

# UTILIZING MOBILE TECHNOLOGY IN ENHANCING TEACHING AND LEARNING IN MATHEMATICS

Luisito C. Hagos<sup>1</sup>, Alejandro D. Delos Santos<sup>2</sup>, Isaias L. Borres<sup>3</sup> and Ulysis V. Lim<sup>4</sup>

<sup>1</sup>New Era University, Philippines; <sup>1</sup>Far Eastern University, Philippines; <sup>1,2,3</sup>Our Lady of Fatima University, Philippines; <sup>3</sup>University of Caloocan City, Philippines; <sup>4</sup>Rizal Technological University, Philippines  
(<sup>1</sup>dochagosneu@yahoo.com; <sup>2</sup>alexdelossanotsiii@yahoo.com; <sup>4</sup>ulvlim\_59@yahoo.com)

## ABSTRACT

Because of the fast paced technology, the academe is already becoming technology-enriched more so in the delivery of instruction. The teaching and learning can now be executed through modern means of instructions – e.learning, d.learning and m.learning (mobile learning). The objective of this research was to enhance learning through the use of text messaging or short message system (SMS) in Mathematics particularly in Algebra, Trigonometry and Calculus. In spite of very limited characters in the SMS the lectures developed included sample problems equipped with schematic diagram (figure), formula and solution. The researchers developed mathematics lectures in SMS format and aimed to find out the engineering students' assessment of the lecture-texts. The research found out that the lecture-texts are valuable tool in filling in the students' time into learning opportunities specially when teachers are late or absent from class. The research also found out the students assessed the lecture-texts' illustrations, contents, ability to promote self-learning, ease of use, self-pacing and flexibility as very satisfactory.

## KEYWORDS

m-learning, Texting, Mobile technology, Hybrid learning, Sms-based lectures, Mobile learning, Technology-enriched lectures in math

## INTRODUCTION

When cyber communication was introduced, people thought that it was the best of what the technological revolution could offer. But as advancements in digital technology brought about developments in both local and global modes of communication, people now find themselves storing, transmitting, and receiving immeasurable loads of data wherever they maybe. Now, people do not even need a "computer" to access email and surf the Internet – these can be done with the help of no less than what most people now consider as their ever-accessible and inseparable companion - the cellular or mobile phone.

Research conducted on the characteristics of mobile phone respondents stated that majority are young adults and adolescents (94%). The 16-24 age group described ownership of a mobile phone as a 'necessity'. The 16-24 age brackets are precisely the age brackets of students who are in college and it may safely be assumed that almost all college students own a mobile phone. Research further shows that the most widely used feature of the mobile phone is the short message system or SMS, which is more popularly known in the Philippines as text message (Nix et al., 2006; Taa, 2004). Text messaging, as Filipinos put it, is a convenient way to communicate using mobile phones.

In the University of Pretoria in South Africa where none of the post-graduate students in the open-education program had email or could avail of e-Learning but all had a mobile phone, the university used mobile phones very successfully to administrate their paper-based distance education programs, achieving almost immediate communication by text messaging (Brown, 2005).

The foregoing review shows the current uses of text messaging in schools: in terms of facilitating an experiment, conveying information between staff and students, reducing dropout rates, and administrating open education. However, the researchers failed to find a research on the value of using the mobile phone in filling in the few minutes to hours of “dead time” encountered by students when the teacher is late or absent and for some reason is unable to advice students a day or so in advance, or leave lessons or tasks for the students to work on.

The objective of this research was to transform such unproductive time, which is often wasted, into learning opportunities for students through the use of text messaging. The researchers developed mathematics lectures in text format and aimed to find out the assessment of engineering students of the text-based lectures, which in this study are referred to as lecture-texts. The aspects of the lecture-texts that were targeted to be assessed were: the illustrations, contents, ability to promote students’ self-learning, ease of use, self-pacing and flexibility, advantages, and disadvantages.

Figure 1 shows how lecture-texts can be used to promote the ongoing learning of students in the absence of teachers and to enhance learning: The teacher sends his lecture-texts in cases where he is away on an official business, or absent due to an illness, or attending a meeting, or performing administrative functions. The students solve the problem/s wherever they may be and send the solution/s to the teacher through text messages before the day of the next class meeting.

