

Students' perception and attitude on ict integration in mathematics classroom

Rodulfo T. Aunzo, Jr. Ed.D^{1*} and Joseph Anthony T. Climaco²

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¹Faculty, Department of Mathematics, College of Arts and Sciences, University of San Carlos, P. Del Rosario St.Cebu City, Philippines.

²BSA-III, School of Business and Economics, University of San Carlos,P. Del Rosario St., Cebu City, Philippines.

ABSTRACT

In the advent of the mobile gadgets such as cellphone, iPhone, iPod, iPad, and tablet, people in all walks of life are using them anywhere and anytime. These mobile gadgets are equipped with applications which can read pdf files, PowerPoint presentations, and documents. With these, a research study on Student' Perception and Attitude on ICT Integration in Mathematics Classroom was conducted. This also investigated how mobile gadgets were utilized inside a Mathematics classroom during the teaching-learning process. With 93 sample students, the following findings were established: The students have a positive attitude towards mathematics, agreed if ICT will be integrated in the teaching-learning inside the classroom, still agreed after the ICT integration and evaluated the ICT integration as effective. Moreover, there is an increased level of agreement of the students after experiencing the ICT integration in Mathematics classroom, a significant relationship between the students' attitude towards Mathematics and the students' perception on ICT integration inside the classroom and a significant relationship between the students' assessment on the effectiveness indicator of ICT integration and the students' attitude on ICT integration.

Key words: Mathematics Education, Impact Study, Mobile Gadget, Mobile E-Learning, Students' Perception and Attitude, ICT Integration, Mathematics Teaching-Learning Process.

*Corresponding author.E-mail: dolph_fu@yahoo.com.

INTRODUCTION

Billions of mobile phones are now accessible in the market nowadays (Elmorshidy, 2012). Indeed, innovative mobile devices, such as smartphones and personal digital assistants, have become ubiquitously available and have changed the ways people establish relationships (Haddon, 1997). The ubiquity of mobile devices is also important: learners, whether young children, teenagers or university students, are accustomed to seeing and using camera phones and handheld games devices (Wishart, 2008). These mobile devices combine communication and computing into a multipurpose gadget that provides users with various

types of services (Bergman, 2000). Indeed, mobile users carry their device everywhere, they use it around the clock, and it has become their personal information-processing interface of choice (Brightman, 2008). Current developments in capabilities of mobile devices, both smart phones and tablet computers, have led to a significant rise in the penetration rate of wireless devices among the general population. Even more noticeable over recent years is the increasingly fast-growing rate of penetration of mobile devices among younger people. Students as true representatives of the "digital natives" generation (Prensky, 2001) are keen to discover new

technologies. Mobile devices became a default means of opening the Internet according to current surveys (Internet in Britain Report, 2011), while the number of UK mobile contract subscriptions have surpassed considerably UK population (Carphonewarehouse Penetration Rate of Smartphones, 2011). More advanced phones will allow for TV subscribers to view television programming over mobile phones. This speaks to the market (and the capabilities and functions of these devices), it does not necessarily suggest how this technology can be utilized for learning (Elmorshidy, 2012). Indeed, the capabilities that already exist via Web browsers, desktop computers, CD-ROMS and other technologies are all becoming possible now (with streaming video in many multimedia formats) on a wide number of phones (Elmorshidy, 2012).

Thus, higher education institutions invest in technology to improve student experience and increase efficiency (Benson and Morgan, 2013).

The proliferation of smart mobile devices and higher bandwidth of internet connections have had a significant impact in higher education. Advanced capabilities of mobile devices and better connectivity have led to a growing number of the student population accessing Virtual Learning Environments (VLE) through their smartphones, downloading and working with lecture slides on iPads instead of paper notes, participating in VLE discussion forums through their phones, etc.

With the growing number of mobile devices in the hands of the younger population, it is only a matter of time before higher education students will be expecting wireless access to learning materials to complement and/or replace current Internet-based VLEs (Benson and Morgan, 2013).

Mobile e-learning environment possesses many unique characteristics as described by (Yu and Chieh, 2008). Better adaptation to individual needs, ubiquitous and responds to urgent learning need, flexibility of location and time to learn, interactive knowledge acquisition, efficiency due both to re-use and feedback, situational instructional activities and integrated instructional context (Elmorshidy, 2012).

