World Academy of Science, Engineering and Technology
International Journal of Educational and Pedagogical Sciences
Vol:11, No:2, 2017

Stop Texting While Learning: A Meta-Analysis of Social Networks Use and Academic Performances

Proud Arunrangsiwed, Sarinya Kongtieng

***Abstract*—**Teachers and university lecturers face an unsolved problem, which is students' multitasking behaviors during class time, such as texting or playing a game. It is important to examine the most powerful predictor that can result in students' educational performances. Meta-analysis was used to analyze the research articles, which were published with the keywords, multitasking, class performance, and texting. We selected 14 research articles published during 2008-2013 from online databases, and four articles met the predetermined inclusion criteria. Effect size of each pair of variables was used as the dependent variable. The findings revealed that the students' expectancy and value on SNSs usages is the best significant predictor of their educational performances, followed by their motivation and ability in using SNSs, prior educational performances, usage behaviors of SNSs in class, and their personal characteristics, respectively. Future study should conduct a longitudinal design to better understand the effect of multitasking in the classroom.

***Keywords*—**Meta-regression analysis, social networking site use, academic performance, multitasking, motivation.

I. Introduction

MUCH research has been conducted on the impact of the relationship between Social Networking Sites (SNSs) use and academic performance [1]-[7]. More importantly, several studies show positive results in the use of in-class technologies and academic performance [8]-[12]. However, recent studies show more on the negative results between the use of SNSs and resulting educational performance [13], [14]. Four out of 14 research articles during 2008-2013 from online databases have met the predetermined inclusion criteria investigated in this study.

In regards to earlier studies, Brown et al. [15] have long discussed the benefits of college students that constantly have access to computers in classrooms/campuses. As a result, the studies demonstrate a mutual theme that if almost everyone "takes to" the new era of using in-class technologies, most educators would reap the benefits of an educational revolution that creates positive outcomes on education [16].

Chiu and Wang [17] defined web-based learning as, "based on material delivered through a Web browser over the public Internet, private intranet, or extranet". Driven [18] found evidence that using web-based activities in classes can enhance overall educational performance, particularly in group projects. In the same way, other research shows more positive effects of using in class technologies that result in academic success, such as helping increase students' satisfaction, motivation, and opening them up to apply a wider knowledge base with the course material [19], [20]. On the other hand, recent studies have discussed the negative impacts on the use of in-class technologies and aftermath class performances. The results show that the use of in-class technologies such as SNSs can possibly lead to multitasking in classes which can produce negative results on class performance [21], [22].

This research has become conceptualized, which comes from the positive and negative effects of the relationship between SNSs use, and a student's aftermath academic performances. However, many scholars have begun to ponder the idea that college students using in-class technologies reap academic achievement, while excessive use of SNSs in classes reap negative impacts on aftermath educational performances. So far, there are a number of these studies that have been explored, but they are not quite organized. This study aims to apply a meta-analytical method to synthesize findings related to the college students' use of social-networking sites (SNSs) in class, and their aftermath educational performances.

II. Literature Review

A. Technology Use and Academic Performance

Internet/web technology and laptops have become very popular in today's education [16]. According to many researchers, it showed that there are mixed results of both positive and negative outcomes on the academic performance of technology use by students [23]. Chiu and Wang [17] mentioned that Internet/web technology has stimulated the rapid growth of learning. Carswell and Venkatesh [24] also mentioned that web-based learning has influenced students to study. Driver's [18] studies found evidence of positive outcomes from students who use laptops with web-based learning improved overall class satisfaction. Chiu and Wang [17] studies show some factors of the technological characteristics that can influence a student's performance such as: a student's intention, acceptance, self-efficacy, computer confidence, and focus of control. Some studies have found that using a laptop and web technology can increase a students' motivation in studying to their overall academic achievements, and to perform well in class [19], [20]. However, recently there are some faculties that have been banning laptop use during lectures due to the negative impact on student learning and performance [25]. Schwartz [26] reported that laptop use in class could be a distraction, as professors felt frustrated by students who were surfing the Internet during lectures.