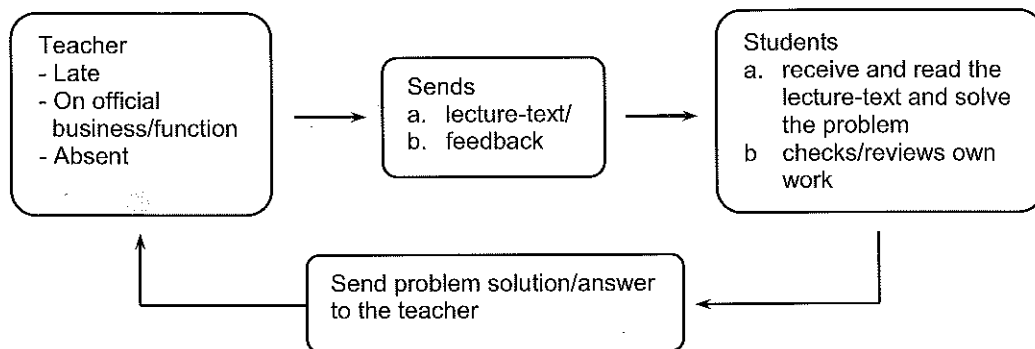


Figure1. Text-based lectures flow

## RESEARCH METHODOLOGY

Instructional Research and Development (IRD) as described by Borg and Gall (SUNY College of Environmental Science and Forestry, 2006) is used in this study wherein the researchers developed and validated an instructional material: the text-based lectures or lecture-texts. The researchers prepared and validated mathematics lectures and/or problems confined to 160 characters in order to fit even low-end cellular phones. These lectures and problems were transformed into text messages and then tried out by sending them to the students whenever their Mathematics teachers were late or absent. After a one-month trial, the students assessed the lecture-texts as to the satisfactoriness of the following aspects: illustrations, contents, ability to promote students’ self-learning, ease of use, self-pacing and flexibility, advantages, and disadvantages.

The respondents were 90 students from the 176 College of Engineering and Technology students officially enrolled in Mathematics during the first semester of the Academic Year 2006-2007. The respondents belonged to three classes that were randomly drawn from six classes. All the respondents had their own mobile phone.

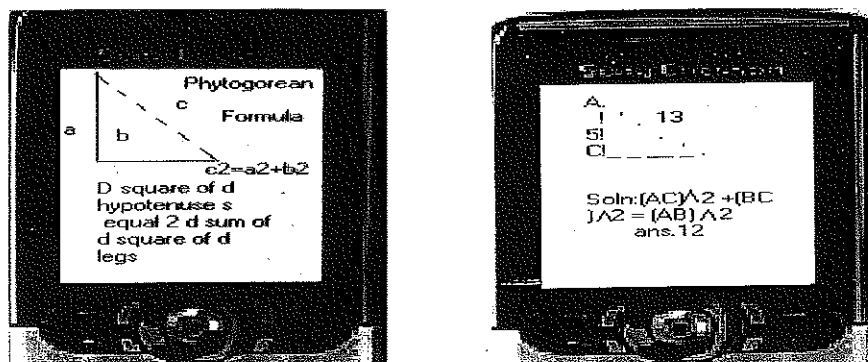
## DISCUSSION

Table 1 shows the respondents' assessment of the lecture-texts' illustrations. It shows that the students found the illustrations relevant (w.m. 3.75), adequate (w.m. 3.87), and helpful in the analysis of the problem (w.m. 3.75).

**Table 1. Respondents' assessment of lecture-texts' illustrations (n=90)**

Characteristics	Weighted Mean	Verbal Interpretation
Illustrations are relevant	3.75	Very Satisfactory
Illustrations are adequately provided	3.87	Very Satisfactory
Illustrations help the students in the analysis of the problem	3.75	Very Satisfactory
<b>Mean</b>	<b>3.98</b>	<b>Very Satisfactory</b>

Illustrations are important in helping students analyze problems faster and easier. They also help students to be more interested and focused on the lecture-texts. An example of lecture-texts in Algebra is shown in Figure 2. It shows how important illustrations are in presenting concepts like the Pythagorean theorem.



