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Smartphone and Our Students: Is It Being Good for Their Study?

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Abstract
The objectives of this study are to: (I) find out the discriminations or variations (if any) between the attentive and inattentive university students in terms of their purposes of using smartphones, (II) analyze the cause-effect relationship between "the purposes considered to have good or bad impact on study" and "the smartphone usage behavior of the attentive students", and (III) analyze the cause-effect relationship between "the purposes considered to have good or bad impact on study" and "the smartphone usage behavior of the inattentive students". 400 students (200 attentive and 200 inattentive) students are surveyed. Based survey and statistical analysis results, it is found that attentive and inattentive student are differentiating from each other in terms of their purposes of using smartphones for learning and study, social networking and entertainment. Moreover, the reasons of using smartphones believed to be in favor of their learning activities have positive impact on the attentive students' smartphones usage behavior, whereas inattentive students are not acting likewise. Corrective actions by the interested parties should be undertaken to reform this unexpected scenario.
Keywords: Smartphone, Students, Education, Bangladesh.

1. INTRODUCTION

Are the smartphone users in Bangladesh being smart enough for themselves and the society? Nowadays, that is the question which is bothering us, particularly when it is about our students. As per BTRC (Bangladesh Telecommunication Regulatory Commission), 130 million people out of the total population of 166 million people in Bangladesh are using mobile phones, among which 10 million people have their own smart phones and in every quarter 1.5 million new smart phone users are added(Sagor, 2016). In addition, number of internet users in Bangladesh is 62 million, whereas 72% people are using mobile subscriber based internet facility (bdnews24.com, 2015; GSMA Intelligence, 2014).On the other hand, as per Telenor, 51% people of the total 166 million population of Bangladesh are residing between 18 to 25 years old, which indicates that the youngsters are dominating the smartphone user market.

This is the scenario of Bangladesh, whereas people more precisely the students (between 18-25 ages) are spending a significant amount of time on this device and the number of users is increasingly day by day in a noticeable way. Obviously, it is most expected scenario of Bangladesh to be a country of digital reformation as per the agenda of current ruling party and it also essential for building a generation of having enough technical know-how. But the worrisome fact is, whether this modern-technology (smartphones) well-equipped with the internet facility is helping or is being used by our students for their educational purposes or not. If it is not, then what actions should be taken by anyone (To Whom It May Concern) for making this right? On the other hand, if it is being helpful for them, then what actions should be taken by anyone from anywhere for reinforcing this? The main pursuit of this research initiative is to address these issues. Realizing the implication of this situation, certain objectives are expected to meet through this study. These are: (I) finding out the discriminations or variations (if any) between the attentive and inattentive university students in terms of their purposes of using smartphones, (II) analyzing the cause-effect relationship between "the purposes considered to have good or bad impact on study" and "the smartphone usage behavior of the **attentive students**", and (III) analyzing the cause-effect relationship between "the purposes considered to have good or bad impact on study" and "the smartphone usage behavior of the **inattentive students**".

2. LITERATURE REVIEW

Litchfield (2010) has tried to define smartphone from its functional perspective as a device that has an operating system (OS) essential for being operated by the users and permanent internet connection. On the other hand, Prensky (2011)has pointed out some other features and facilities of smartphone like as messaging option in different formats (i.e., voice, text, image, MMS, etc.), email, internet browsing, geo-positioning, downloading and uploading. Furthermore, smartphones can act as mobile entertainment units where a user can watch videos, listen to music, update blogs, as well as audio and video blogging (Kibona & Mgaya, 2015).

However, there are plenty of literary works done on this discipline depicting both negative and positive consequences of smartphone usage on education and the users' behavioral pattern. But, from the methodological point of view those literary works were not scientific and constructive enough to use as an empirical evidence for

getting into a conclusion. Along with this, the context was also different from Bangladesh. However, a quick snapshot of the findings of those research works is given on the following section.

