

# Enhancing Teaching and Learning through SMS-mediated Lectures in Mathematics

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**Abstract.** The objective of this research was to promote the ongoing learning of students even when teachers are late or absent from their classes and to enhance learning through the use of text messaging or the short message system (SMS). 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 a valuable tool in filling in the students' time into learning opportunities when the teacher is late or absent from class. The research also found out that the engineering students assessed the lecture-texts' illustrations, contents, ability to promote self-learning, ease of use, self-pacing and flexibility as very satisfactory.

## 1. 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.

The mobile phone's tremendous popularity is a social phenomenon. Its service market around the world has reached 2 billion in 2005 and still counting, as forecast says that ownership would reach 3 billion as early as 2010 (Nix, Russell and Keegan, 2006). This is for a world population of just over 6.6 billion (Wikipedia, 2007; United Nations Population Division, *World Population Prospects*, 1998).

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, Russell and Keegan, 2006; Taa, 2004). Text messaging, as Filipinos put it, is a convenient way to communicate using mobile phones.

Mobile phones are virtually a requirement to keep up with the demands of everyday life. Increasingly, advancements in these mobile devices are making them even more practical not only for on-the-go communication, but also for on-demand information sharing, training and learning. Schools have taken advantage of mobile communication to offer features in which students could check class schedules, class suspensions, major activity updates, and more information through their own mobile phones (DLSU-Manila, 2003).

As universities explore ways to promote and strengthen learning, these devices are becoming the perfect tools for incorporating fun and learning. Cheung (2004), for example, established the technical feasibility of text messaging as a medium to facilitate classroom experiments in economics, both in assembling responses from students and for reporting feedback to individual students.

The University of Ulster in Northern Ireland has had great success in the use of text messaging for the reduction of student drop-out. The students appreciated the “We missed you in class”-texts and wanted the university to expand the service to other areas – like assignment deadlines (Nix, Russell and Keegan, 2006).

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.

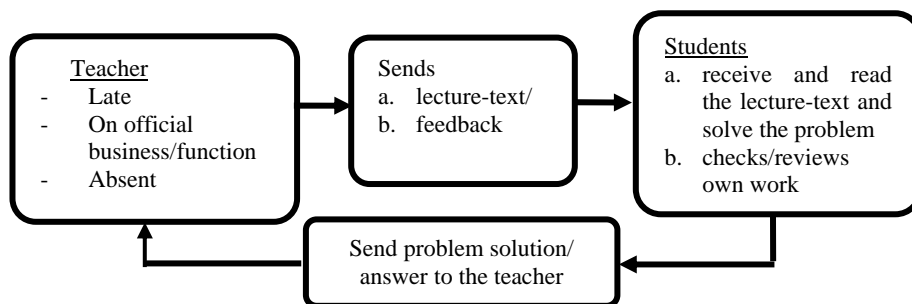


Fig. 1. Text-Based Lectures Flow

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.

## 2. 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.

## 3. Discussion

**Table 1.** Respondents' Assessment of Lecture-Texts' Illustrations (n=90)

<b>Characteristics</b>	<b>Weighted Mean</b>	<b>Verbal Interpretation</b>
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>

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).

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.

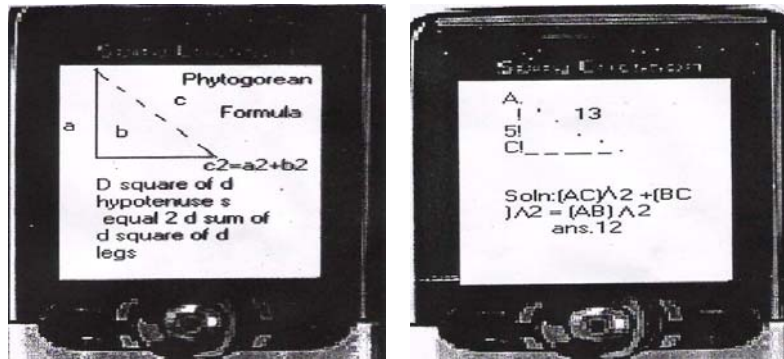


Fig. 2. A Lecture-text of Pythagorean Theorem in Algebra

Table 2. Respondents' Assessment of the Lecture-Text's Contents (n=90)

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>

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. 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.

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.



