Smartphone Use and its Effects on the Student Final Grade (a case study in the Environmental ChemistryClass)

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Abstract. This research aimed at investigating the effects of *smartphone* usage on the environmental chemistry student's final grades and identifying the dominant applications used by students in order to help the learning process during environmental chemistry course taking. The participants in this research were 24 students who enrolled the environmental chemistry course in the even semester of academic year 2017/2018. The duration of smartphone usage data was collected by using App Usage application, student responses were recorded using questionnaires and the final scoreobtained from the final test results. The result reveals that for every 1000 seconds increase of smartphone use yields an increase in a final score about 1 point (out of 100). In the other word, the independent variable can explain the dependent variable of about 16.4%. The app usage also recorded that some applications dominantly used by students in the environmental chemistry coursewere found to be browser application such as Chrome and MozillaFirefox, data processing application such as Microsoft Word, Microsoft Power Point and PDF Reader. This result implies that if the use of smartphone is properly controlled, the positive effects could be gained.

Keywords: *Smartphone*, App Usage, learning result, environmental chemistry

1. Introduction

The global increase in internet needs has significantly affected the usage of electronic devices like smartphone, tablet and PC worldwide as explicitly reported by (The BEREC, 2015). In addition to Indonesia,The Indonesian Internet Service Providers Association (APJII) reported that internet users in Indonesia reached 143 million people or 54.5% of the total 262 million Indonesian populations by 2017. The development of internet technology encourages the renew efforts to the usage of technology in education, although based on observations it has not been maximally used.For example, most of students use smartphone and internet to access social media and other entertainment applications more oftenrather than as educational tool. Less time spent in social media have positive impact to academic performance (Manumpil, Ismanto, & Onibala, 2015). Furthermore, students generally have more than one type of social media or chat application that always active on their smartphone even when they are performing academic tasks, thus would negatively affect their academic performance(Felisoni & Godoi, 2018; Jacobsen & Forste, 2011)

In spite of Some studies findings indicate that smartphone use relates to reduced performance not only during daily activities like working, driving and walking but also studying (Baert et al., 2018), the use of smartphone does not always have a negative impact on learning outcomes if it is controlled properly. Smartphone can be utilized as media and learning resources to increase

the students' interest and motivation, the ability of a smartphone to operate a data processing application is very helpful for students in learning and doing their tasks. The availability of an internet connection on a smartphone also facilitates the learning process because students can easily deal with difficult lesson topic such as chemistry either in the form of articles, journals, and so on to increase the students' activity, interest and motivation. Furthermore, by utilizing smartphone as learning media, students enable to learn independently through distant learning and individual learning during their off time (Nath & Mukherjee, 2015)

Many researches have explained the negative and positive impact of smart phone use without controlling the classroom when using the smart phone, the vast majority of research explained the effect of free style use of smart phone, in this research we elaborate the class room of environmental chemistry to strictly examine the positive implication of smart phone use against the student performance. The course of environmental chemistry is a scientific study of chemical and biochemical phenomena that occur in nature that related to sources, reactions, transport, effects and circumstances of chemicals in the air, soil and water environment and the effects of human activities on them. Since so many updated reports and phenomena about the environmental issues that can be obtained from the internet and integrated to the course, therefore, controlling the students in their activities of utilizing smart phone and examining the impact of it is very challenging.

In addition to the internet, chemical learning applications can be downloaded also on smartphones so the chemistry learning process becomes more practical. Smartphone usage should be able to improve the learning outcomes with many features that can be used for help the learning process. However, several studies that have been conducted have found a negative correlation between the usage of smartphones and learning outcomes, because generally it using questionnaires as a reference so there are many significant biases found in the obtained data. this is because the intensity of smartphone usage is difficult to measure manually (Duncan, Hoekstra, & Wilcox, 2012). Therefore, an intensity measurement application such as the App Usage Application must be used in this case. the App Usage application can accurately record the intensity of smartphone and its application usage for certain period of time. With accurate data, it will be more precisely determine the effect of smartphone usage on students' learning outcomes, especially in the field of study that requires smartphone and internet assistance in finding lesson materials, such as environmental chemistry.

2. Methodology

This research is an associative research with qualitative approach that uses quantitative data analysis. The research was conducted from April to May 2018 at the Teacher Training and Education Faculty, Syiah Kuala University. The data was collected during eight times face-to-face meetings at environmental chemistry course. The sample used in this study are students majoring in Chemical Education who enrolled in environmental chemistry course in the even semester of 2017/2018. the sample was selected by purposive sampling.