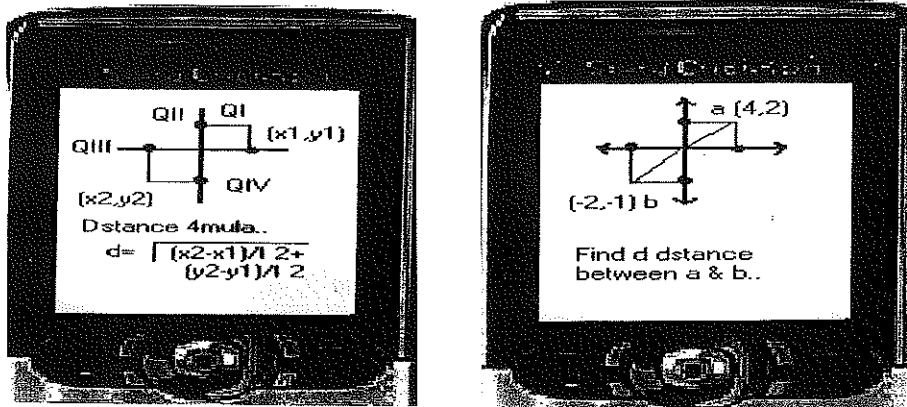
**Figure 2. A Lecture-text of Pythagorean Theorem in Algebra**

The lecture-texts did not deviate from the topics in the course outline and this criterion received a very satisfactory rating (w.m. 4.00) from the respondents (Table 2). They also assessed the contents as easy to read in spite of their being text-based (w.m. 4.00) and easy to understand (w.m. 3.73). This shows that the lecture-texts served the purpose for which they were devised: to be read well by the students in order to support their learning while the teacher is away.

**Table 2. Respondents' assessment of the lecture-text's contents**

Characteristics	Weighted Mean	Verbal Interpretation
Lectures are within the course outline	4.00	Very Satisfactory
Lectures are easy to understand	3.73	Very Satisfactory
Lectures are easy to read.	4.00	Very Satisfactory
<b>Mean</b>	<b>3.91</b>	<b>Very Satisfactory</b>

An example of how a lecture-text was presented as to content is shown in Figure 3. It presents the distance formula that is a lecture in Calculus.



**Figure 3. Lecture-text of Distance Formula in Calculus**

Based on Table 3, the students think that the lecture-texts are able to very satisfactorily promote self-learning (w.m. 4.00) through the activities provided that they can do on their own. These activities include solving the problems, looking up specific concepts in reference books, making measurements of readily available materials around the students, and other similar hands-on and experiential tasks. During unstructured interviews with the students, they said that they enjoyed answering the problems in the lecture-texts as they felt like they were answering text puzzles. They also liked the activities stipulated in the lecture-texts as these made them move about and interact with other people. The ability for independent learning promoted by the lecture-texts provides many advantages to the students. Students are able to work on their own through the given activities. They also have the freedom to devise and try out alternative way of learning they deem appropriate to the topics.

**Table 3. Respondents' assessment of the lecture-text's ability to promote students' self-learning**

Characteristics	Weighted Mean	Verbal Interpretation
Activities can be done by students on their own	4.00	Very Satisfactory
Has provision for self-evaluation	3.12	Satisfactory
Composed of topics ideal for self study	3.68	Very Satisfactory
<b>Mean</b>	<b>3.60</b>	<b>Very Satisfactory</b>

The students also evaluated the topics as appropriate for self-study (w.m. 3.68), as these are ones that would not need the teacher to explain any further.

The criterion "Has provision for self-evaluation" received a rating of 3.12 described as "Satisfactory". This maybe explained by the fact that the researchers have not yet developed the lecture-text format wherein the students would receive feedback automatically on whether their responses are right or wrong. The lecture-text currently does not have provision for built-in self-evaluation such as the lecture-text of sine law in Trigonometry presented in Figure 4.

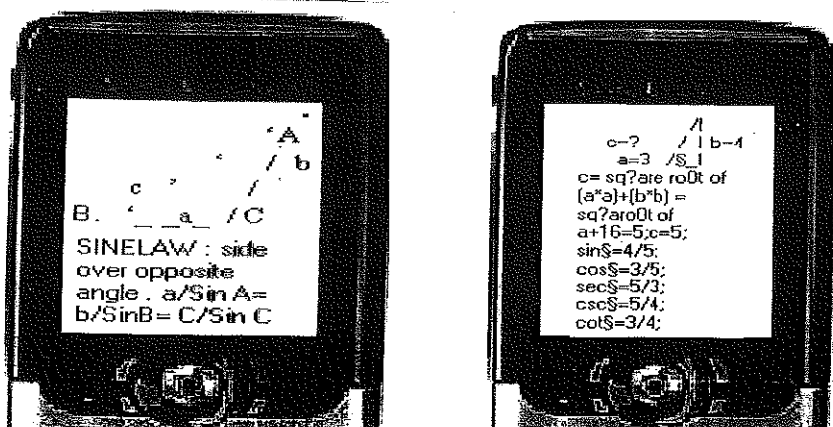


Figure 4. A lecture-text of Sine Law in Trigonometry

Although all the problems have instructions for self-checking and re-checking of answers, most of the respondents were so eager to send the answer back to their teachers that they did this instantaneously without taking the time to recheck their work. They did not have the patience to recompute their answers. This being the situation, the respondents resorted to waiting for their teacher to give feedbacks by way of text messages or when the teacher meets the students in class.

