THE RELATIONSHIP BETWEEN SMARTPHONE USE AND ACADEMIC PERFORMANCE IN A SAMPLE OF TERTIARY STUDENTS IN SINGAPORE: A CROSS-SECTIONAL STUDY

By

JINGMING ZHAO *   **WEI YUPING ***   **ISMAIL MAIDEEN ***

ZAN KHIN MOE ***   **A. M. A. NASIRUDEEN ******

*-**,**** *Lecturer, School of Health Sciences, Ngee Ann Polytechnic, Singapore.*
,** *Senior Lecturer, School of Health Sciences, Ngee Ann Polytechnic, Singapore.*

ABSTRACT

The use of smartphone for socialising and learning has become a norm among students in Singapore. Educational institutions are creating lessons and applications for use on mobile platforms. However, the effectiveness of smartphones for learning has not been well studied in Singapore. This study was conducted to understand the association between smartphone use for learning activities and academic performance (measured by cumulative GPA) in a sample of tertiary students in Singapore. A questionnaire that contained questions concerning demographic data and use of smartphone for learning was used for data collection (n=619). Results showed that there is a significant association between smartphone use for learning activities and student's cumulative Grade Point Average (cGPA) (p < 0.05). Results also indicated that female students used the smartphones more frequently for learning compared to male students and international students made more frequent use of smartphones for learning compared to local students. Students' level of satisfaction with using smartphone for learning activities was also surveyed. In conclusion, this study showed that students who used smartphones for learning had higher academic performance (cGPA). Variables such as gender and nationality of students played a role in smartphone use for learning and impacted on students' cGPA.

Keywords: Academic Performance, Higher Education, Mobile Learning, Smartphone, Tertiary Students.

INTRODUCTION

Advancements in smartphone technology have impacted every aspect of society and individual in recent years. Individuals accessing e-mail, text, multimedia, interactive videos, e-book, etc. via smartphone has become a norm in daily life. With this new trend, the use of smartphone as a learning tool and the development of educational interventions based on smartphone have attracted increasing attention (Rung et al., 2014). A few studies have been reported whereby students found it valuable and useful to use smartphone to access social media for learning, mobile educational applications, and other learning materials for tertiary education (Robinson et al., 2013; Rung et al., 2014).

Past researches have shown that the use of smartphone can enhance blended learning (Echeverría et al., 2011), as well as play a major role in contributing to on-campus teaching. Students have used smartphones to access course content, acquire information related to their performance, and to discuss and share notes and viewpoints with lecturers (Cochrane, 2010). Therefore, it is clearly evident that smartphones can have a significant contribution to current tertiary education as they might offer possibilities to enhance teaching and learning.

As with every technology, understanding the factors that would impact students' daily use of smartphone effectively in their education is important in order to develop most appropriate educational interventions.

Use of Smartphone Enhances Learning

Wallace et al. (2012) reported that 78.3% of students used applications in their smartphone for educational purposes and more than 80% of student respondents described that using smartphone would increase effectiveness of learning as they could access information quickly. Furthermore, participants who used smartphone to manage their time by accessing schedules and calendar could study more efficiently as the smartphone could remind them of the study schedules. Participants stated that the smartphones were very efficient as it helped them organise information and ideas (Schepman et al., 2012). If the students are unable to attend their lessons, they would still be able to access to their study materials via smartphones and would not miss out on any important information (Sarwar and Soomro, 2013). A study conducted by Payne et al. (2012) showed that medical school students who used medical related apps via smartphone more frequently had better performance both in their clinical attachments as well as on campus study. Another study by Sandberg et al. (2011) reported that the use of smartphones for learning is no longer limited to specific geographical locations, such as classrooms. The availability of smartphones maximizes the possibilities for students to get information and learn knowledge inside as well as outside the classroom (Davies et al., 2012).

Smartphone as a Tool of Communication between Teachers and Learners

The study done by Barati and Zolhavarieh (2012) found that using smartphone for learning provided direct communication among teachers and students and it allowed the learner to communicate with classmates and instructors regardless of location (Santos and Ali, 2012; Gikas and Grant, 2013). Similarly, the study conducted by Wallace et al. (2012) had shown that more than 80% of the participants used smartphone to communicate with teachers and peers and it increased students' engagement and motivation to do well academically.

1. Aim of the Study

The main aim of the study was to investigate the use of smartphone for learning by students from a tertiary institution in Singapore. Literature search indicated that there were no published studies on the impact of smartphone use for learning on academic performance among students studying in a tertiary institution in Singapore. This study aims to fill in the information gap of understanding how mobile devices such as smartphones impact on tertiary students' cGPA in Singapore.