Within the classroom, it has been shown that mobile devices, with appropriate software, can be highly effective in supporting small group collaborative learning, improving on what was possible to achieve without these tools (Zurita and Nussbaum, 2004; Valdivia and Nussbaum, 2007). With these, the mobile platforms for e-learning are an attractive solution to help engage the student community, enrich learning and help students throughout academic life.

The mobile networks can enable learners to learn anytime and anywhere. However, before one can judge and evaluate the effectiveness of m-learning, learning modules suitable for such devices need to be available and used in mobile environment (Elmorshidy, 2012).

OBJECTIVES

This study aimed to establish the students' perception and attitude on ICT integration in Mathematics classroom. Specifically, this study aimed to:

- a) Describe how ICT was integrated in a Mathematics classroom;
- b) Establish the students' attitude towards Mathematics;
- c) Find out the students' perception and attitude on ICT integration;
- d) Establish the students' assessment on the effectiveness of the ICT integration;
- e) Establish the relationship between
 - e.1) students' attitude towards Mathematics and students' perception on ICT integration; and
 - e.2) students' attitude on ICT integration and students' assessment on the effectiveness of the ICT integration;
- f) Establish the difference between
 - f.1) the students' perception and students' attitude on ICT integration;
 - f.2) the perception on ICT integration of the students living within the Cebu City proper and outside the Cebu City proper.
 - f.3) the attitude on ICT integration of the students living within the Cebu City proper and outside the Cebu City proper.

MATERIALS AND METHODS

The materials and method employed in this research study is discussed in the subsections below:

Research Design

This study utilized the one-shot study design employing the before and after investigation to establish the change in the behaviour of the students on ICT integration in Mathematics classroom. This study was conducted using survey methodology. Questionnaires and surveys are often used in educational research for collecting information that is not always directly observable (Gall et al., 1996). A survey on the student-respondents' perception and attitude on ICT integration in Mathematics classroom was conducted. A correlational approach was also employed to establish relationship between the students' attitude towards Mathematics and the students' perception on ICT integration in Mathematics classroom.

Sample and Settings

This study was conducted at University of San Carlos, Cebu City, Philippines, during the second semester of the school year 2013 to 2014. There were three sets of

respondents in this research study. The first set of respondents was the professors of the said University handling Statistics in the previous semesters. They evaluated the content of the e-learning material, and made comments and necessary revisions of the said material. The second set was students in a Statistics class, which was not selected as a sample after the fishbowl method. They established the readability of the e-learning materials. The revisions were made based on the questions raised by the students during the dry run of the material. The third set of respondents is the subject of this research study, the student-respondents of the researchers during the second semester of the school year 2013 to 2014. The sample consisted of ninety-three students from three different sections which were randomly chosen, through fishbowl method, from the original four Statistics classes.

Measures

There were two sets of researcher-made instruments. The first set of the survey questionnaire established the demographic profile, students' attitude towards Mathematics, and students' perception on on ICT integration in Mathematics classroom. This set of survey questionnaire was given to the student-respondents a day before the implementation of on ICT integration in the class. The second set of the survey questionnaire established the students' attitude on ICT integration in Mathematics classroom, students' assessment on the effectiveness of ICT integration, and their comments/suggestions of ICT integration. This second set of the survey questionnaire was given to the student-respondents after the ICT integration in Mathematics classroom.

Data-Gathering Procedure

This research study underwent the following data-gathering procedures: Development of the e-Learning Material. The teacher-researcher developed the e-Learning material based on the previous assessment results of the students on the topic Normal Distribution. Validation of the e-Learning Materials. The e-Learning material was submitted to the professors handling Statistics for at least four semesters, to validate the content of the said material. The said material was revised based on the comments and suggestions of the professors. After the revision, it was used as an enrichment material to a set of students in a Statistics class, to test the readability of the said material. During the two-week duration of the said topic, students' comments and questions were gathered and used as basis in the improvement of the said material.

Administration of the First Set of the Survey Questionnaire. Before the implementation of the e-learning material, the first set of the survey questionnaire was administered to the student-respondents to establish their demographic profile, attitude towards mathematics, and perception on ICT integration. Implementation of the Mobile e-Learning. Three days before the start of the lesson on the Normal Distribution, the e-Learning material was uploaded by the teacher-researcher to the class Facebook group page. Then, the students downloaded the said material into their mobile gadget which could read PowerPoint presentations such as tablets, cellphones, iPhone, etc. A day before the discussion of the said topic, the teacher-researcher took a complete list of the students who downloaded the said material in their mobile gadgets. The said material was used by the student-respondents, during the two-week duration of the lessons, as a learning material. They used it as a reference material in answering seat works, assignments, drills, short tests, etc. Administration of the Second Set of the Survey Questionnaire. After the two-week duration of the topic Normal Distribution, as indicated in the course syllabus, the second set of the survey questionnaire was administered to the student respondents. This was to establish the students' attitude on ICT integration, students' assessment on ICT integration, and students' comments/suggestion on ICT integration. Analyzing the Data. The researcher quantified the students' responses on the survey questionnaire. Statistical treatment of the data was made by the teacher-researcher.

