

The Relationship Between Smartphone Use and Academic Performance: A Case of Students in a Malaysian Tertiary Institution

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ABSTRACT

This study examined the extent to which students in one Malaysian university use smartphones to support their school-related learning and how these activities relate to CGPA. For seven consecutive days, 176 students from three academic programs recorded their daily smartphone use for learning. Significant differences were found in uses of smartphones depending on academic program. Further, it was found that the more students utilized their smartphone for university learning activities, the lower their CGPA. The outcome of this study suggests a need to evaluate and better understand the instructional uses of smartphones for tertiary students..

Keywords: *Smartphone, CGPA, learning activities*

INTRODUCTION

The 21st century has seen technology use becoming an inevitable part of life. Based on a Groupe Speciale Mobile Association (GSMA) (2015) report, half of the world's population has a mobile subscription with smartphone adoption already reaching critical mass in developed markets. Smartphones are now responsible for 60% of Internet connections around the world. This form of technology has advanced with simple call and text messaging functions being replaced with functions such as Internet access, email, camera applications and multimedia services (Lefebvre, 2009). In 2007, the Apple Company launched its first ever smartphone simultaneously marking the impact on education with its learning mobile applications (apps). By May 2013, the number of apps downloaded from the iTunes App Store alone reached 50 billion (Apple Press Info, 2013).

The possible influence of mobile devices on higher education and their impact on lifelong learning opportunities is still unclear and is an evolving field of study (Kukulska-Hulme, 2007). It is not surprising that educators have considered using mobile devices such as smartphones in education given their affordable, popular and practical functions (Ismail, Bokhare, Azizan, & Azman, 2013; Pullen, Swabey, Abadooz, & Sing, 2015). The appeal factor for learning through smartphones, and particularly through apps, would be the ease and flexibility offered by mobile learning. It minimizes the barriers inherent in traditional methods or activities that used to be carried out in schools and universities (Valk, Rashid, & Elder, 2010). However, Abdullah, Sedek, Mahat, and Zainal (2012) reported that university students often use their smartphones for personal communication rather than for learning. A recent study done on college students by Tossell, Kortum, Shepard, Rahmati, and Zhong (2015) found that smartphone use was perceived as favorable prior to study

but later revealed students viewed smartphones as detrimental to their educational goals in the end.

According to a survey titled *The Consumer Barometer* conducted by Google and TNS (2014), Malaysia leads the world in terms of smartphone usage. The survey revealed that over half (55%) of Malaysians use their mobiles to listen to music, half (50%) play online games and almost seven out of ten (67%) Malaysians watch online videos on their phones. What about learning? Do Malaysian tertiary school smartphone users utilize this device to support their learning? Despite the prevalent smartphone usage among tertiary level students, the extent to which this technology has contributed to their academic achievement is still inconclusive.

LITERATURE REVIEW

Technology and Education

Technology has undergone significant progression that benefits many, including educational stakeholders. Smartphones, the Internet-enabled devices incorporated with computer applications and software, are among the eminent breakthroughs in this latest century. It is not right to deny the existence of technology because most employers now seek graduates who are digitally literate (The Star, 2014). A lot of research has been done to investigate students' preparedness to incorporate learning with mobile devices, some of which are Malaysian-based by Abas, Peng, and Mansor (2009), Hussin, Manap, Amir, and Krish (2012) and Hamat, Embi, and Hassan (2013). Positively, the respondents in their studies welcomed the integration of learning with mobile gadgets. Hussin et al. (2012) researched student readiness for mobile learning in four aspects: basic, skill, psychological and budget. They found that Malaysian university students were not yet ready for mobile learning. However, it is assumed that with the growing development in smartphones, mobile learning would be made possible as many companies are very competitive in manufacturing smartphones, incorporating up-to-date apps, sold at low prices. Subsequently, this technology can reach even low-income households.