In addition of the other features of smartphones, O'Malley, et al. (2011)has emphasized the smartphone based learning process, whereas the learning process is not confined only to a certain geographical location, because anyone can access to the study materials from anywhere and anytime. Smartphone (also termed as mobile phone) is an anytime and anywhere device which is assisting its users to get available services discreetly and randomly. Moreover, smartphones and other mobile technologies are affecting student's learning methods and pedagogy (Buck, McInnis, & Randolph, 2013).The contribution of smartphones in distance learning and making students socially interactive and communicative is undeniable (Ketheeswaran & Mukunthan, 2016). Sung (2005) and Shongwe (2009) have conceded smartphone as a tool that is mitigating the digital divide. Besides smartphones, other technologies are also blessing us through revolutionizing the teaching and learning process by eliminating the distance barriers and facilitating smooth interaction among teachers and learners (Maiye & McGrath, 2010; McFarlane & Sakellariou, 2002). As the youngsters are being much more exposed to smartphones (one of many other blessings of ICT), Evans (2009) has termed them as *digital natives* and their parents/teachers as *digital immigrants*. Based on a survey of 124 students Morphituo (2014) has found that there is a significant transformation in terms of using smartphones instead of using laptops and this has substantial impact on the student's education, grades and study approach. Pange & Lekka (2015) have rated smartphone as the most useful and popular technological device. More precisely, Spachos, et. al. (2014) has indicated the importance of mobile applications in continuing medical education. Similarly, a structured questionnaire based survey on 361 medical students of University of Birmingham, UK has revealed that 59% students have their own smartphones; among which 37% students are really using this device as a learning tool (Robinson, et al., 2013). Moreover, 84% students believe that it can be useful for them also, but 64% thinks that it will be expensive for them to possess a smartphone and 62% students don't get this device useful for their medical education (Robinson, et al., 2013). Another study on 83 respondents shows that 54% respondents use mobile phone based internet, whereas rest of the respondents has reported the cost of using mobile phone based internet as the reason for not using (Molnar, 2014). However, a prominent research initiative has found that how smartphone or mobile based learning can help the students on their laboratory classes, more specifically on realizing administrative and safety instructions of the labs and knowledge related to their interested experiments (Shi, Sun, Xu, & Huan, 2016). Nevertheless, the authors have pointed out that the male students have more exposures to mobile learning rather than the female students (Shi, Sun, Xu, & Huan, 2016). 30 faculty members and 40 students of Sokoine University of Agriculture, Tanzania were gone through an in-depth interview, where it was found that most of them were using their smartphones for learning and teaching purposes and some of them also had m-learning applications (Mtega, Bernard, Msungu, & Sanare, 2012). Bomhold (2013) has found that 35 (76%) respondents (students) of the total number of 46 respondents use smartphone apps mostly for finding their academic contents on the internet. Although, 7% of the 403 Japanese university students are using smartphones for educational purposes. (White & Mills, 2012)

Therefore, it is predicted that smartphone would be widely used learning device for the students by 2020 (Caverly, Ward, & Caverly, 2009). In another study, most of the respondents (students) among the 520 (total sample size of the study) have declared smartphone as useful device as they can use this device for downloading and accessing their educational course materials (Vafa & Chico, 2013). On the other hand, Jesse (2015) conducted an explanatory study on the 395 smartphone users those were college students selected from two different academic institutions. The focal point of this study was to identify the most and the least useful smartphone applications (Apps) for educational purposes for the students, which helped the IS (information systems) educators to better know how to connect or involve the students in learning process through smartphones enabled with some useful apps. However, that study was only based on a single province of USA whereas the smartphone usage pattern might be different from other areas. Likewise, in another study conducted in Saudi Arabia based on 165 female faculty members, Alfarani (2014) has found that two things have negative effect on the adoption and usage of m-learning or smartphone; these are: (1) Resistance to Change (because, Saudi Arabians feel more comfortable with the traditional learning and teaching process), and (2) Perceived Social Culture (because, their perceptions are mostly influenced by the conservative social structure of Saudi Arabia). Nevertheless, the findings may not be appropriate for other contexts having different social structure and citizen's perception. On the other hand, based on a survey on 419 students; (a) generic competencies, (b) learning activities, (c) performance expectancy, (d) effort expectancy, and (e) self-efficacy are suggested by Sevillano-García & Vázquez-Cano (2015) as the factors affecting the adoption of digital mobile devices among the students. In contrast of that, based on a focus group discussion, Woodcock, et.al. (2012) have found that most of the students are not well-aware of the potential of smartphone as an assisting device on their learning and study. On this logical ground, they have suggested to emphasize more on the development of such platforms which will uplift the awareness level of the students. In addition to this, Halder, et.al. (2015) have analyzed the diversity of attitudes of the students towards using smartphones for educational purposes in terms of the