The instrument used includes the student response questionnaire and the App Usage application that have been installed on each respondent's smartphone. The questionnaire aimed to represent students' responses about smartphone usage and its effect on the learning outcomes score of environmental chemistry course. Furthermore, the students also encouraged to fill several questions regarding frequently used apps to examine their behavior in using the smartphone, so

researcher could compare whether the statements agree with the data recorded by the app usage. The App Usage application will accurately record the usage of learning applications on smartphones and at the end of the class students were asked to email the recorded data to researcher for compilation. All the data were analyzed using simple linear regression test by Microsoft Excel.

3. Result and Discussion

3.1 The Intensity of Smartphone Usage and Students' Learning Outcomes Score

Smartphone that used to find relevant learning resources of environmental chemistry by accessing the internet with a browser application is the most popular learning resources and media that used by students. The ease of smartphone usage and the number of chemical articles that can be accessed freely on the internet caused students prefer to use smartphone than a textbook to find learning resources.

The validated questionnaire was used to measure students' responses about the effect of smartphone usage and its application to the final score of environmental chemistry courses as a learning outcomes. This questionnaire was given at the end of the meeting, consists of statements aimed to collect student responses about the intensity of smartphone usage and the purpose of it.
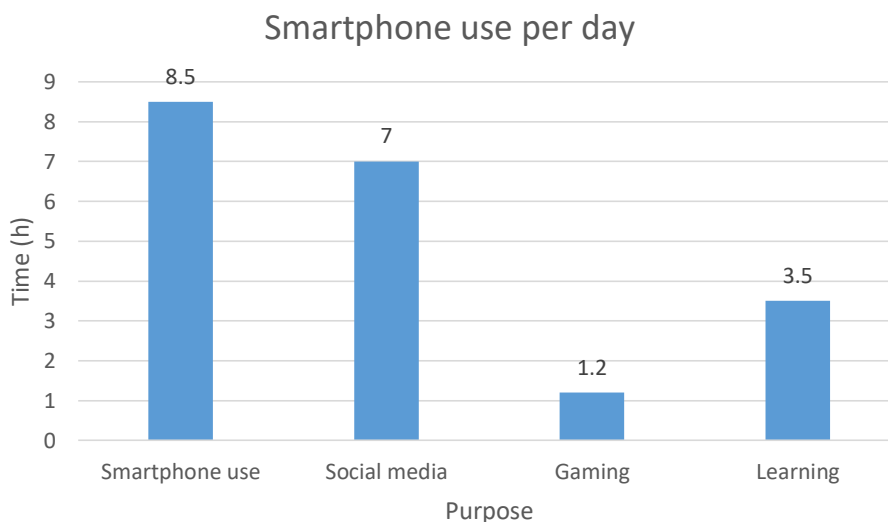

Figure 1. Smartphone use per day

The graph illustrates that students use smartphone not only for social media and surfing the internet but also gaming and learning. However, duration of learning is not surprisingly low since student use social media more frequently which consume most of their time of smart phone operation. Moreover, most student did not have the learning app installed in their smart phones and they frequently use a browser app to perform searching in dealing with their assignments and homework.

The following chart depicts the average time use of smart phone for several purposes and daily average use of smart phone for any other activities. It also clearly shows that social media is the most attractive feature that determined why students spend more time using social media app like WhatsApp, Webtoon, twitter and Instagram.

Table 1. Frequently used social media apps

No.	Application	Number of Users (people)
1	*WhatsApp*	29
2	*Instagram*	28
3	*YouTube*	25
4	*Line*	23
5	*Facebook*	16
6	BBM	3
7	Others*	2

*app used by less than 3 students

Based on the data in Table 1, it is revealed that the students installed more than one social media app like WhatsApp Instagram and Line. Other applications include WebToon and Joox with 3 users, Musical.ly application, Twitter, Path, Tik Tok, WattPad with 2 users each application, and Smule, Skype, IMO, Pinterest, Gmail, VIF applications , Go-Jek, Grab, Share it, CookPad and IFLIX with 1 user each application. Most students access social media applications more than 10 times per day, even when the learning process is taking place as recorded in the App Usage application and recognized by students through a questionnaire. Using social media application during learning session is feared can disrupt students' concentration due to the notification disturbance. Some studies reported that using social media app during the learning session lead to decrease student interest and attention both for higher education (Boateng & Amankwaa, 2016) or tertiary education institution(Larson, 2015).Therefore, in order to eliminate any problems from social media use that students could encounter, this research primarily measure the time of smart phone use only during learning process.