2. Methods

2.1 Research Design

This was a descriptive, cross-sectional, correlational quantitative study that employed convenience sampling technique.

2.2 Samples and Settings

The sample size was computed using the Slovin's formula. The minimum estimated sample size, with 95% confidence interval, was 276. However, 700 students were invited to participate in the study. Participants were from an institution of higher learning in Singapore. In selecting the respondents, the following criteria were used: (1) students in a full-time course; (2) students who had completed at least 2 semesters of studies; (3) students who owned a smartphone for daily use; (4) students who are enrolled in the same course. The last criteria was necessary to ensure that the frequency and necessity of smartphone use was standardized with regards to academic matters. Table 1 summarises the demographic characteristics of the participants.

Questionnaires collected were checked for missing data and such were rejected. Finally, questionnaires from 619 students (88.4% response rate) were used for data

Demographic Characteristics	n	%
Gender		
Male	171	27.6
Female	448	72.4
Age		
17 - 53	619	100
mean = 19.86		
Nationality		
Local students	434	70.1
International students	185	29.9
Year of study		
Year 2	313	50.6
Year 3	306	49.4

Table 1. Characteristics of the Sample n = 619

analysis.

2.3 Instruments

Self-reported survey questionnaires were used in this study. The questionnaire consisted of 3 sections: demographic characteristics, use of smartphone for learning and frequency of use, and student satisfaction with using smartphone for learning.

The first section consisted of personal profile of the respondents. The students use of smartphone for various learning activities, such as "Use Educational Apps", "Share Notes with Classmates", etcetera was ascertained in the second section. In the third section, data on students' satisfaction with using smartphone for learning was gathered. Students were asked to rate the extent of their satisfaction with using smartphone for learning on a four (4) point Likert scale ranging from one (1), meaning "Strongly disagree" to four (4), meaning "Strongly agree".

The questionnaire used for this study was developed in-house. We assessed internal consistency using Cronbach alpha coefficients. The results obtained had an overall Cronbach's alpha of $(r) = 0.76$. Content Validity Index (CVI) was also assessed as mentioned in Jayanthi et al. (2014). Briefly, faculty researchers in the School of Health Science were asked to validate the questionnaire. The rated findings were used to calculate the content validity of individual items (I-CVI) and the content validity of the overall scale (S-CVI/UA) using the method described by Polit and Beck (2006). The mean I-CVI and S-CVI/UA for the questionnaire used in this study was 1.0 and 0.79, respectively. Instruments with validity confident of at least 0.7 are accepted as valid in research (Kathuri and Palls, 1993).

2.4 Cumulative Grade Point Average (cGPA)

In this study, the cumulative Grade Point Average (cGPA) was used as a measure of students' academic performance. The cGPA score would take into account students' performance in tests, course work, and examinations. The cGPA score implies that the higher the score, the better the student had performed academically. As such, the cGPA will be a good measure of a student's academic performance (Jayanthi et al., 2014).

2.5 Ethical Considerations

This study was approved by the Institutional Review Board of Ngee Ann Polytechnic. Written and verbal information about the study were given to all participants. Written consent was sought from the students before the survey was administered.

2.6 Data Analysis

Both descriptive and inferential statistics were used to analyse the data. Descriptive statistics included frequency, mean, percentage, and standard deviation. Independent sample t-tests were used to investigate any significant association between demographic factors and cGPA. Inferential statistics such as multiple regression analysis was used to examine the relationships between variables.

The collected data from the respondents were transferred to Microsoft Excel 2010. Standard data entry and quality control procedures were used including double entry, range and consistency checks, and manual review of outliers. The data were then coded and entered in Statistical Package for Social Sciences (SPSS) version 23 for analysis.

3. Results and Discussions

3.1 Use of Smartphone for Learning and Demographic Factors

Figure 1 shows a graphical representation of mean
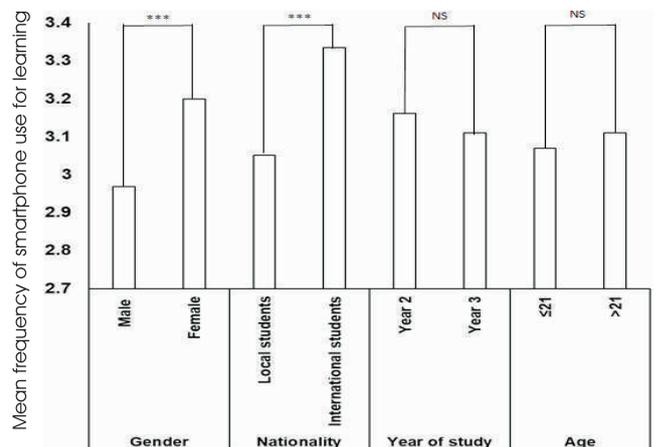
***p<0.001 (2 tailed), **p<0.01 level (2-tailed), * p<0.05 level (2-tailed), NS (Not significant).