RESULTS AND DISCUSSIONS

The following findings were based on the result of the statistical and analytical analysis of various data: Process of the Implementation of Mobile e-Learning in a Mathematics Classroom. The ICT integration in mathematics classroom underwent the following processes:

Development and Validation of the e-Learning Material

The teacher-researcher developed the e-learning on the topic Normal Distribution based on the previous assessment results of the students on the said topic. Then, it was submitted to the professors handling Statistics for at least four semesters to validate the content of the said material. Based on the comments and suggestions of the professors, the e-learning material was revised. After the revision, it was used by the students in a Statistics class to test its readability. After two-week of utilization, the students' comments and

Table 1. Students' attitude towards mathematics.

Sections	SA	A	U	D	SD	Totals	Wx	Description
1	137	282	198	84	25	726	3.58	Agree
2	66	193	184	57	25	525	3.42	Agree
3	87	200	226	86	2	601	3.47	Agree
Totals	290	675	608	227	52	1852	3.5	Agree

SA – strongly agree; A – agree; U – undecided; D – disagree; SD – strongly disagree; Wx – weighted mean.

Table 2. Difference among the students' attitude towards mathematics.

Sections	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
1	3.58	Agree	1.2E-07	47.599	15.51	Significant
2	3.42	Agree				
3	3.47	Agree				
Totals	3.5	Agree				

Table 3. Students' perception on ICT integration in mathematics classroom.

Sections	SA	A	D	U	SD	Totals	Wx	Description
1	80	219	189	36	3	527	3.64	Agree
2	59	163	145	14	4	385	3.67	Agree
3	81	183	146	29	2	441	3.71	Agree
Totals	220	565	480	79	9	1353	3.67	Agree

questions were gathered. These comments and suggestions were used as a basis in the revision of the said e-learning material.

Implementation of the Mobile e-Learning Material

The e-learning material which underwent the validation stage was uploaded by the teacher-researcher in their class Facebook page. Then, the students downloaded the said material into their mobile gadgets which could read PowerPoint presentations. The teacher took a complete list of the students who have a copy of the said material in their mobile gadget. Then, the student used the said material as a reference during the class activities such as seat works, drills, assignments, etc.

Students' Attitude towards Mathematics

Table 1 shows the students' attitude towards Mathematics. As reflected in the table, the three sections agreed on the statements about Mathematics learning. This implies that they have a positive attitude towards Mathematics. Statistically, with a total weighted mean of 3.50, this shows that the students from the three sections collectively have a positive attitude towards Mathematics. These findings suggest that in designing learning activities for the students, it has to be engaging, attractive

and student-centered in order to maintain the positive attitude of the students towards Mathematics. Table 2 shows the difference on the students' attitude towards Mathematics. As reflected in the table, computed value (47.599) is greater than the tabular value (15.51). This leads to the rejection of the null hypothesis, which means that there is a significant difference on the students' attitude towards Mathematics among the three sections. This coincides with the p-value which is less than $\alpha = 0.05$ which leads to the rejection of the null hypothesis. Furthermore, the table shows that Section 1 has highest weighted mean (3.58), which means that they have the highest level of agreement on the statements about Mathematics learning compared to the other two sections. While Section 2 has the lowest weighted mean (3.42), which means that they have the lowest level of agreement on the statements about Mathematics learning compared to the other two sections. In this connection, in order to ensure successful completion of e-Learning projects, the developers must possess technical skills as well as soft skills of interpersonal communication and understanding of human motivation problems (Jewels and Ford, 2006).

Students' Perception on ICT Integration in Mathematics Classroom

Table 3 shows the students' perception on ICT

Table 4. Difference among the on ICT integration in mathematics classroom.

Sections	Wx	Description	p-value	Computed Value	Tabular value	Remarks
1	3.64	Agree	0.36399843	8.748	15.51	Not Significant
2	3.67	Agree				
3	3.71	Agree				
Totals	3.67	Agree				

Table 5. Students' attitude on ICT integration in mathematics classroom.