Smartphone Use in Learning situations

Norries, Hossain, and Soloway (2011) in their study demonstrated that students' achievement increase significantly when students use mobile learning devices, including smartphones, during learning time. This is because their time-on-task completion will increase as they have the device at hand. Norries et al. (2011) also found that students were constantly using the smartphone camera to take pictures of abstract concepts taught in class so that later they could relate them with the concrete ideas. Similarly, Woodcock et al. (2012) reported that respondents in their research believed that smartphones had allowed them to improve productivity and eventually their learning performance. Kumar (2011) indicated that students were downloading online lectures and reading from e-books to improve learning. Another study conducted by Mtega, Bernard, Msungu, and Sanare (2012), shows the respondents in their study do not just use traditional mobile learning applications, such as text messages and calls, but they utilize mobile learning applications such as GPS, camera, voice calls, emails, Google drive, and so forth, to create, upload, download and share academic resources with their friends. All the abovementioned research illustrated that smartphones have created sophisticated avenues for students to learn and it is undeniable that more students are spending more time using mobile apps. This is positively correlated with the higher rate of smartphone ownership among higher education students (Bowen, Kyle, & Mathew, 2012).

Though many current studies have shown smartphone usage benefits in learning, Woodcock et al. (2012) demonstrated contrasting findings. Students were found always using their phones more for playing games and other leisure activities than for learning. Among the identified factors preventing widespread adoption of smartphones for education are physical, technical and psychological limitations. White and Mills (2012) also found that students were increasingly adopting smartphones with the focus on personal use rather than education. In this study, students were asked if they used smartphone applications in categories in education, dictionary, games and maps. Similarly, Anzai, Funada, and Akahori (2013) investigated mobile device use for mobile photo note-taking, in order to examine the effect of this trend on vocabulary retention.

The study found no significant difference in short term vocabulary retention.

In recent years, more studies were carried out on smartphone use in relation to academic performance. For instance, Jacobsen and Forste (2011) in their study found a negative relationship between calling, texting, and self-reported grade point average (GPA) among university students in the United States. On the other hand, Hong, Chiu, and Hong (2012) found that calling and texting were positively correlated with a self-reported measure of academic difficulty among a sample of female Taiwanese university students. Yet in another research, Lepp, Barkley, and Karpinski (2015) reported that students who used the cell phone more on a daily basis were likely to have a lower GPA than students who used it less. Basing their conclusions on a sample of 536 undergraduates from 82 self-reported majors at a large public university, the researchers suggested a vital need to sensitize students and educators about the potential academic risks associated with high cell phone use.

More studies were carried out to investigate the causes behind a negative relationship between electro media use and academic performance; multitasking has emerged as a possible explanation (Jacobsen & Forste, 2011; Junco & Cotton, 2011; 2012; Karpinski et al., 2013; Kirschner & Karpinski, 2010; Rosen et al., 2013; Wood et al., 2012). Obviously, as smartphone use is not only limited to texting and calling but Internet use, email, and social-networking sites such as Facebook, it can potentially increase multitasking and task switching during academic activities. This ultimately leads to decrease in academic performance.

Despite the prevalent smartphone usage among tertiary level students, the extent to which this technology has contributed to their academic achievement is still inconclusive. Smartphone functions are no longer limited to only texting and calling; instead a wide array of activities need to be considered. Based on existing literature, this exploratory study was carried out to determine the extent of smartphone use in terms of learning by students at one Malaysian university and to investigate the relationship between smartphone use for related learning activities and students' academic performance. The findings of the present study may be helpful in articulating a theoretical basis for further research.

Problem Statement

Globally, smartphones use among tertiary level students has increased tremendously over the last two years. Higher learning institutions need to develop sound strategies to leverage students' smartphone use in order to create a more autonomous learning environment. To date, numerous studies have been conducted to investigate the use of mobile devices themselves. For most of the research reporting on the benefits and limitations of smartphone, there was very little empirical evidence to support their claims (Merchant, 2012). Although there is some evidence regarding students' use of smartphones in higher education, there is little research on how they have used smartphones to support learning activities and how this relates to academic performance. This study considered the amount of time tertiary level students used smartphones in sixteen learning activities and explored how it influenced their academic performance. Understanding the stated relationship may give insights as to whether smartphone usage has indeed contributed to increasing students' learning opportunities or likewise affected their academic performance negatively.