demographic factors (age, gender, and residential status) and the academic factors (institution and concentration).Kumar (2011) has explored the implication and usage of 3G enabled smartphones on technical and professional studies in the context of India. This paper has pointed out the profound impact of smartphones in eradicating the differences between traditional learning process (brick-mortar based) and distance learning process (online based). That is why; Burgess & Murray (2014) have found that the effectiveness of psychology class can be increased by using smartphone flashcards instead of the traditional ones. Furthermore, Ncube & Suleman (2014) have conducted a study on Zimbabwe, whereas the authors identified the gaps between the traditional classroom lessons taught by the teachers and the understanding level of the students which was caused by some resource constraints (i.e., like the duration of the class). Authors suggested that smartphones equipped with internet connection can supplement student's learning efforts and minimize these gaps by providing access to the learning materials outside the classrooms. On the other hand, Lohr (2014) has emphasized that in education smartphones with useful apps capable of providing simulated visual and digital contents of the learning materials can be much more effective than the traditional demonstration classes. For making this technology more effective, Rodríguez, et al. (2014) have proposed to implement an ad-hoc network within the university classrooms which will be based on and accessed by both teacher's and student's mobile phones for conveying their corresponding purposes of teaching and learning. A structured questionnaire based survey conducted in Cyprus has revealed that most of the people spend more than 2 hours a day on their smartphones (Christou, 2014). But another study shows that university students of the Republic of Yemen are not positively using smartphones for their learning and educational purposes (Tuparov & A.Alsabri, 2014). Stylianidis (2014) has reviewed the corresponding literature in an extensive way for proposing a framework which will accommodate the learning process through mobile technology (i.e., smartphones, tablets, etc.) in an efficient and effective way. This framework has emphasized the importance of organizing the learning contents which can be accessed by the students and teachers through their smartphones. Organista-Sandoval & Serrano-Santoyo (2014) have suggested to formulate a policy in Mexican universities related to the usage of smartphones by the students and teachers which will be necessary for harnessing the pedagogical potential of these devices. This suggestion was the consequence of their research findings which depicted that 97% teachers and students are smartphones users in Mexican universities. Another study shows that the students and teachers of Niger Delta University of Nigeria are well-aware of the usage of smartphones or tablets in academic works and thus the necessity to make a collaboration of the university with an IT company for developing a platform of smartphone/tablet based information systems is emphasized on that study (Ebiye, 2015).

3. RESEARCH DESIGN, CONCEPTUAL FRAMEWORKS AND METHODOLOGIES

Both discrepancies and insights are found on the above literature through a rigorous investigation in terms of methodological and contextual perspectives, based on these gaps and leads the primary quest for this research initiative is set to pinpoint whether the smartphone usage behavior of the university students in Bangladesh is in favor of their educational benefit or not.