Figure 1. Graphical Representation of Mean Frequency of Smartphone use for Learning and Demographic Variables

frequency of smartphone use for learning and demographic variables. Figure 1 shows that female students used the smartphones more frequently (mean = 3.12) for learning compared to male students (mean = 2.94). International students made more frequent use of smartphones (mean = 3.34) for learning compared to local students (mean = 3.1). Year of study and age of students had no statistically significant impact on the frequency of smartphone use for learning.

The findings of this study on gender differences on the use of smartphone for learning is in contrast to the study by Jambulingam and Sorooshian (2013) where the authors showed no significant differences among Malaysian female and male tertiary students. However, a study by Halder et al. (2015) showed that female tertiary students had more positive attitude towards using mobile phones for educational purposes than their male counterparts. The results showed that age had no significant impact on frequency of smartphone use for learning. This finding mirrors that of another study that showed that age was not a significant factor in using smartphone for learning activities (Alzougool and AlMansour, 2017).

A multiple regression analysis was performed to investigate the relationship between the demographic variables and cGPA. Results showed that age and year of study had no significant impact on cGPA attained. However, regression analysis coefficient showed that cGPA will increase by 0.166 units if the student is a female and by 0.233 units if the student is of a foreign nationality (Table 2). These coefficients are highly significant with a p-value of less than 0.001.

There was no relevant study found on literature search for effect of nationality on use of smartphone for learning. This study could be the first to show that international students were more frequent users of smartphones for learning compared to their local counterparts and this attitude likely benefitted them with a better cGPA. The international students who participated in this study were from Asian countries, such as China, Myanmar, Malaysia, etc. Most of these students do not have educational training with English as the medium of instruction. As such, they have difficulties in clearly articulating their

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.295[a]	0.087	0.081	0.4880025

(a)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	13.915	4	3.479	14.608	0.000[b]
Residual	146.222	614	0.238		
Total	160.137	618			

[a] Dependent Variable: cGPA
[b] Predictors: (Constant), Level Year 2, Female, Age ≤21, international student

(b)

	Unstandardized Coefficients		Standardized Coefficients		
Model	B	Std. Error	Beta	T stat	Sig. (p-value)
(Constant)	2.990	0.061		48.665	0.000
Female	0.166	0.046	0.146	3.621	0.000
International Student	0.233	0.045	0.210	5.189	0.000
Age: ≤21	-0.070	0.060	-0.047	-1.164	0.245
Level: Year 2	0.032	0.041	0.032	0.791	0.429

(c)

Table 2. Multiple Regression Analysis between Independent and Dependent Variables (a) Regression Statistics, (b) ANOVA[a], (c) Coefficients

uncertainties to their lecturers and peers (Arkoudis and Tran, 2010; Alavi and Mansor, 2011). Hence, it is very likely that these international students prefer the use of smartphone for learning instead.

3.2 Smartphone use for Learning Activities and Academic Performance

Sample t-test analysis was used to study the impact of learning activities on cGPA scores. As shown in Table 3, only two learning activities, "Contacting Lecturers Regarding Lessons" (mean cGPA = 3.16) and "Taking Photos of Educational Materials" (mean cGPA = 3.15) showed significant association with mean cGPA. Students

Learning Activities	Yes	No
Surfing web for learning materials	3.14	2.97
Sharing notes with peers	3.13	3.15
Contacting lecturers (regarding lessons)	3.16*	3.02*
Writing iReport	3.11	3.15
Taking photos of educational materials	3.15*	2.94*
Making educational videos	3.12	3.17
Video recording of lessons	3.15	3.05
Audio recording of lessons	3.15	3.10
Downloading educational videos	3.16	3.08
Using educational applications	3.16	3.07
Using a social networking site	3.13	3.17

*p<0.05 level (2-tailed)

Table 3. Independent Samples t-test Analysis: Mean cGPA and use of Smartphone for Learning Activities

who used the smartphone for these two activities scored higher cGPA than those who did not. A study by Moh (2015) also showed that students who used smartphones in a learning context showed improvement in a computer literacy course. However, a study by Lepp et al. (2015) showed that use of smartphone was associated with decreased academic performance.