Objectives of the Research

The objectives of this research are the following:

(1) To investigate how students at one Malaysian university use their smartphones to support their classroom learning.

(2) To investigate the relationship between the amount of time students spent using smartphones for school-related learning activities and their academic achievement at one Malaysian university.

Based on the research objectives, the following research questions will be answered by the study:

(1) How do students at one Malaysian university use their smartphones to support their classroom learning?

(2) How does time used on smartphones for learning activities relate to academic achievement among students at one Malaysian university?

METHODOLOGY

Research Design

This study utilized a quantitative method and employed a correlational research design. It sought to describe the selected demographic characteristics and discover relationships between smartphone usage among undergraduate students in a public university in Malaysia and their academic performance.

Population and Sampling

A structured random sampling method was utilized where every unit in the population had an equal chance to be selected from the second year diploma students of three faculties; namely Administrative Management (N = 127), Computer Science (N = 178) and Accounting (N = 107) of a public university in Malaysia. Because the research model required substantial effort on the part of cooperating faculty members, the opportunity to participate was extended to faculty members on a voluntary basis. Students attending courses offered by the cooperating faculty were asked to voluntarily participate in the study. To be selected as a respondent in this study the respondents were required to have a smartphone. Given the long-standing practice of students and faculty at the target university, it was not surprising that all students in the three targeted faculties own and regularly use smartphones in connection with their schoolwork. No effort was made to account for the gender distribution of the student participants. No effort was made to account for the particular smartphone brand or model, or service provider each respondent used during the study period. This decision was based upon analyses reported by Elias (2011) indicating that smartphone users, especially younger users, tend to select their preferred instrument based on issues such as cost of smartphone, cost of the Internet access service, screen size, ease of use, and equipment choices made by their peers. Given this, attempts to standardize the manufacturer and model of smartphones used by students in any given learning environment are likely to be counter-productive.

However, an effort was made to stratify the sample such that there were an equal number of participants from the three target faculties. All of the thirty students in each of the six classes volunteered to participate. Hence, sixty students participated from each targeted faculty: Administrative Management (AM) (n = 60), Computer Science (CS) (n = 60), and Accounting (AC) (n = 60). Although the sample of AM students represented a larger percentage of the population of students at the target program-level than was invited to participate from either CS or AC, it was felt that having equal sample sizes participating from each faculty was more important than having an equal percentage of representation from each. This sampling technique provided the advantage of having the respondents from each program group studying the same courses in their discipline during the study period.

Instrumentation

The participants completed the Smartphone Use Survey based on how much time they spent using their smartphone for school-related learning activities each day for seven days. The items include an array of school-related activities designed to elicit responses regarding daily time used in learning activities such as using the smartphone for texting friends regarding assignments, downloading learning materials, and so forth. Respondents recorded the number of minutes they estimate they engaged in each activity during the previous day.

This instrument was adapted from a set of Likert-type survey items on smartphone use devised by Almahfud (2014) in which the author has done content validation by an expert review panel. The revised items were piloted. The internal consistency reliability for the final scale was .81. In the present research, we

have adapted the participants' data entry process to report the actual count of time spent on the smartphone. Face validity of the modified instrument was confirmed by a pilot run with the primary investigator and three lecturers who were the instructors for the study target course sections.

In addition, it was felt that an actual report of time, rather than the categorical responses used in Likert-type items constructed by the original author, would provide a more reliable measure of actual time spent on each activity. This assumption was vindicated by the finding that the internal consistency reliability score for the modified instrument is .98 as compared to .81 for the original version. The survey was completed using a paper form for each day of the study.

Data Collection

Based upon their expressed interest to be included in research projects for skill and career development reasons, a team of three lecturers joined the primary investigator. They were oriented to the processes of completing the Daily Record of Smartphone Use, as well as the processes of maintaining the anonymity of study participants during the research. This team now serves as the co-authors of this study report. Three other lecturers, who were interested in learning how their students use smartphones to support their schoolwork, offered to encourage students from two of their course sections to voluntarily participate in the study. The researchers had no direct instructional relationship with the study participants.