The tabulated data as presented in Table 4 shows that the lecture-texts are user-friendly. They are free from complicated procedures (w.m.3.50), require ordinary texting ability from the students (w.m.4.00), and is compatible with any mobile phone unit from the simplest units to the more sophisticated ones (w.m.4.00). These characteristics make the lecture-texts appealing to students in addition to the contents of the lecture-texts that enable students to be productive when their teachers are absent or late.

Table 4. Respondents' assessment of the lecture-texts as to ease of use

Characteristics	Weighted Mean	Verbal Interpretation
Free from complex procedures	3.50	Very satisfactory
Require ordinary texting ability from the student	4.00	Very satisfactory
Applicable in any mobile phone unit	4.00	Very satisfactory
<b>Mean</b>	<b>3.83</b>	<b>Very satisfactory</b>

Figure 5 shows how the students can easily understand the lecture-texts. The formula presented were areas of triangles used in Solid Geometry.

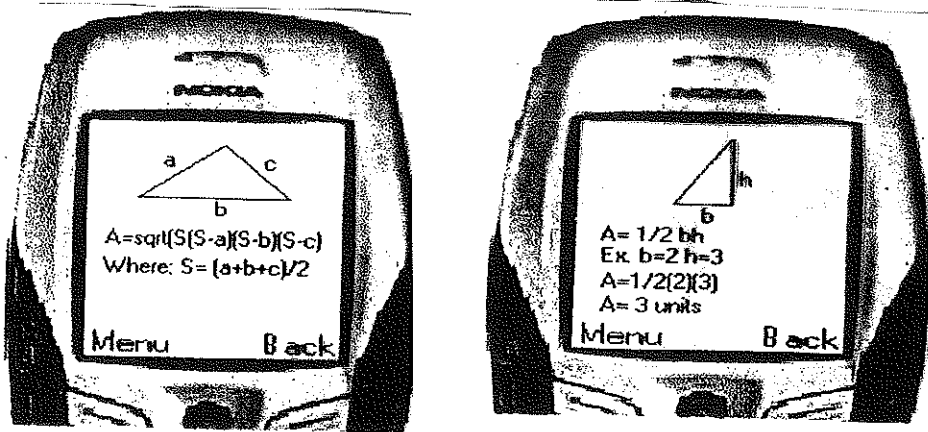


Figure 5. A Lecture-text of area computation in Solid Geometry

Based on the data (Table 5), the students are highly satisfied (over-all mean: 3.80) with the self-pacing quality of the lecture-texts because it gives them the freedom to skip some problems and go back to them later, or to repeat working on others until they are satisfied with their solutions (w.m. 3.50). The lecture-texts give them the freedom to read and review the lectures and problems until the concepts sink in and they are ready to perform the activities at their own time (w.m. 3.81, 3.92). True enough, one of the characteristics of the short message system which makes it very popular among users is its asynchronicity: users may read and send back texts at their own convenient time (Taa, 2004). This same quality is observed in the exchanges of lecture-texts. Students have the liberty to send their answers back to their professors within the day.

Table 5. Respondents' assessment of lecture-texts as to self-pacing and flexibility

Characteristics	Weighted Mean	Verbal Interpretation
Allow students to skip or repeat	3.50	Very Satisfactory
Give students freedom to work	3.81	Very Satisfactory
Allow the students to study at his own time	3.92	Very Satisfactory
Can be used anywhere	4.00	Very Satisfactory
<b>Mean</b>	<b>3.80</b>	<b>Very Satisfactory</b>

Students are also highly satisfied with the freedom lecture-texts give them to work on the activities at their preferred places (w.m. 4.00) such as the lecture-texts in Trigonometry presented in Figure 6. After all, mobile phones are one of the most portable multitask devices which almost all students carry with them wherever they go.