Sections	SA	A	D	U	SD	Totals	Wx	Description
1	70	167	102	13	0	352	3.84	Agree
2	90	155	94	23	1	363	3.85	Agree
3	78	152	71	7	2	310	3.96	Agree
Totals	238	474	267	43	3	1025	3.88	Agree

integration before it is implemented in Mathematics classroom. As reflected in the table, the three sections agreed on the statements about the implementation of ICT integration in Mathematics classroom. This implies that they have a positive perception on ICT integration before it is implemented in Mathematics classroom. With a total weighted mean of 3.67, this shows that the three sections collectively have positive perception on ICT integration in Mathematics classroom. These findings matched the responses from students regarding mobile learning have for the most part been positive, as indicated by the results of surveys such as (Thornton and Houser, 2002). Thus, these promote the characteristics of mobile learning which include urgency of learning need, initiative of knowledge acquisition, mobility of the learning setting, interactivity of the learning process, situatedness of instructional activities, and integration of instructional content (Chen et al., 2002). In 2008 study on the use of mobile devices in language learning, learners are very much aware of the practical limitations of the mobile phone for language learning, but the general attitudes of the learners in the current study, at the very least, were not negative. Although the overall use of the mobile phone for the vocabulary learning tasks was low, the survey data indicated that learners approached the technology with a degree of expectation, with over two-thirds of the learners expressing an interest in using mobile phones for language learning in either the short or long term (Stockwell, 2007). Table 4 shows the difference on the students' perception on ICT integration before it is implemented in Mathematics classroom. As reflected in the table, computed value (8.748) is less than the tabular value (15.51). This leads to the acceptance of the null hypothesis, which means that there is no significant difference on the students' perception on ICT integration before it is implemented in a Mathematics classroom. This coincides with the p-value (0.36399843) which is greater than the alpha (0.05). A 2005 International Data

Corporation survey across seven key markets including Australia, Hong Kong, Malaysia, China, Singapore, South Korea and Taiwan recorded an increase in mobile phone owners to 90.2% from 80.2% the previous year (Star InTech, 2006). The statistics show that mobile technologies today are pervasive as a new medium for communication. (Smith et al., 1999) outlined four promising characteristics of hand held devices, namely: (1) small size and high portability; (2) instant access with no waiting for boot-up; (3) flexibility to support a wide range of learning activities; and (4) the cost of the technology is relatively cheap. Hence, it supply ubiquitous learning environment, mobile learning, learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies (Elmorshidy, 2012). In summary, Burston (Burston, 2011) emphasized that students' perception of the "anywhere and anytime" convenience is overwhelmingly favourable.

Students' Attitude on ICT Integration in Mathematics Classroom

Table 5 shows the students' attitude on ICT integration after its implementation in Mathematics classroom. As reflected in the table, the three sections agreed on the statements about their attitude after the implementation of ICT integration in Mathematics classroom. This implies that they have a positive attitude after the implementation. With a total weighted mean of 3.88, this shows that the three sections collectively have a positive attitude after the implementation. For language learners, mobile phone devices can impact the learning of grammar, as noted by Baleghizadeh and Oladrostam (2010), who found that English as a foreign language students who had access to mobile phones scored better on a post-test than those in the group without access to a mobile phone.

Table 6. Difference among the students' attitude on ICT integration in mathematics classroom.

Sections	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
1	3.84	Agree	0.04486389	15.831	15.51	Significant
2	3.85	Agree				
3	3.96	Agree				
Totals	3.88	Agree				

Table 7. Students' assessment on the effectiveness indicator of ICT integration in mathematics classroom.

Sections	SA	A	D	U	SD	Totals	Wx	Description
1	32	74	16	6	0	128	4.03	Agree
2	41	61	23	7	0	132	4.03	Agree
3	33	60	17	2	0	112	4.11	Agree
Totals	106	195	56	15	0	372	4.05	Agree

Table 6 shows the difference on the students' attitude on ICT integration after its implementation in Mathematics classroom. As reflected in the table above, the computed value (15.831) is greater than the tabular value (15.51). This leads to the rejection of the null hypothesis, which means that there is a significant difference on the students' attitude on ICT integration after its implementation in Mathematics classroom. This coincides with the p-value (0.04486389) which is lesser than the alpha (0.05).