Confidential study IDs were assigned to each participant to ensure their seven separate reports could eventually be attributed to a single participant and to support later analyses of the extent to which students from different faculties might report different smartphone use preferences.

Participants were instructed to keep track of their smartphone use, by making regular notes throughout the day followed by making usage reports daily early on the following day. They were further instructed that during periods of "smartphone multi-tasking," for example texting about a class assignment while simultaneously recording a class lecture, they should record time spent on each activity as a separate entry on the report form.

Table 1 provides a list of the 16 stems to which participants responded, while Figure 1 provides a graphic representation of the correct entry to record a total of 2 hours and 5 minutes of using the smartphone to "Access course information" on the day of this report.

Table 1: List of Stems for Responses to "How often do you use your smartphone to:"

Text About Class Assignments	Up/Download Learning Materials
Check Reference Materials	Check Word Meanings
Read News	Practice Pronunciations
Solve Math Problems	Access Online Quizzes
View Course PowerPoint Slides	E-Mail About Assignments
Take Class Notes	View Course Video
View Course Pictures	Record Class Lectures
Make Translations	Record Class Presentations

Figure 1: Example of the Instructions Given for Completion of the Daily Smartphone Use Report

Study ID: _____
 Day: 5
 Date: 10-12-15

How often do you use your smartphone to: e.g.: Access course information?

Hour(s) 4 6 8 10 12 14 16 18 20 22 24
 1 3 5 7 9 11 13 15 17 19 21 23
 Minute(s)

1 | | | | | | | | 10 | | | | 15 | | | | 20 | | | | 25 | | | | 30 | | | | 35 | | | | 40 | | | | 45 | | | | 50 | | | | 55 | | | | 59

We ensured that the study participants completed the Daily Record of Smartphone Use at the beginning of each school day, while reports for the weekend days were turned in to us on the first day of the school-week, during the week-long study period.

The time frame for data collection was set at one week. A total of 176 usable questionnaires were received: all 60 Administrative Management students, 59 of 60 Computer Science students, and 57 of 60 Accounting students had submitted complete surveys (See Table 2). Using a table provided by Kraemer and Thiemann (1987, p. 109), a sample size of 168 is sufficient to support a two-tailed comparison of means at the 5% level with a power of 70 and a α 0.19. It was
 inferential outcomes of statistical analyses.

Subsequently, copies of the academic transcript of each participant who submitted a complete survey were provided by the faculty head. This information was used to establish the overall academic achievement or CGPA of each participant.

Data Analyses

CGPAs were extracted from the transcripts and treated as scale data. Descriptive statistics were used to answer the research questions posed for this study. Means, standard deviations and medians of accumulated time committed to each of the target smartphone uses and the total weekly use recorded on the Daily Record of Smartphone Usage were calculated. These scores were compared to academic achievement scores using bivariate comparisons of means.

FINDINGS AND DISCUSSION

Means and medians of total smartphone use, and sample and population CGPAs are reported by academic program for the 176 respondents in Table 2.

Table 2: Demographic Descriptions

Programme	Gender	Mean Smartphone Use (Minutes/Week)	Mean CGPA
Administrative Management	Male	6337.37	2.95
	Female		
	Total		
Computer Science	Male	5001.98	3.11
	Female		
	Total		
Accounting	Male	6142.81	3.28
	Female		
	Total		

Samples of the students from three faculties participated in this survey, Administrative Management (AM) has the highest number of respondents which comprised 34.1 % of the study sample (n = 60) and 47.2% of the population of all AM students (N = 127) at that level of the program, Computer Sciences (CS) students constituted 33.5% (n = 59) of the study sample and 33.1% of all CS students (N = 178) at that level of the program. Accounting (AC) students constituted 32.4% (n = 57) of the study sample and 53.3% of all AC students (N = 107) at that level of the program.

Overall, the AM group displayed the highest use of smartphone for the study period, with a mean of 6337.37 and a median of 3666.50 minutes, followed by the AC group, with a mean of 6142.81 and a median of 3485.00 minutes. The CS group reported a mean of 5001.98 and a median of 3264.00 minutes. In terms of CGPA, the highest mean came from AC, 3.28 followed by CS, 3.11 and the AM has the lowest mean among the three groups which is 2.95.