3.1 Research Questions/Problems

The research questions going to be addressed on this study are as the followings:

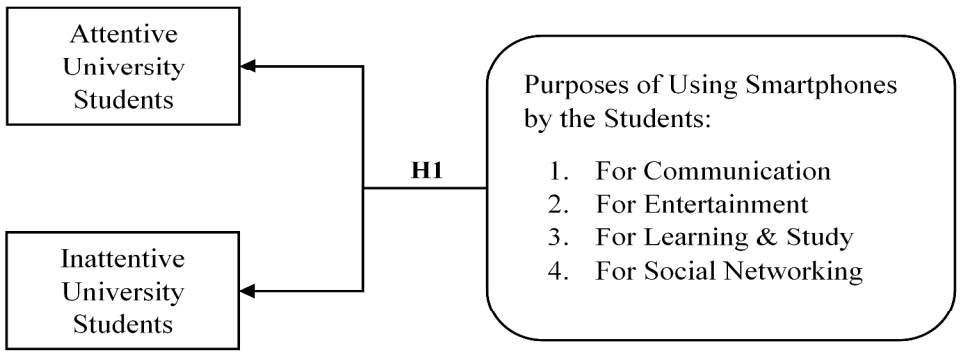
Table 1: Research Problems of the Study

RQ1:	Are there any discriminations or variations between the attentive and inattentive university students in terms of their purposes of using smartphones?
RQ2:	Is there any cause-effect relationship between "the purposes considered having good or bad impact on study" and "the smartphone usage behavior of the **attentive students**"?
RQ3:	Is there any cause-effect relationship between "the purposes considered having good or bad impact on study" and "the smartphone usage behavior of the **inattentive students**"?

3.2 Proposed Frameworks/Models

For the addressing the research questions (See **Table 1**) derived based on the gaps found in the literature and contextual necessity (considering the scenario of Bangladesh), two conceptual frameworks are proposed here, whereas first one is associated with the research question no. 1 (See **Figure 1**and **Box 1**) and the second one is associated with the research question nos. of 2, 3, and 4 (See **Figure 2**). Furthermore, **Table 2** and **3** represent the hypotheses of the study those are subject empirical testing and the details of the constructs/variables adopted in this study those are incorporated in the proposed conceptual frameworks, respectively.

Figure1: Conceptual Framework in Correspondence with the Research Question No. 1



Box 1: Mathematical Expression of the above Model

The linear equation based expression of the above conceptual framework is:

$$D = b_0 + b_1 Comm_1 + b_2 Ent_1 + b_3 L\&S_3 + b_4 SN_4$$

where, D = Discriminant Score
b's = Discriminant Coefficients or Weights
Comm = Communication Purpose (Predictor Variable 1)
Ent = Entertainment Purpose (Predictor Variable 2)
L&S = Learning and Study Purpose (Predictor Variable 3)
SN = Social Networking Purpose (Predictor Variable 4)

The coefficients will be determined in way that the dependent groups of students (i.e., attentive and inattentive students) may differ from each other as much as possible(Malhotra, 2014).

Figure 2: Theoretical Framework in Correspondence with the Research Question Nos. of 2 and 3