3.3 Students' Satisfaction with using Smartphone for Learning and Cumulative GPA

Results shown in Table 4 and Figure 2 suggest that the students in this study were highly satisfied with using smartphone for learning. For items 2 – 5 on student satisfaction, more than 90 percentage of students agreed that using a smartphone for learning was beneficial. For item 1, 86.7% of students agreed that using a smartphone greatly enhanced their learning. Furthermore, 85.1% of the students in this study recommended the use of smartphones to conduct

Figure 2. Graphical Representation of Students' Satisfaction with using Smartphone for Learning

lessons (Table 4). The results mirror that of Moh (2015) whereby students expressed positive perceptions after their experience with smartphones for learning.

Conclusion

The results and discussions above demonstrate the impact of smartphone use for learning on the academic performance of a sample of tertiary students in Singapore. In a study by Lepp et al. (2015) cell phone use was negatively associated with academic performance. However, the authors acknowledged that there may be specific uses that are positively related to academic performance. For example, students who used the internet for information performed better academically than those who used the internet for videogames (Chen and Tzeng, 2010). In this study, an attempt was made to better understand how smartphone use for learning activities are related to academic performance. Furthermore, this study showed that female students used smartphone more for learning than male students and international students were more likely to use smartphone for learning than local students.

This present study has two main limitations that limit its generalizability. First, smartphone use for learning was self-reported. Although the questionnaire used in this study was carefully developed to assure content validity, research by Boase and Ling (2013) showed that continuous, open-ended self-report measures of cell phone use are at risk of overreporting. Second, the participants recruited for this study were from a single tertiary institution and hence these results are not representative of the student population in Singapore.
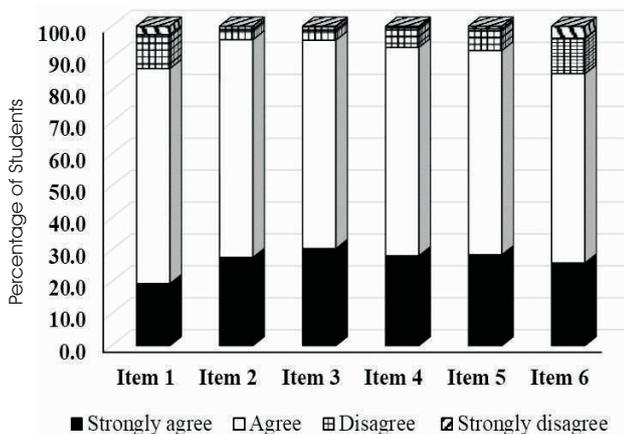
	Strongly Agree		Agree		Disagree		Strongly Disagree	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Item 1: Accessing Learning Management System (LMS)via smartphone greatly enhanced my learning	120	19.4	417	67.4	66	10.7	16	2.6
Item 2: Accessing internet via smartphone for learning resources was beneficial	171	27.6	422	68.2	26	4.2	0	0.0
Item 3: I found it helpful to be able to contact my lecturer via smartphone	188	30.4	404	65.3	26	4.2	1	0.2
Item 4: Overall smartphone use enhanced my ability to learn effectively	174	28.1	404	65.3	38	6.1	3	0.5
Item 5: Overall smartphone use helped me to learn more independently	176	28.4	396	64.0	42	6.8	5	0.8
Item 6: Smartphones should be utilised more by the school/lecturers to conduct lessons	160	25.8	367	59.3	69	11.1	23	3.7

Table 4. Students' Satisfaction with using Smartphone for Learning

Therefore, future research should include tertiary students from other tertiary institutions in Singapore.

Recommendations

School administrators and faculty should recognise the positive effect of smartphones on academic performance. Almost every tertiary student uses a smartphone for communication and entertainment. As such, relevant educational mobile applications should be developed to influence smartphone use for learning. Educators should better understand and guide their students towards more appropriate smartphone use for academic purposes. With proper guidance, smartphones can become tools of research, content search, and self-directed learning. Many educators only see the negative impact of smartphone use in the classroom. When seen as a tool for learning, smartphone use can enhance academic performance of students.

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ABOUT THE AUTHORS

Jingming Zhao is a Lecturer in the School of Health Sciences at Ngee Ann Polytechnic in Singapore. Ms. Zhao's research interest is on using Educational Technology to enhance tertiary students' learning outcomes.

Wei Yuping is a Lecturer in the School of Health Sciences at Ngee Ann Polytechnic in Singapore.

Ismail Maideen is a Senior Lecturer in the School of Health Sciences at Ngee Ann Polytechnic in Singapore.

Zan Khin Moe is a Lecturer in the School of Health Sciences at Ngee Ann Polytechnic in Singapore.

A. M. A. Nasirudeen is a Senior Lecturer in the School of Health Sciences at Ngee Ann Polytechnic in Singapore.