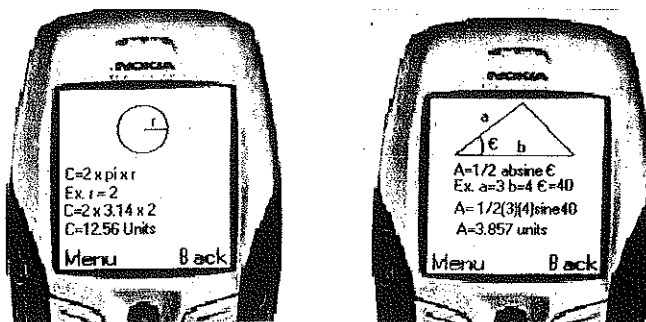


Figure 6. A lecture-text in Trigonometry

Tables 6a and 6b shows that the students see the use of lecture texts as highly advantageous. All the respondents consider that the most important benefit is that the use of lecture-texts enables them to be advised on whether their teacher will be meeting the class or not. When the advice is given ahead of time, the students do not need to spend their time and money to get to school, especially if the subject is their only class for the day. The second ranking advantage is related to the primary reason in that the lecture-texts allow them to do productive work during the appropriated time whether they are at home or already in school.

Table 6a. Summary table of respondents' assessment of the lecture-texts

Lecture-Texts Aspects	Mean	Verbal Interpretation
Illustrations	3.98	Very Satisfactory
Contents	3.91	Very Satisfactory
Ability to promote self-learning	3.60	Very Satisfactory
Ease of use	3.83	Very satisfactory
Self-Pacing and Flexibility	3.80	Very Satisfactory
<b>Overall Mean</b>	<b>3.76</b>	<b>Very Satisfactory</b>

Table 6b. Advantages of using lecture-texts as a learning tool

Advantages	%	Rank
1. Improves students' understanding of a difficult concept	57	5
2. Complements the learnings from the teacher's class lecture	49	7
3. Caters to the learning styles, needs, abilities, and interests of students	50	6
4. Promotes critical thinking skills	59	3
5. Motivates students through the stimulating learning activities created	58	4
6. Promotes the productive use of class time even when the teacher is late or absent	75	2
7. Prevents wastage of students' time and transportation fare when lecture-texts are sent before actual class time.	100	1

According to the respondents, the lecture-texts help promote critical thinking skills in that they have to read the lecture/problem carefully and think of solutions. While the same advantage holds thru when one reads printed materials such as books, said advantage is highlighted by the fact that lectures and problems in SMS format are more appealing to some students, especially to those who are lulled to sleep by reading the small characters of printed books. This is supported by the learning style

theory discussed by McKeachie that suggests that everyone learns better when the material can be approached in more than one way – both visual and verbal, as well as through hands-on active learning. Teachers have to develop a variety of teaching methods to augment the lecture-only method that had previously been used almost exclusively in college classrooms (Zimbardo et al., 2003).

**Table 7. Disadvantages of using lecture-texts as a learning tool**

Disadvantages	%	Rank
1. Extra cost incurred by sending responses to the teacher	9	4
2. Inconvenience caused when student forgets his/her mobile unit at home or elsewhere.	15	2
3. It may run counter to the learning styles, needs, abilities, and interests of some students	13	3
4. Network incurred delay in the transmission of text messages	17	1

While the use of the lecture-texts has advantages, there are a few disadvantages listed down by some respondents, too as seen in Table 7. Seventeen percent of the students encountered problems brought about by delays in the transmission of the lecture-texts due to bad signal or network clogging. However, the students expressed understanding that this is something beyond the control of both the teacher and the students. Other disadvantages seen were the inconvenience experienced when the student forgets his/her unit and the teacher sends lecture-texts, and the instances when the learning style of the students is more of the auditory-type who prefers listening during lectures and class discussions. The student, however, also recognizes that the use of lecture-texts is not a major learning strategy and would be resorted to only when the teacher is late or absent.

## CONCLUSION

The lecture-texts developed by the researchers are a valuable tool in filling in the students' time into learning opportunities when the teacher is late or absent from class. The lecture-texts are very satisfactory in terms of their illustrations, contents, ability to promote self-learning, ease of use, self-pacing and flexibility. The mode of learning presents both visual and verbal, a hands-on active learning. Teachers have assessed the new methodology as a milestone in teaching methods that augment the lecture method. The advantages of using lecture-texts outweigh the disadvantages.

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