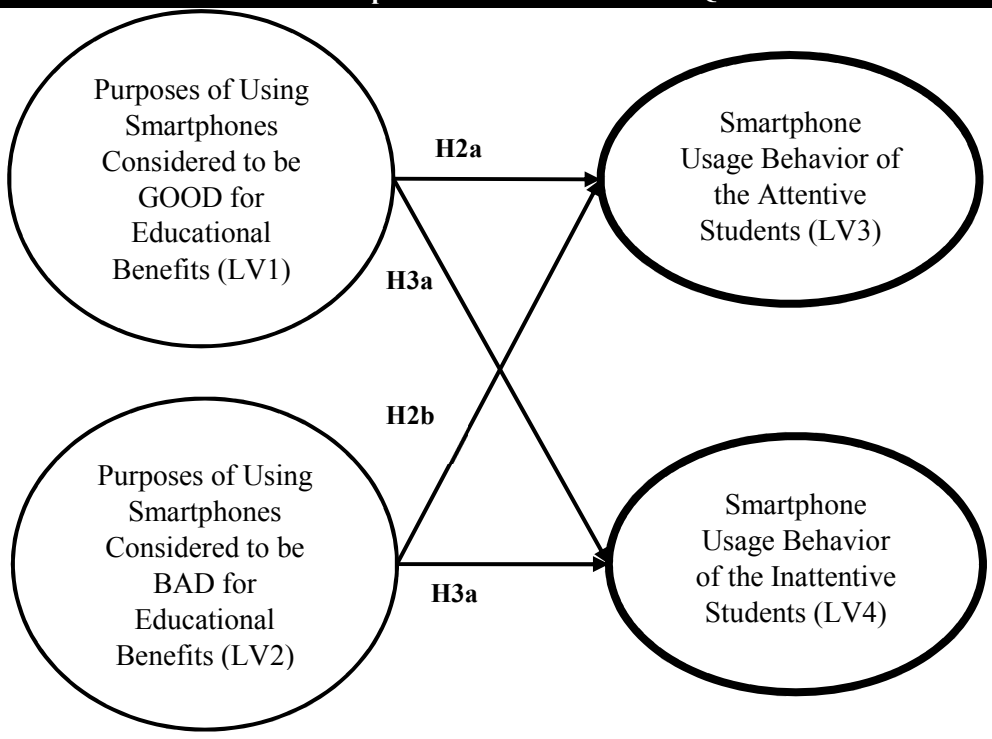


Table 2: Hypotheses of the Study	
H1:	Attentive and Inattentive university students are different from each other in terms of their purpose of using smartphones (i.e., for communication, entertainment, study & learning, and social networking purposes)
H2a:	The purposes of using smartphones considered to be *GOOD* for educational benefits are have significant impact on the smartphone usage behavior of the attentive university students in Bangladesh.
H2b:	The purposes of using smartphones considered to be *BAD* for educational benefits are have significant impact on the smartphone usage behavior of the attentive university students in Bangladesh.
H3a:	The purposes of using smartphones considered to be *GOOD* for educational benefits are have significant impact on the smartphone usage behavior of the inattentive university students in Bangladesh.
H3b:	The purposes of using smartphones considered to be *BAD* for educational benefits are have significant impact on the smartphone usage behavior of the inattentive university students in Bangladesh.

Table 3: Construct/Variable Details of the Conceptual Models and Questionnaire Items		
Related to the First Conceptual Framework(See **Figure 1**)	**Attentive University Students**	Having good and sound academic profiles (e.g., CGPA is more than or equal to 3.25, satisfactory class performance, good presentation and understating capability)
	Inattentive University Students	Having poor academic profiles (e.g., CGPA is less than 3.25, unsatisfactory class performance, poor presentation and understating capability)
	Communication (Comm.)	Using smartphones for phone call, text messaging, MMS, chatting, voice messaging, etc.
	Entertainment (Ent.)	Using smartphones for watching entertaining videos, listening to the music, playing online/offline games, etc.
	Study and Learning (L&S)	Using smartphones for learning and knowing new information, knowledge, preparing study materials, home works, class lectures, etc.
	Social Networking (SN)	Using smartphones for maintaining online based social community in Facebook, twitter, Google+, LinkedIn, etc.
Related to the Second Conceptual Framework(See **Figure 2**)	**Purposes of Using Smartphones Considered Good for Educational Benefits (LV1)**	1. Securing good CGPA (OV1.1) 2. Being updated in terms of technological knowledge (OV1.2) 3. Preparing regular home works (OV1.3) 4. Being updated in any knowledge/information (OV1.4) 5. Downloading/browsing study related contents (OV1.5) 6. Improving class performance (OV1.6) 7. Study related contents sharing (OV1.7)
	Purposes of Using Smartphones Considered Bad for Educational Benefits (LV2)	1. Games (Online or Offline) (OV2.1) 2. Using smartphones during class lecture (OV2.2) 3. Only watching videos (OV2.3) 4. Only listening to the music (OV2.4) 5. Only for maintaining social networking communications (OV2.5) 6. Excessive phone calling, chatting or messaging (OV2.6) 7. Cell-phone based dating (OV2.7)
	Smartphone Usage Behavior of the Attentive Students (LV3)	Categorized as heavy, medium and light users based on the hours per day spent by the attentive students for using smartphones (OV3.1)
	Smartphone Usage Behavior of the Inattentive Students (LV4)	Categorized as heavy, medium and light users based on the hours per day spent by the inattentive students for using smartphones (OV4.1)