P. Arunrangsiwed is a lecturer in Animation and Multimedia program at Suan Sunandha Rajabhat University, Bangkok, Thailand (e-mail: proud.ar@ssru.ac.th; parunran@nyit.edu).

S. Kongtieng is a lecturer in Communication Art program in North Bangkok University, Bangkok, Thailand (e-mail: jannoinoi@hotmail.com).

B. SNSs and Multitasking

SNSs are very popular among students. Facebook is the leading SNS. Karpinski et al. [27] mentioned that it is understandable that students might use SNS while studying, because there is evidence showing a large amount of time dedicated to SNS use by students. They also mentioned that many studies report multitasking with technology such as SNSs and instant messaging that student's use during study, decreases efficiency and productivity in their academic performance [27]. Moreover, studies have shown the negative results of students' class performance as a result of multitasking in class. It often occurs when a student has a laptop in the classroom. They can have access to SNS and often engage in distractive multitasking behaviors which decrease their class performance [27]. Meanwhile, Karpinski and Kirschner's [28] studies show the negative relationship between students using SNS, instant messaging, and Youtube in class and their GPA.

C. SNSs Use and Grades

People of all ages use Facebook and leads all other SNSs [23]. Particularly among the younger generation, researches show that almost all college students spend more time using Facebook than other SNSs [23]. Junco [23] also mentioned factors that influence people to use Facebook or engage in SNS such as gender, race and socioeconomic status, yield varying degrees of technological ownership, adoption and use within the demographic charts. There are many studies that have examined the relationship between a student's use of Facebook and their grades (GPA) or class performance. A study by Kolek and Saunders [29] showed that there was no relationship between Facebook use and GPA (grades). Nevertheless, Kirscher and Karpinski's [28] study showed the negative relationship between Facebook users and their GPA. It reported that Facebook users have a lower GPA than students who did not use Facebooks, as non-users studied more hours per week than Facebook users [28].

As previously stated, many researchers have showed mixed results about the relationship between SNSs use (included: Facebook) and class performance (grades/GPA). This study gathers four published articles of certain related topics to investigate this matter. Researchers coded the characteristics of the selected articles on multiple dimensions, including the names of, and the correlations between, independent and dependent variables. In spite of having this study, five predicting variables have emerged in this study. These are the students' personal characteristics, SNSs usage behaviors, prior class performances, motivation and ability, and value and expectancy. A multiple regression analysis (MRA) was performed to examine the predictability of the five predictors on students' academic performances. In the other words, this study aims to analyze the related factors that have been reported in previous researches. The purpose of this study is to apply a meta-analysis method to find out the more related factors between the relationship of technology/SNSs use by students and their academic performance.

D. Research Question

This paper addresses the following research questions:

RQ1: What are the most influential types of variable that effect correlation in this study?

RQ2: What is the direction of the study in this area that should be conducted in the future?

III. Methods

The main purpose of the current study is to identify the most influential type of variables. Meta-analysis was selected as the method of the current study, because it could offer quantitative methods to synthesize the findings from previous studies. To measure the influence of variables, effect sizes need to be used as the outcome variable in meta-analysis. The most common effect sizes in the selected papers are correlation (Pearson's r). All independent variables in the selected study were categorized as five types as mentioned earlier. These five types of variables were coded as dummy variables to fit in regression analysis. The detailed methodology will be provided as following:

A. Cases Selection

After setting the objectives of the study, the researched have searched for previous research papers that fit the inclusion criteria. Fourteen papers were found, however 10 were dropped because they did not provide the type of effect sizes that could be used in the current study. The effect size which the researchers used in this study is correlation.