3.2 Regression Analysis

The affect of smart phone usewas carried out using linear regression analysis with a significance level (α)=0.05. Students' score data is the dependent variable and the intensity data of smartphone usage is the independent variable with the number of samples that meet the criteria of 24 students.
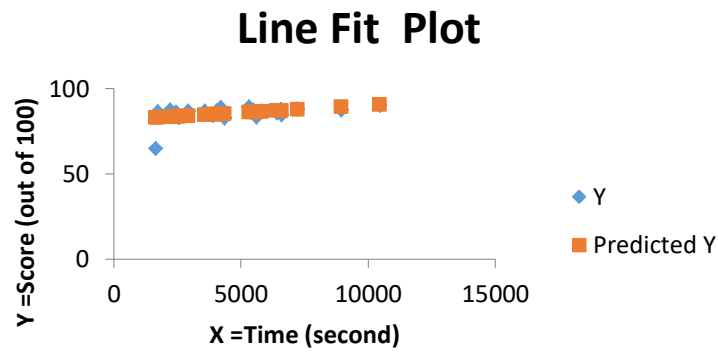
Line Fit Plot

Figure 2. Line Fit Plot

Table2._Summary Output_

Regression Statistics	
Multiple R	0,405498913
R Square	0,164429368
Adjusted R Square	0,126448885
Standard Error	4,464395625
Observations	24

Based on the results of data analysis in the table above, R square obtained of 0.164 or 16.4%. That is, the dependent variable is able to be explained by an independent variable of 16.4%.

Tabel 3._Output_ Anova

	df	SS	MS	F	_Significance F_
Regression	1	86,2867774	86,2867774	4,329312164	0,04931336
Residual	22	438,4782226	19,9308283		
Total	23	524,765			

The degree of freedom (df) of the total is n-1, where n is the number of observations. Observations in this study is 24, so that the total degree of freedom is 23. The degree of freedom of the regression model is 1, because in this study there was only 1 independent variable. Whereas the degree of freedom for residuals is the total free degree value minus the value of the free regression level, which is 22.

Sum of Square for regression is obtained from the sum of squares from the prediction of the dependent variable (i.e student's score) minus the average value of the dependent variable from the actual data. Then all the results of the calculation are added up. While the Mean of Square or the average number of squares is the quotient between the Sum of Square column and the df

column to get the F_{count} value. If the F_{count} value> F_{table}, it can be stated that independent variables have a significant effect on the dependent variable. Based on the results of data analysis, it is obtained that F_{count} values of 4.329 and df: 0.05, (2-1), (24-2) so that the F_{table} value of 4.301 is obtained. Because the value of $F_{count}>F_{table}$ is 4.329> 4.301 it can be concluded that the regression equation model that is formed is a fit criteria which means that the independent variables have an influence on the dependent variable.Significance value indicates the point of error that occurs if the F_{count} value is 4.329. After data analysis, the Sig. $\leq (\alpha)$ which is 0.049 < 0.05 so it can be concluded that the independent variables are simultaneously able to explain changes in the dependent variable, or the model is declared fit.

The criteria for hypotheses tests have been fulfilled so that H_a is accepted and H_o is rejected or in other words, there is a positive influence on the controlled use of smartphones to the score of environmental chemistry courses for Chemistry Education students of the Faculty of Teacher Training and Education Syiah Kuala University. The higher the intensity of students using a smartphone, the higher the score obtained, although with R^2=0.164 or the independent variable can explain the dependent variable of 16.4%, means that smartphone usage has a positive effect to the score of environmental chemistry courses even though the effect is considered small.

Positive impact of smartphone use or internet use have not been intensively reported since many researchers focused on negative side of using internet and smartphone to student performance either in schools or universities. For example(Asdaque, Khan, Asad, & Rizvi, 2010) reported that the more time used by students to access the internet, the lower the GPA students in Pakistan could gain. However, another study by (Dorji, 2015) revealed that the intensity of using internet among tertiary students in Butan lead to greater academic performance. Depend on how teacher utilize the internet and smartphone use in the class room, it could determine whether it provide negative or positive impact to student performance.

4. Conclusion

This study focused on examining the causal effect of using smart phone as study tool on the student final grade in one particular class room course. The result indicates small impact but positive, thus this study might or might not relevant to other class and further study is needed to eliminate such distraction from other apps like social media or video streaming app, or future study could also provide specific integrated learning app that might give more promising positive influence to students.

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