

A Structural Equation Modelling Approach to Elucidating the Interplay between Internet Use and Social Behaviours

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Abstract

Despite having a proliferation of research in students' excessive Internet use, most of them tend to emphasise on its pathological aspects and adverse effects on students' daily routines, lacking a holistic elucidation of the interplay between students' Internet use and their social behaviours in the real-world. The aim of this study is to deepen our understanding of how adolescents' Internet use is associated with their offline social behaviours. A cross-sectional survey with 559 participants (aged 12 – 19) was conducted. Two sets of questionnaires were administered to the participants to probe their patterns of Internet use together with their self-reported pro-social and anti-social behaviours in the real-world. The results indicate that (1) anti-social behaviours in the real-world are associated positively with delinquent Internet use; (2) pro-social behaviours in the real-world have a negative association with delinquent Internet use; (3) anti-social behaviours in the real-world are associated positively with delinquent Internet use; and (4) delinquent Internet use has a positive association with pro-social Internet use. We argue that most online behaviours are not purely delinquent or pro-social, but mixed. Adolescents and young people exhibiting anti-social behaviours in the real world are prone to delinquent Internet use and vice versa.

Keywords: Internet Addiction, Problematic Internet Use, Structural Equation Modelling, Pro-social Behaviour, Anti-social Behaviour

1. Introduction

The unprecedented growth and dissemination of information and communication technology has created huge challenges to the education community. Students of this generation are immersed in ubiquitous digital environments such as Facebook, YouTube, computer games, digital music players, video cams, instant messengers, cell phones etc. They are portrayed by Prensky (2001) as digital natives who are being socialised and cognitively developed in a fundamentally different way as compared to their predecessors. Regardless of one's favouritism, technology has been rapidly transforming the world we live in and the way our new generation learn to live. Along with all the benefits it brings, the ever-changing nature of information and communication technology continues to arouse attention to its possible drawbacks. The emergence of excessive use of Internet and engagement in massively multiplayer online role playing games (MMORPG) (Peters and Malesky Jr 2008) is becoming apparent across university campuses and schools (Young and Rogers 1998, Chou and Hsiao 2000, Griffiths 2000b, Young 2004, Chou *et al.* 2005). Results of some research studies indicate that over-engagement with Internet is associated with time-disruption which leads to interference with academic work and daily routines (Kaltiala-Heino *et al.* 2004, Young 2004, Chou *et al.* 2005, Yellowlees and Marks 2007), a neglect of basic drives such as narrowing range of interests (Young 2004), reduced quality of meals, decreasing sleeping time and disrupted sleep patterns (Block 2008). The problematic behaviours associated with Internet use have been discerned by some researchers to be similar to those found in substance use disorders or impulsive control disorders. Most of the criteria for identifying Internet addiction have been derived from the criteria stipulated for psychoactive substance dependence or pathological gambling stipulated in the fourth edition of the Diagnostic and Statistical Manual Disorders (DSM-IV) (Block 2008). They tend to emphasise on its pathological aspects and adverse effects on students' daily routines, lacking a holistic elucidation of the interplay between students' Internet use and their social behaviours in the real-world. The aim of this study is thus to deepen our understanding of how adolescents' Internet use interacts with their offline social behaviours.

2. Previous Research

Despite escalating interest and proliferating research work in this area, heterogeneity still exists among the use of terminology, diagnostic conceptions, and measurement (Demetrovics *et al.* 2008). Some researchers define such problematic behaviour as a type of psychiatric disorder among other mental disorders and use terms such as Internet addiction (IA) (Goldberg 1995) or pathological Internet use (Morahan-Martin and Schumacher 2000), while others regard it as a separate disorder and use compulsive Internet use (Greenfield 1999), problematic Internet use (Griffiths 2000a, Tsai and Lin 2001, Caplan 2002) or excessive Internet use (Mitchell 2000, Treuer *et al.* 2001, Hansen 2002, Ceyhan *et al.* 2007) to coin it. Some researchers perpetuated the urge for the inclusion of Internet addiction as a type of mental health disorder in the new edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (Pratarelli and Browne 2002, Widyanto and McMurran 2004, Young 2004, Huang *et al.* 2007, Block 2008, Demetrovics *et al.* 2008). Although this approach of using psychiatric disorders as a starting point to delineate Internet addiction was predominant in the early descriptions of the phenomenon, the conceptualization and definition of Internet addiction are still debatable among academia and clinical practitioners. Demetrovics *et al.* (2008) argue that many of these scales have never been subjected to systematic psychometric testing, lacking evidence-based standardization and clear-cut clinic assessment criteria for Internet addiction.