B. Inclusion Criteria

1. The studies need to have as the main focus as SNSs usage behaviors, personal characteristic, prior educational performances, expectancy, and motivation and ability in using SNSs
2. Selected studies were published during 2008 to 2013 from Elsevier.
3. Selected papers used survey and self-report studies.
4. The samples of selected studies were students in the university.
5. Selected papers offered future directions.

C. Types of Predictors

Four selected papers provide 44 pairs of predictors and outcome variables. These 44 pairs were used as cases in SPSS. The researchers categorized the predictors into five groups. First, personal background including education, major, and demographic were grouped. Second, expectancy, which grouped factors that included performance expectancy, effort expectancy, attainment value, utility value, and intrinsic value. Third, behavior which grouped laptop use, FB check, FB check yesterday, time spent preparing for class, FB time, multitasking, and SNS use. Motivation included computer self-efficacy, facilitating conditions, social influence, social isolation, anxiety, and risk of arbitrary. Prior education included delay in responses, class attendance, as well as HS rank (HSR), ACT score, and course performance. After all predictors were coded into these five groups, the researcher

coded them again into dummy variables, which provide more flexibility to be analyzed using MRA.

D. Analysis

Hierarchical linear regression was used to investigate the relationship between these types of independent variables and outcome effect sizes [28]. The purpose of this analysis is to estimate the most influential type of variables that provide the largest effect size between independent and dependent variables. Descriptive statistics were also run to examine the overall characteristic of selected papers.

IV. Results

A. Descriptive Statistics and Characteristics of Selected Cases

The four selected studies consisted of a sample of 3,049 participants. These participants were from the United States (77.3%), Taiwan (9.4%) and Europe (13.3%). A total of 44 pairs of predictive and dependent variables had been tested in the selected studies. These variables were grouped for correlation analysis in this study. The first group is students' personal characteristics (gender, age, ethnicity and major). The study of Karpinski et al. [27] was the only study that emphasized this group of variables. This study also compared and contrasted European and American students. The second group is SNSs usage behaviors (laptop use, multitasking, Facebook check and time spent). Variables in this group were found in three studies, which are [25], [23], and [27]. To test SNSs usage behaviors is similar to many classic studies, in which the researchers would test the relationship between the level of media usage and outcome behaviors. The next group of variables is prior class performances (ACT score, course performance, high school rank and class attendance). These variables were examined in two studies which are [17] and [25]. The last two groups are value and expectancy (performance and effort expectancy, attainment-utility-intensive values) and motivation and ability in using SNSs (computer self-efficacy, social influence, facilitating conditions, social isolation, anxiety, and risk of arbitrary). Both groups of variables were found in Chiu and Wang's study [17].

B. Regression Analysis

Regression analysis is used to measure the causal relationship between types of variables and their outcome correlations. The multiple correlation coefficient is statistically significant, R=0.485, and R Square=0.235. After multiple regression was analyzed to see the relationship between predictive variables and correlation, the results showed a significant regression coefficient for the variable group of value and expectancy ($t=2.503$, $p=0.017$, $p<0.05$). There was a non-significant regression coefficient for motivation and ability in using SNSs ($t=0.202$, $p=0.841$), usage behaviors of SNSs in class ($t=-0.910$, $p=0.369$), and prior educational performances. In this case there was no relationship between students' personal characteristics and correlation. In other words, the ranking of influential predictors, started with the most influential type of variables to the smallest influential variable, is (1) value and expectancy, (2) usage behaviors of SNSs in class, (3) motivation and ability in using SNSs, and (4) prior educational performances.

V. Discussion and Suggestion

Since the results of all selected studies were from survey, questionnaire or self-reporting tools, Fried [25] suggested that these tools should have been replaced by computer-monitoring software. This is because Fried claimed that the weekly survey resulted in the formation of memories about the survey on the participants. In the other words, the participant could remember the survey and repeat answering the same thing, despite the fact at each moment was different. One very important factor that researchers who use computer-monitoring software need to aware of is that participants must not be aware that they are being monitored, as the results could be affected by the anxiety of such knowledge. This suggestion was adapted to another study in 14 early selected papers. Sana et al. [30] used computer-monitoring software to see how students multitasked in class.