3.3 Methodological Approach

The methodological approach of this study is mixed. Both qualitative and quantitative techniques are applied here to develop the conceptual models and test the empirical significance of these models respectively. At the first phase, explorative and desk research (qualitative) approach was adopted to determine the constructs and the variables. At the second phase, based on the objectives and research questions two different statistical methods were adopted and used to empirically validate and test the proposed conceptual models of this study. The details of the methodological approach are depicted on the following table.(Hair, Jr., Hult, Ringle, & Sarstedt, 2014; Burns & Burns, 2008).

Table 4: Methodological Details of the Study
(Hair, Jr., Hult, Ringle, & Sarstedt, 2014; Burns & Burns, 2008; Malhotra, 2014)

Research Question No(s).	Statistical Methods Used	Nature of the Analysis	Data Collection Techniques Used
1 (See **Table 1**)	Discriminant Analysis	Quantitative	Structured Questionnaire based Field Survey
2 and 3(See **Table 1**)	Partial Least Square – Structural Equation Modeling (PLS-SEM)	Quantitative	Structured Questionnaire based Field Survey

3.4 Population and Sampling

Target Population: The target population of the study is the students from different academic institutions of Bangladesh. More specifically, the students of colleges and universities, those are aged from 18 to 25.

Sampling: The sampling technique of this study is a multiple-stage sampling process, whereas at the first stage the target population is clustered in terms of geographic locations (i.e., number of districts in Bangladesh), after which based on accessibility and convenience facility Dhaka city is selected as the sampling area for conducting structured questionnaire based survey. At the second stage, a sample frame (list of the universities in Dhaka city) is prepared, based on which 10 strata (consists of 5 universities) are created by following simple random sampling (SRS) process. At the final stage, a single stratum is selected among the 10 strata by following a simple random sampling process. On which, 450 students (225 are attentive students and 225 are inattentive students) are randomly selected to survey on them from the selected strata, whereas the sample size is determined considering the financial constraints and convenience of the researchers.

3.5 Data Collection and Preparation

A structured questionnaire is prepared to conduct a survey on the sampled units (students) containing the questions representing the observed variables or the construct parameters (See Figure 1: Theoretical Framework of the Study). The electronic format of the questionnaire is delivered to the students through e-mail. 409 respondents have replied, therefore the response ratio is 409/450 = .91 or 91%, whereas non-response error is 9% which is between the tolerable level (Hair, Jr., Hult, Ringle, & Sarstedt, 2014). For the sake of preparing error-free data set 9 respondent's data are eliminated because of erroneous responses.400(200 attentive and 200 inattentive students) respondents are used for further analysis, among which 50 (25 attentive and 25 inattentive students) respondents are kept apart as hold-out sample. IBM SPSS v. 20, statistical software is used to prepare and analyze data on this study.