Furthermore, the table shows that Section 3 has the highest weighted mean (3.96), which means that Section 3 has the highest level of agreement on the statements about their attitude after the implementation compared to the other two sections. While Section 1 has the lowest weighted mean (3.84), which means that Section 1 has the lowest level of agreement on the statements referring to their attitude after the implementation compared to the other two sections. This implies further, that the three sections under the same instructor have different attitude on ICT integration after its implementation in Mathematics classroom.

Indeed, it was concluded in 2003 study that mobile learning has multitude advantages, and that this technology has a place in the teaching models of the future (Seppala and Alamaki, 2003). In 2004 review of mobile learning in the field of medicine, mobile devices allows medical interns and residents to take notes and record audio which can be studied and reviewed at a later date. The freedom afforded by being able to access information "anytime, anywhere" becomes a tremendous advantage and convenience when you take into account how many patients must be seen during a typical physician's rounds. With this, 28% of the US physicians already use mobile computing as part of their daily routine and that as this technology advances, this percentage will grow (Whitsed, 2004).

Effectiveness Indicator of ICT Integration in Mathematics Classroom

Table 7 shows the students' assessment on effectiveness indicator of the ICT integration in Mathematics classroom. As reflected in the table, the three sections agreed on the statements about the effectiveness of the ICT integration in Mathematics classroom. This implies that the students rated the implementation as effective. With a total weighted mean of 4.05, this shows that the students from the three sections collectively have positive attitude towards the effectiveness of the implementation, which implies that the three sections collectively rated the implementation as effective. Indeed, in a 2008 study, students using the mobile learning demonstrated a higher level of knowledge of the subject matter covered in the course when compared to students choosing not to use the tools (McConatha and Praul, 2008). Also, as was recalled, in 2007, a researcher had discussed how lessons and lectures delivered to students via mobile devices are evolving. He examined podcasts, audio and video files, and how they can be easily incorporated into courses. In general, the outcomes were rated very highly. After an initial period of training and acclimation, comments on how staff and students experience these opportunities were measured. His students reported that they enjoyed the ability to pause and segment lectures and to listen to them on their own time. An additional feature rated as highly valued centred on the fact that much of this information was readily available when students were away from their desktops (Gomez, 2007). Table 8 shows the difference on the students' assessment on the effectiveness indicator of the ICT integration in Mathematics classroom. As reflected in the table, computed value (5.715) is lesser than the tabular value (15.51). This leads to the acceptance of the null hypothesis, which means that there is no significant

Table 8. Difference on the students' assessment on the effectiveness indicator of ICT integration in mathematics classroom.

Sections	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
1	4.03	Agree	0.45586095	5.715	15.51	Not Significant
2	4.03	Agree				
3	4.11	Agree				
Totals	4.05	Agree				

Table 9. Students' attitude towards mathematics and students' perception on ICT integration in mathematics classroom.

Variables	SA	A	D	U	SD	Totals	Wx	Description
Attitude Towards Math	290	675	608	227	52	1852	3.5	Agree
Perception on ICT Integration	220	565	480	79	9	1353	3.67	Agree

Table 10. Correlation between the students' attitude towards mathematics and the students' perception on ICT integration in mathematics classroom.

Variables	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
Attitude Towards Math	3.5	Agree	2.79E-12	60.83	9.49	Significant
Perception on ICT Integration	3.67	Agree				

difference on the students' assessment on the effectiveness indicators of the implementation of ICT integration in Mathematics classroom among the three sections. This coincides with the p-value which is greater than $\alpha = 0.05$ which leads to the acceptance of the null hypothesis. In a 2005 study in Japan, the results of their experiments were particularly revealing. The researchers observed improvements in test scores ranging from between 35 and 75%, using pre-post-test measures over paper materials alone. The students' reactions to this new learning opportunity were positive. The researchers noted that since the cell phone is so well established in Japan, distributing educational material through them is a relatively effortless process. They stress that interactivity in content seemed a superior teaching method when compared to using static web pages alone for conveying material. As the United States catches up in more technologically advanced cell phone usage, M-Learning should become even more attractive to businesses and educational institutions wishing to advance their learning environments (Thornton and Houser, 2005)

Correlation between the Students' Attitude towards Mathematics and the Students' Perception on ICT Integration in Mathematics Classroom

