and performance.

Table 1: List of mathematical software and applications

S N	Mathematical Software	Area or specialization	S N	Mathematical Software	Area or specialization
1	Mathematica	Computational Algebra	14	Singular	Commutative Algebra Algebraic Geometry
2	Maple		15	Macaulay2	
3	MatLab		16	SPSS	
4	MathCAD		17	R-PROYECT	Calculation
5	MÁXIMA		18	GP/PARI	Number Theory
6	MuPAD		19	Kash/Kant	
7	SciLab		20	Magma	Arithmetic Geometry Number Theory

8	YACAS		21	GAP	Group Theory Discrete Math
9	GNU Octave	Numerical Analysis	22	Dynamic Solver	Differential Equation
10	SCILAB		23	<u>GeoGebra</u>	Geometry
11	GNUPLOT		24	SCIGRAPHICA	Plotting software
12	LABPLOT		25	<u>Gnuplot</u>	
13	SAGE		Computational Algebra Geometry Experimentation	26	<u>CoCoA</u>

The given list of mathematical software is not complete and there is many other mathematical software available. These Educational Applications can be used extensively in teaching and learning mathematics at University level. These interactive ICT tools can be used in Mathematics classroom to create innovation. These dynamic mathematics software and applications are the best way to learn Mathematics. The unique features of this e-learning tool are many and varied and they facilitate in attaining achievement and performance. Computer Algebra Systems (CAS) can be used to assist students in learning and to maximize better understanding of the concepts. They are mathematical applications dynamically facilitating symbolic, graphical, algebraic and numerical approaches to a most of the mathematical concepts with computer. Dynamic Geometry Technologies allow the user to grasp the concept of function. Through these tools, students can discover properties of graphs and visualize functions' graph being studied. These Applications have all features of high-level programming languages through which students enjoy the power and versatility of these Applications and are encouraged

developing conceptual understanding and a deeper approach to learning.

4. CONCLUSION

The practice of ICT integrated learning is an essential tool for learning Mathematics in the twenty-first century. Students in technology supported education environments and online learning conditions can perform better than those who receive face to face instruction. Teacher should try to use both classroom traditional lecture and e-learning to keep learning fresh. In the language of Bitter and Pierson (2005): “A recent meta-analysis demonstrated that students using technology had modest but positive gains in learning outcomes over those students who used no technology” (107). But e-learning has its own constraints. The maximum use of educational technologies may be helpful in bringing creativity and innovations in learning process. But it is almost impossible to be replaced by a teacher of traditional lecture. However, e-learning is beneficial in many ways but for those learners who know how to exploit it prudently. It brings wonder when integrated cautiously without completely abandoning old methods.

Finally, it is hoped that the teacher of Mathematics in our time to be concerned with the development of attitudes and environments that help to facilitate the students' learning of mathematical content, and its complex concepts and deep skills, which challenge their minds

and contribute to the formation of a real learner, can interact and communicate in the language of mathematics, which is complementary to and supportive of aspects of classroom understanding and learning, while taking care of the appropriate standards for learners' needs and the characteristics of their growth..

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