Fig. 3. Lecture-text of Distance Formula in Calculus

Table 3. Respondents’ Assessment of the Lecture-Text’s Ability to Promote Students’ Self-Learning (n=90)

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>

Based on the data gathered, 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.

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.

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.

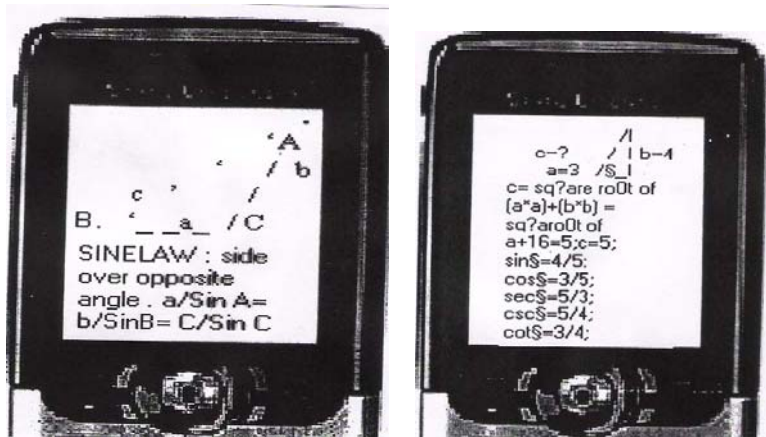


Fig. 4. A Lecture-text of Sine Law in Trigonometry

Table 4. Respondents' Assessment of the Lecture-Texts as to Ease of Use (n=90)

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>

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.

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

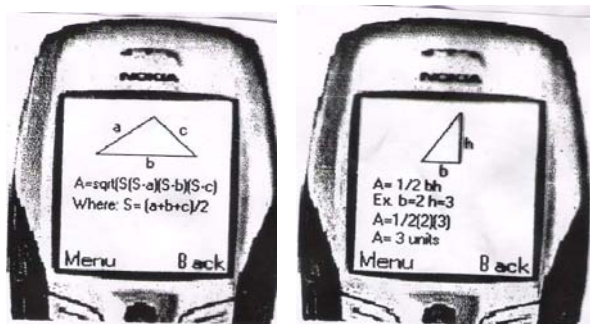


Fig. 5. A Lecture-text of Area computation in Solid Geometry

Table 5. Respondents' Assessment of Lecture-Texts as to Self-Pacing and Flexibility (n=90)

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>

Based on the data, 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.

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.

Table 6 puts together all the aspects of the lecture-texts evaluated by the students. All the aspects obtained the rating “very satisfactory”. The illustrations contained in the lecture-texts obtained the highest mean of 3.98, which means that the students find the illustrations appealing, relevant, and useful.

Although still under the range “very satisfactory”, the aspect “ability to promote self-learning” obtained the lowest rating of 3.60 among the six. This is because the lecture-texts developed by the researcher left much to be desired in terms of giving feedback to the respondents. The respondents expressed a desire to receive instant feedback to their answers, and the researchers are still working this out.

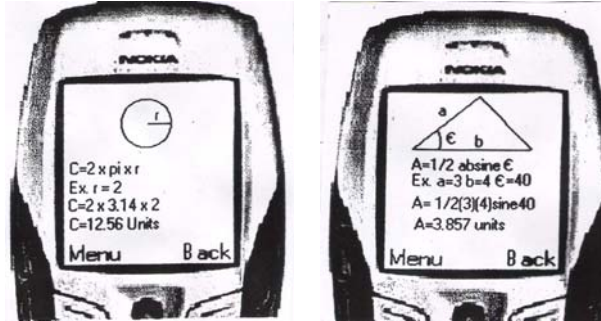


Fig. 6. A Lecture-text in Trigonometry

Table 6. Summary Table of Respondents' Assessment of the Lecture-Texts (n=90)

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>Over-all Mean</b>	<b>3.76</b>	<b>Very Satisfactory</b>

Table 7 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 7. Advantages of Using Lecture-Texts as a Learning Tool (n=90)

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, Weber and Johnson, 2003).

**Table 8.** Disadvantages of Using Lecture-Texts as a Learning Tool (n=90)

<b>Disadvantages</b>	<b>%</b>	<b>Rank</b>
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. 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.

## Conclusions

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 advantages of using lecture-texts outweigh the disadvantages.

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