Table 9 shows both the students' attitude towards Mathematics and their perception on ICT integration

before its implementation in Mathematics classroom. As reflected in the table, the three sections agreed on the statements about Mathematics learning and also agreed on the statements about their perception on ICT integration before it is implemented. This implies that they have a positive attitude towards Mathematics and also have a positive perception on ICT integration in Mathematics classroom. These analyses uphold to Bull and Reid (2004) who echoed sentiments, commenting that revision materials tailored to the needs of individuals and appropriate for viewing on a handheld computer are recommended, indicating that user requirements play an integral role in m-learning. These studies indicate that user requirements are of paramount importance in an m-learning context and hence should be assessed prior to any development of content or context for m-learning (Hafeez-Baig et al., 2006). Table 10 shows the correlation between the students' attitude towards Mathematics and their perception on ICT integration in Mathematics classroom. As reflected in the table, the computed value (60.83) is greater than the tabular value (9.49). This leads to the rejection of the null hypothesis, which means that there is a significant relationship between the students' attitude towards Mathematics and their perception on ICT integration in Mathematics classroom. This coincides with the p-value which is less than $\alpha = 0.05$ which leads to the rejection of the null hypothesis. These findings adhered to Brandt, Hillgren and Björgvinsson (2004), who quoted that, while highlighting the importance of peer-to-peer learning in

Table 11. Students' perception and attitude on ICT integration in mathematics classroom.

Variables	SA	A	D	U	SD	Totals	Wx	Description
Perception on ICT Integration	220	565	480	79	9	1353	3.67	Agree
Attitude on ICT Integration	238	474	267	43	3	1025	3.88	Agree

Table 12. Difference between the students' perception and attitude on ICT integration in mathematics classroom.

Variables	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
Perception on ICT Integration	3.67	Agree	9.00E-08	38.527	9.49	Significant
Attitude on ICT Integration	3.88	Agree				

Table 13. Students' attitude on ict integration in mathematics classroom and effectiveness indicator of on ICT integration.

Variables	SA	A	D	U	SD	Totals	Wx	Description
Attitude on ICT Integration	238	474	267	43	3	1025	3.88	Agree
Effectiveness Indicator of ICT Integration	106	195	56	15	0	372	4.05	Agree

mobile contexts, warned of the need to contextualise the learning sequences to suit user requirements.

Difference between the Students' Perception and Attitude on ICT Integration in Mathematics Classroom

Table 11 shows both the students' perception and attitude on ICT integration in Mathematics classroom. As reflected in the table, the three sections agreed both on the statements about their perception and their attitude on ICT integration in Mathematics classroom. This implies that they have positive perception and positive attitude on ICT integration in Mathematics classroom. These analyses will support to the widespread implementation of mobile learning, since it also conformed to the findings of a 2008 study, which revealed that the use of mobile learning made a positive and significant difference in the outcome performance as measured by average test score for students using the LMA software to review and practice for the exams (McConatha and Praul, 2008). Table 12 shows the difference between the students' perception and attitude on ICT integration in Mathematics classroom. As reflected in the table, the computed value (38.527) is greater than the tabular value (9.49). This leads to the rejection of the null hypothesis, which means that there is a significant difference between the students' perception and their attitude on ICT integration in Mathematics classroom. This coincides with the p-value which is less than $\alpha = 0.05$ which leads to the rejection of the null hypothesis. Furthermore, the table shows that the students' attitude on ICT integration has higher weighted mean (3.88) compared to their perception on ICT integration. This means that the students have a higher

level of agreement after the integration compared to their level of agreement before the integration. This implies further that the students have an increased level of agreement after experiencing the ICT integration in Mathematics classroom. These findings provide a platform to mobile technologies to provide the means and the methods for demonstrating that learning no longer needs to be classroom bounded. The capabilities of mobile devices will likely merge even more to provide a networked, multimedia device that is always with students (Wagner, 2005). Learning can happen any time and everywhere. Most of our learning takes place in informal situations where we do not even know we are learning. We simply adapt to the environment and social situations we are living in. Mobile learning enhances this opportunity for informal learning (Chuang, 2009).

Correlation between the Students' Attitude on ICT Integration in Mathematics Classroom and Effectiveness Indicator of ICT Integration

Table 13 shows both the students' attitude on ICT integration in Mathematics classroom and effectiveness indicator of the ICT integration. As reflected in the table, the three sections agreed on the statements about their attitude after ICT integration in Mathematics classroom and also agreed on the statements about their assessment on the effectiveness of the ICT integration in Mathematics classroom. This implies that they have both positive attitude after the utilization and a positive attitude towards the effectiveness of the ICT integration. These analyses will support effective implementation of mobile learning, since it is also in conformity to the principles of Davis' Technology Acceptance Model, which suggests

Table 14. Correlation between the students' attitude on ict integration in mathematics classroom and effectiveness indicator of ict integration.