Descriptive statistics reported in Table 3 shows that the most frequent use of smartphones, based upon Mean scores, was for “communicating with others by texting” (M = 593.32, SD = 744.324, Median = 345.50), followed by “accessing reference materials” (M = 537.17, SD = 501.434, Median = 437.50), and “reading news” (M = 485.16, SD = 667.881, Median = 80.00). The smartphone uses rated as being used least often were “viewing course video” (M = 221.11, SD = 400.067, Median = 60.00), “record class lecture” (M = 218.98, SD = 415.841, Median = 295.00) and “record class presentations” (M = 186.69, SD = 363.309, Median = 54.50).

It is interesting to note that the most frequent use, based on Median scores was for “checking reference materials” (M = 537.17, SD = 501.434, Median = 437.50), “communicating with others by texting” (M = 593.32, SD = 744.324, Median = 345.50), and “recording class lectures” (M = 218.98, SD = 415.841, Median = 295.00). The smartphone uses rated as being used least often, base on Median scores, were “e-mailing about assignments” (M = 230.07, SD = 406.067, Median = 56.00), “viewing course video” (M = 221.11, SD = 400.067, Median = 60.00), and “record class presentations” (M = 186.69, SD = 363.309, Median = 54.50).

Table 3: Smartphone Use in Minutes by Type of Use for Seven Days

Type of Use	Mean	Std. Dev.	Median
Text About Class Assignments	593.32	744.324	345.50
Reference Materials	537.17	501.434	437.50
Read News	462.75	545.500	80.00
Solve Math Problems	398.09	476.574	212.50
Course PowerPoint Slides	372.39	501.756	175.00
Class Notes	363.49	461.015	160.00
Course Pictures	317.31	530.436	117.50
Make Translations	315.23	456.197	122.50
Up/Download Learning Materials	314.30	398.967	150.00
Word Meanings	298.01	432.226	125.00
Practice Pronunciation	266.82	417.481	100.00
Access Online Quizzes	247.58	423.970	85.00
E-Mail About Assignments	230.07	406.524	56.00
View Course Video	221.11	400.067	60.00
Record Class Lectures	218.98	415.841	295.00
Record Class Presentations	186.69	363.309	54.50
Total Smartphone Use for Week	5826.69	6848.583	3483.50

In the present study, the Mean number of minutes of smartphone use per respondent, per week is 5826.69, which represents nearly 57.80% of the total number of minutes in a 7 day period. At first glance, this seems to be an unlikely outcome, even given that respondents were instructed to report usage minutes for two or more applications in which they engaged simultaneously. Moreover, given the very large standard deviation of 6848.583 found for the Mean of 5826.69, we are more comfortable relying on the calculated Median scores which account for 3483.50 minutes of use, including instances of multi-tasking, in the 10,080 minutes of a 7 day period (34.55% of the total time available).

This finding is aligned with other research reporting that texting is a common method for communicating with others. For example, Davis (2010) found that young people are using texts an average of four-hundred-fifty-four minutes per day as compared to the seventy-seven minutes per day documented in 2004. In addition, the Tindell and Bohlander (2012) survey found that university students' use of smartphones for texting is prevalent before and during class. The majority of students surveyed reported sending or receiving a text message in class at least once or twice while about one-third text in class every day.

The research team was also interested to learn the extent to which differences in academic programs might be reflected in differences in smartphone use. To assess this issue, the overall study sample was structured to include approximately equal groups of 60 students from each of the three main faculties of the university: Completed surveys were submitted by Administrative Management (AM) 60, Computer Science (CS) 59, and Accounting (AC) 57 (See Table 2).