4. ANALYSIS, FINDINGS AND IMPLICATION

Results and Implications of Discriminant Analysis

Table 5 (a): Results of Two-Group Discriminant Analysis (Related to RQ No. 1)

Pooled Within-Groups Correlation Matrix

	Comm.	Ent.	L&S	SN
Comm.	1.00	-	-	-
Ent.	0.020	1.00	-	-
L&S	0.091	0.021	1.00	-
SN	0.031	0.081	0.110	1.00

Wilk's λ (*U*-statistic) and univariate *F* ratio with 1 and 348 degrees of freedom

Variable	Wilk's λ	*F*	Significance
Comm.	0.9641	1.218	0.198
Ent.	0.4123	18.76	0.000
L&S	0.6839	23.63	0.000
SN	0.5295	5.578	0.020

Canonical Discriminant Functions

Function	Eigenvalue	Percent of Variance	Cumulative Percent	Canonical Correlation		After Function	Wilk's λ	Chi-Square	df	Sig.
					:	0	0.338	29.71	4	0.000
1*	1.684	100.00	100.00	0.847	:					

Table 5 (b): Results of Two-Group Discriminant Analysis (Related to RQ No. 1)

Standard Canonical Discriminant Functions Coefficients		**Structure Matrix** Pooled within-groups correlations between discriminating variables and canonical discriminant functions (variables ordered by size of correlation within function).	
Comm.	0.073	Comm.	0.163
Ent.	0.851	Ent.	0.913
L&S	0.485	L&S	0.536
SN	0.712	SN	0.853

Canonical Discriminant Functions Evaluated at Group Means (Group Centroids)

Group	Func. 1
1	2.45
2	- 2.37

Table 5 (c): Results of Two-Group Discriminant Analysis (Related to RQ No. 1)

Classification Results

		Students (Attentive vs. Inattentive)	Predicted Group Membership 1	2	Total
Original	Count	1	194	6	200
		2	2	198	200
	%	1	97%	3%	100%
		2	1%	99%	100%
Cross-validated	Count	1	191	9	200
		2	7	193	200
	%	1	95.5%	4.5%	100%
		2	3.5%	96.5%	100%

*{(194+198) / 400} × 100 = 98% of the original grouped cases correctly classified.
**{(191+193) / 400} × 100 = 96% of cross-validated grouped cases correctly classified.

Classification Results for Cases Not Selected for Use in the Analysis (49 Holdout Samples)

	Actual Group	No. of Cases	Predicted Group Membership 1	2
Group	1	25	23	2
			92%	8%
Group	2	25	3	22
			12%	88%

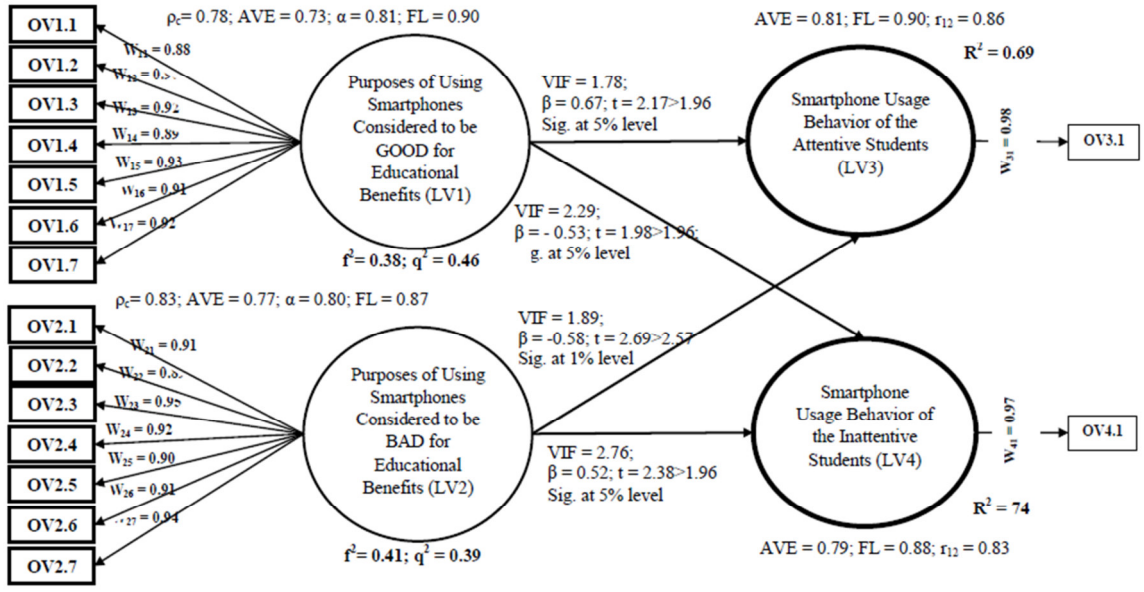
Percent of grouped cases correctly classified: {(23+22)/50}x100 = 90%