Variables	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
Attitude Towards ICT Integration	3.88	Agree	0.000374	20.635	9.49	Significant
Effectiveness Indicator of ICT Integration	4.05	Agree				

Table 15. Students' perception on ICT integration in mathematics classroom, according to location of residence.

Location of residence	SA	A	D	U	SD	Totals	Wx	Description
Within Cebu City Proper	173	426	356	63	8	1026	3.68	Agree
Outside Cebu City Proper	47	118	107	15	1	288	3.68	Agree
TOTALS	220	544	463	78	9	1314	3.68	Agree

Table 16. Difference between students' perception on ict integration in mathematics classroom, according to location of residence.

Location of residence	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
Within Cebu City Proper	3.68	Agree	0.050722	9.453	9.49	Not Significant
Outside Cebu City Proper	3.68	Agree				
Totals	3.68	Agree				

that the attitude towards using mobile learning will affect user satisfaction as well as behavioral intention to use, which will result in actual use of the technology (mobile learning) and produce a net impact on individual users and the society (Elmorshidy, 2012). As a product of the student's positive attitude towards the implementation of Mobile e-Learning of Mathematics in the classroom, the resulting positive indication of effectively is exhibited. Table 14 shows the correlation between the students' attitude on ICT integration in Mathematics classroom and their assessment on the effectiveness indicator of the ICT integration. As reflected in the table, the computed value (20.635) is greater than the tabular value (9.49). This leads to the rejection of the null hypothesis, which means that there is a significant relationship between the students' attitude on ICT integration and their assessment on the effectiveness indicator of ICT integration. This coincides with the p-value which is less than $\alpha = 0.05$ which leads to the rejection of the null hypothesis. These analyses support the m-learning study by Attewell and Savill-Smith (2004) discussed the influences of learning on adult learners using mobile devices. The study specifically examined aspects of how to engage these learners in learning activities, how their attitudes change and the contribution of the activities towards improving literacy. The study indicated that adult learners used mobile devices, such as personal digital assistants (PDAs), to improve their organisational skills. Further, the mobile devices appear to have improved

collaborative learning.

Difference between Students' Perceptions on ICT integration in Mathematics Classroom, According to Location of Residence in Cebu

Table 15 shows the students' perception on ICT integration in Mathematics classroom, according to location of residence. As reflected in the table, the two groups (living within the City proper and living outside the City proper) agreed on the statements about their perception on ICT integration in Mathematics classroom. This implies that they both have a positive perception on ICT integration in Mathematics classroom. With a total weighted mean of 3.67, this shows that the two groups collectively have a positive perception on ICT integration before its implementation. These findings connected to the assertion that "Mobile learning is an emerging paradigm that has yet to be clearly defined" and that user requirements play a crucial role in mobile learning. The implication of this is that one needs to understand user needs prior to developing any learning environment or context (Baber et al., 2004). Table 16 shows the difference between the students' perception on ICT integration in Mathematics classroom, according to location of residence. As reflected in the table, computed value (9.453) is lesser than the tabular value (9.49). This leads to the acceptance of the null hypothesis, which means that there is no significant difference between the

Table 17. Students' attitude on ICT integration in mathematics classroom, according to location of residence.

Location of residence	SA	A	D	U	SD	Totals	Wx	Description
Within Cebu City Proper	208	371	200	33	2	814	3.92	Agree
Outside Cebu City Proper	31	109	70	9	0	219	3.74	Agree
Totals	239	480	270	42	2	1033	3.88	Agree

Table 18. Difference between students' attitude on ICT integration in mathematics classroom, according to location of residence.

Location of Residence	Wx	Description	p-value	Computed Value	Tabular Value	Remarks
Within Cebu City Proper	3.92	Agree	0.008672	13.604	9.49	Significant
Outside Cebu City Proper	3.74	Agree				
Totals	3.88	Agree				

perceptions of the two groups. This coincides with the p-value (0.050722) which is greater than the alpha (0.05). These findings reveal that educational practice can be embedded into mobile life. With the trend in educational media becoming more mobile, portable, and individualized, the learning form is being modified in spectacular ways (Yu and Chieh, 2008). Hence, it supply ubiquitous learning environment, mobile learning, learning that happens when the learner takes advantage of learning opportunities offered by mobile technologies (Elmorshidy, 2012).