Table 4 shows that despite using smartphone for school related learning purposes, the results indicate there is a significant but weak inverse correlation between smartphone usage for eight of the school-related activities assessed in the study and academic CGPA of this sample of tertiary students. This means the more these students utilized their smartphone for the learning activities the lower their CGPA. This is in line with Chen and Peng (2008) who found that low levels of Internet use have been associated with improved academic performance. However, Chen and Tzeng (2010) found that among heavy Internet users information seeking was associated with better academic performance. In another research conducted by Ng, Zakaria, Lai, and Confessore (2014), no significant correlation was found between time spent on Internet-associated activities, in terms of school-related and non-school-related uses, and academic achievement, or text messaging activities for school-related purposes. These findings reaffirmed that despite the prevalent smartphone usage among tertiary level students, the extent to which this technological device has contributed to academic achievement is still inconclusive

Table 4: Correlation of Cumulative Grade Point Average and Minutes of Seven Days of Smartphone Use by Type of Use (Only Significant Correlations Reported)

Type of Use	CGPA (<i>r</i>)	<i>p</i> value
View Course Pictures	-.194**	.010
View Course PowerPoint Slides	-.212**	.005
Review Class Notes	-.169*	.025
View Course Videos	-.196**	.009
E-Mail About Assignments	-.172*	.022
Record Class Presentations	-.160*	.034
Solve Math Problems	-.182*	.016
Up/Download Learning Materials	-.148*	.050
Total Smartphone Use	-.166*	.027

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

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

The respondents of this study have spent a substantial amount of time in using smartphones for their learning tasks; however the effort reflected negatively on their academic performance. Based on the results reported in Tables 3 and 4, one might ask, at the end of the day what has smartphone use for school-related activities contributed to the respondents' learning? They could have been looking up words twenty times per day and acquiring none of them or spending hours reviewing class notes on their smartphones and retaining very little information for their effort. This result could be the consequences of multitasking while doing a learning task. The psychological literature has found that multitasking is detrimental to learning and task execution. The seriousness of this issue is reflected in recent research evidence that multitasking mobile phone use while executing another task decreases learning and task completion (Ophir et al., 2009; Smith et al., 2011). The current study results showed similar possibility of multitasking which led to unfavorable academic performance.

CONCLUSION AND RECOMMENDATIONS

A posting by Concordia University of Portland Oregon (2016) asserts that with proper school-use of smartphones 1) students learn the way they are comfortable, 2) Students can get answers quickly, 3) audio and video can bring learning to life, 4) access to educational applications takes learning up a notch, and 5) smartphones allow for social learning. The posting notes that educators "... can be a positive force in helping students to use them (smartphones) properly in the classroom" (p. 1). The posting asserts, "We believe the focus of smartphone use in the classroom should shift from not if they should be used, but to how best to use them" (p. 1).

The present study refined the abovementioned assertions by examining, more specifically, various

school-related learning activities. Based on the research discussion, we can conclude that smartphones have negative effects on students' academic performance even though they were used for school-related learning activities. So, there is a need to evaluate and better understand smartphone use among tertiary students. Generally, when students use smartphones for learning activities, information is essentially transmitted one-way as there is no direct teaching involved. The learners noticed they needed some bit of information, looked for it using their smartphone, plugged the answer into whatever project they were working on and went along their way. Barrs, in his 2011 study, recommended that detailed guidance and explanation on how to use smartphones appropriately in classroom settings is imperative for meaningful learning. Hence, if smartphones were to be used in school-related learning activities, it would be more successful if it involved conversations between tutors and students. This means that having a tutor to facilitate the usage will deter students from being distracted from their original learning. Darling-Hammond, Zieleski, and Goldman (2014) from Stanford University conducted a study in 2014 on at-risk students' learning with technology affirmed that a successful learning process does not solely rely on technology availability; equally important is the availability of teacher support and input from other students. The combination of technology uses, strategic teacher support and social interaction among learners will produce the strongest output.

Smartphone use is definitely a dominant cultural staple of this generation of university students. They use them during class time, while completing homework and while studying (Smith, Raine, & Zickuhr, 2011; Tindell & Bohlander, 2012). There is a vital need to better understand the mechanisms underlying this behavior. Future studies should focus on ways to facilitate learners' intentional behavior toward using smartphones so that they will develop the capacity to use smartphones to increase learning effectiveness.

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