From the output of discriminant analysis shown in Table 5 (a, b, & c), it can be concluded that among the four variables of communication, entertainment, learning and study, and social networking (these are the purposes of using smartphones) three variables are significantly differentiating and discriminating attentive and inattentive students in terms of their smartphone usage behavior, whereas these three variables are entertainment, learning and study, and social networking. More precisely, based on the discriminant function, *F*-test value, significance at 1% level and standard canonical discriminant coefficients this conclusion can be derived, whereas the cross-validation and leave-one-out validation show 96% and 90% accuracy of the results, respectively.

4.1 Results and Implications of PLS-SEM Analysis

Based on the PLS-SEM analysis results shown in the Figure 3 and Box 2, it can be concluded that both exogenous constructs of "Purposes of Using Smartphones Considered to be GOOD for Educational Benefits (LV1)" and "Purposes of Using Smartphones Considered to be BAD for Educational Benefits (LV2)" have significant impact on the endogenous constructs of "Smartphone Usage Behavior of the Attentive Students (LV3)" and "Smartphone Usage Behavior of the Inattentive Students (LV4)". But the interesting fact is, bad and reasons are negatively affecting the smartphone usage behavior of the attentive and inattentive students, respectively.

Figure 3: PLS-SEM Analysis Results



Box 2: Notations, Parameters and Acceptable Values (Malhotra, 2014; Hair, Jr., Hult, Ringle, & Sarstedt, 2014)	
OV = Observed Variables (See **Table 3**)	f^2 = Effect size of the constructs (More 0.35 represents strong effect)
LV = Latent Variables/Constructs (See **Table 3**)	q^2 = Predictive relevance of the constructs (More 0.35 represents strong effect)
W_{ij} = Weight/Outer Loadings of the LVs (More than .80 is acceptable)	r_{ij} = Test-retest reliability value (More than 0.80 carries strong correlation)
ρ_c = Composite Reliability (0.70 to 0.90 is acceptable)	FL = Fornell-Larcker Criterion (√AVE>Correlation with any other constructs)
AVE = Average Variance Extracted (0.70 to 0.90 is acceptable)	R^2 = Coefficient of Determination (More than 0.50 is acceptable)
α = Cronbach's Alpha (0.70 to 0.90 is acceptable)	β = Path Coefficients (Acceptable if it is significant at 5% level)
VIF = Variance Inflation Factor (Less than 5 is acceptable)	t = Calculated value of t-statistic

5. LIMITATIONS& FUTURE RESEARCH

There are certain limitations of this study. First, the moderating effect of the demographic factors (i.e., gender, regional status, social status) is not considered in this analysis. Second, there could some other purposes of using smartphones those are omitted in this research after considering the four major purposes. In that case, the effect of these minor issues/reasons were not analyzed and justified. So, these limitations can be resolved in further

research initiatives.

6. CONCLUSION

This study is merely an explorative research initiative, whereas it was tried to investigate that what is happening whenever a student is spending so much time on his/her smartphones, is it being good for him/her or not. Based on rigorous and careful statistical method based analysis, it was found that the attentive students, having a quite satisfactory academic profile, are much more influenced by the good purposes (e.g., using smartphones for preparing learning materials and course contents) rather than being influenced by the bad reasons, whereas the inattentive students are representing the opposite scenario. Motivation and mass-awareness about technology among the students can bring some changes on this unexpected scenario, but in that case the interested shareholders should come forward and act responsively, like the parents, teachers, social leaders, government, and any other authorities.

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