Difference between Students' Attitudes on ICT Integration in Mathematics Classroom, According to Location of Residence

Table 17 shows the students' attitude after the ICT integration in Mathematics classroom, according to location of residence. As reflected in the table, the two groups (living within the City proper and living outside the City proper) agreed on the statements about their attitude on ICT integration after its implementation. This implies that they have a positive attitude on ICT integration. With a total weighted mean of 3.88, this shows that the two groups collectively have a positive attitude on ICT integration. These findings showed that the emergence of the recent mobile technologies, mobile learning, or m-learning, is beginning to offer 'stunning new technical capabilities' in education. This new genre of learning is viewed as a revolutionary stage in educational technology. Ultimately, these increasing computing capabilities will fulfil the goal of equitable access, and therefore enhance the processes of learning and teaching (Hsinyi et al., 2009). Table 18 shows the difference between the students' attitude on ICT integration in Mathematics classroom. As reflected in the table, the computed value (13.604) is greater than the tabular value (9.49). This leads to the rejection of the null

hypothesis, which means that there is a significant difference on the students' attitude on ICT integration after its implementation. This coincides with the p-value (0.00867231) which is lesser than the alpha (0.05). Furthermore, the table shows that students living in the city has higher weighted mean (3.92) compared to students not living in the city. This means that the students living in the city have a higher level of agreement in terms of their attitude on ICT integration compared to those students living outside Cebu city proper. Thus, the choice of education technologies should be guided according to the contextual requirements related to a broad range of social, cultural, political and economic factors (Macleod, 2005). The challenges for educators and technology developers will be to find ways to ensure that this new learning is highly situated, personal, collaborative and long term; which means a truly learner-centred learning experience (Siff, 2006). Educators will need to adapt from a role as transmitters of knowledge to guiders of learning resources. Technology developers will need to respond to concerns of security and privacy while designing devices and services that learners both want and will pay for (Chuang, 2009).

Conclusion

Based on the findings of this study, the following conclusions are derived:

1. The student-respondents have a positive attitude towards mathematics. And this attitude has a significant relation to their perception on ICT integration before its implementation in Mathematics classroom.
2. The student-respondents have a positive perception on the ICT integration before its implementation in a Mathematics classroom.
3. The student-respondents rated the effectiveness of the ICT integration as effective means of learning.

4. The student-respondents have a positive attitude on ICT integration after the implementation in a Mathematics classroom. And this attitude has a significant relation to their assessment on the effectiveness of the implementation on ICT integration in Mathematics classroom.
5. There is an increased level of agreement on ICT integration after they experienced the integration.
6. The student-respondents living in Cebu City proper have a higher level of positive attitude on ICT integration after its implementation in a Mathematics classroom compared to those living outside the Cebu City proper.

RECOMMENDATIONS

With reference to the statistical analyses, the vast literature on the use of mobile gadget in the teaching-learning process, findings and conclusions, the researchers provides the following recommendations:

Mathematics Teachers:

1. Utilize the availability of the mobile gadgets in the content delivery of the lesson.
2. Develop learning materials which can be utilized by the students with the aid of their mobile devices.
3. Conceptualize a system of real-time consultation for students during the discussion and outside the classroom setting using mobile technologies.

To the School Administrators and/or Curriculum Planners:

1. Create a strategic plan for Mathematics instruction where mobile gadgets are utilized in the teaching-learning process.
2. Include the following goals in developing the strategic plan:
 - a. Program Development Plan
 - b. Governance Strengthening Plan
 - c. Subscription and Development Program
 - d. Physical Development Plan
 - e. Design a mobile e-learning system that is compatible to all mobile gadgets.

To the Book Authors and/or Publishing Companies:

1. Take advantage of the availability of the mobile gadgets in the development of learning materials and references
2. Deliver multimedia materials designed specifically for mobile devices.
3. Design activities that are compatible to all mobile gadgets.

To the Mobile Application Developers

1. Deliver interactive tasks, such as online quizzes.

2. Develop interactive learning materials in mathematics.
3. Create a consultation system that enables student-professor interaction.

To the Researchers:

1. Replicate this research study using a control group to compare the experimental group.
2. Develop a research study that covers the impact on mobile e-learning in mathematics classroom.
3. Create a strategic plan for research purpose that will serve as a springboard of the school administrators in their implementation of mobile learning in Mathematics classroom.
4. Venture into further research for wider implementation of mobile e-learning in the classroom setting.

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