The research of Chiu and Wang [17] claimed the limitation in their study was that data were collected from adult learners; thus, the results might not be applicable to average college students. In our study, the relationship between correlations and personal characteristics could not be found. Personal characteristics are gender, age, ethnicity and academic major. This shows how the data collection of adult learners was not the weakness of Chiu and Wang's study.

Since there is no relationship between correlations and personal characteristics, it does not only support Chiu and Wang's study, but also supports all related studies from around the world. Today, many lecturers/instructors need to be researchers at the same time, thus giving them a good opportunity to collect the data from their students. They do not need to worry about limitation such as that their students are non-English speakers, adult students, or from uncommon majors. This finding provides a convenient approach for future research, since there is no effect of samples' demographic data on the effect size. In the other words, samples from any country should provide a similar research results. This reveals that researchers could explore the negative outcome of media used in class on any participants with different personal characteristics and different nations. Based on this conclusion, researchers from around the world could help contribute to the knowledge regarding the negative outcome of media.

The group of variables related to prior class performance includes ACT score, course performance, high school rank, class attendance. It is recommended that this group of variables be explored deeper in future research. Prior class performance might affect the learning outcome after using media in different ways. Prior knowledge was also an interesting variable in [31], that animation-based courseware could improve the learning outcome of students with low prior knowledge more than students with high prior knowledge. These low prior knowledge students might learn better with teachers who use SNSs as a multi-media teaching method. The

results of this study suggest that this variable and its relationship to media used in the classroom needs to be examined more in the future.

The future direction which was suggested by the selected studies is that longitudinal research design should be used. This is similar to Arunrangsiwed's study [32] of existed meta-analytic papers. She found various papers which suggested using longitudinal design to explore the field of media violence. Multitasking in class is also considered as a type of media violence. The reason that longitudinal research design should be used is that using media is a continuing process. It does not stop in one period of time, and it does not have a single-linear relationship.

Future studies also require analysis of the whole numbers/ results without considering the effect of media on gender or age. Similarly, [32] also recommended that the total sum of results should not be separated by the gender variable.

Although many studies tended to choose SNSs usage as their independent variable, the current study suggested that the group of variables that could be a better predictor is value and expectancy. The next step of research in this field would be to a deeper exploration of value and expectancy, which include performance and effort expectancy and attainment-utility-intensive values. Other variables in this group are also needed to be studied to understand how it could affect students' learning outcomes.

Many users of social networking sites/applications often debate how long Facebook and Twitter will last. This discussion is important; however, it is imperative to understand that if one social networking site/application ceases to exist that another will be one born to take its place [33]. In the selected papers of this study, almost all SNSs refer to Facebook and Twitter, according to their year of publication. It is not understood if different social networking sites/applications or different platforms of media would affect the correlation in different ways. This limitation is a gap that is recommended for exploration in future studies.

Another way to look at media is that media is not violence because of itself. Media shapes only our form of communication. Media is changing and developing every day, and at the same time, people are adding new content to the various forms of media. Although mainstream media has shifted away from the broadsheet newspaper to television, and from television to social networks, the researchers found evidence of violence in the media in every generation, and in every segment of society [34], [35]. The current study concludes that the negative outcome of media used in class is caused by the students, not by the characteristic of media. In the other words, the actual negative effect is the poor behavior of students in using media in classroom. Teachers or instructors should help increase media literacy skills in their students, so they understand how to use media appropriately.

ACKNOWLEDGMENT

We would like to thank Suan Sunandha Rajabhat University [36] for supporting our conference fund. And also thank Opaporn Pasvekin, Uayporn Pasvekin, and Assoc. Prof. Rosechongporn Komolsevin for their initial cooperation.

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