In regard to the impact of excessive Internet use on social relationship and social behaviours, the findings are equivocal. Although Young *et al.* (1998) propose that excessive Internet use causes an increase in level of social isolation and depression, Morahan-Martin

(1999) and Ha et al. (2007) expound that the research findings concerning the causal relationship between loneliness and excessive Internet use is far from conclusive. Chou et al. (2000) argue that Internet use has remarkably positive influences on relationships with peers, parents and teachers among both the deemed addicts and the deemed non-addicts groups. On the other hand, Pratarelli et al. (2002) claim that Internet addiction is the causal factor that leads to excessive behaviours that involves using Internet for sexual purposes and a variety of personal goals. However, the composite reliability and fitting indices of the structural equation models presented in their article are far from satisfactory for justifying their claims. It is noteworthy that many of the abovementioned studies tend to consider only the problematic or pathological aspects of Internet use and thereby lacking a holistic spectrum for elucidating online behaviours. To deepen our understanding of the interplay between Internet use and social behaviours, a more comprehensive delineation of Internet use and its relationship with social behaviours in the real world is deemed necessary.

Taking previous evidence into account, this study aims to develop an instrument that can delineate both pro-social and delinquent Internet use and scrutinise the interplay between Internet use and social behaviours. To avoid drawing direct parallelism between mental disorders and Internet addiction, grounded on the work of Davis (2001), Caplan (2002) and Ma (2002), we developed the two questionnaires: Adolescent Internet Use Questionnaire (AIUQ), and Adolescence behaviour Questionnaire (ABQ). AIUQ and ABQ probe into participants' pro-social and delinquent Internet use as well as their pro-social and anti-social behaviours in the real world. The research questions of this study are fourfold: First, is participants' delinquent Internet use associated with their offline anti-social behaviours and vice versa? Second, is there any association between participants' offline pro-social behaviours and their delinquent Internet use? Third, how is participants' anti-social behaviours associated with their pro-social Internet use? Four, is there any association between participants' pro-social Internet use and their delinquent Internet use? As Ma (2002) argues that pro-social and anti-social behaviours in the real world coexist among adolescences, it is worthy to explore whether the participants' behaviours in the cyber-world also vacillate between pro-social and delinquent.

3. Method

3.1 Domain of Study

The study aimed to construct a scale that gives a more comprehensive description of Internet use and explore the interrelationships between Internet use and the offline pro- and anti-social behaviours of a cohort of Chinese students. Building on the earlier work of Morahan-Martin *et al.* (2000) and Caplan (2002), in this study we constructed a 43-item Adolescent Internet Use (AIUQ) scale to gauge the behaviours associated with Internet use. This proposed scale was comprised of two sub-scales: Pro-social Internet Use (NIU) and Delinquent Internet Use (DIU). The items contained in each sub-scale were further divided into the three affective, behavioural and cognitive domains.

The factor structure was examined using confirmatory factor analysis (CFA). With the use of LISREL 8.8 statistical software package, we explored the interrelationships among Internet use, pro-social and anti-social behaviours by first constructing a set of competing structural equation models associated with users' delinquent Internet use (DIU), pro-social Internet use (NIU), and factors associated with their offline pro-social and anti-social behaviours, and the best-fit model(s) were identified according to the corresponding fit indices.

3.2 Participants

Students from five government-aided schools located in different areas of Hong Kong, from a range of social backgrounds and of mixed academic ability, were invited to participate in the study. The total number of participants was 559 (306m, 253f), made up of 66 Grade 7 (37m, 29f), 195 Grade 8 (113m, 82f), 151 Grade 10 (79m, 72f), 108 Grade 12 (61m, 47f), 27 2nd Year Undergraduate (11m, 16f) and 12 3rd Year Undergraduate (5m, 7f) students. All participants were Chinese and their mean ages (standard deviation in parentheses) of the Grade 7, 8, 10, 12, 2nd Year Undergraduate and 3rd Year Undergraduate participants were 13.1(.9), 13.9(.9), 15.6(.8), 18.0(.9), 19.9(1) and 20.5(.8) respectively.

3.3 Instruments

Adolescent Internet Use Questionnaire (AIUQ): The AIUQ, which was constructed based on previous studies by (Morahan-Martin *et al.* (2000) and Caplan (2002) is a comprehensive questionnaire containing a substantial number of newly constructed items. In addition to assessing participants' experience and pathological use of the Internet, the AIUQ measures cognition, behaviour, and negative outcomes on the basis of Davis's (2001) concept of generalized Pathological Internet Use. Participants are asked to rate items on a 5-point Likert scale, ranging from Strongly Disagree to Strongly Agree. The two main scales used in the AIUQ are: (1) NIU, pro-social Internet use, referring to behaviours that are regarded as good, altruistic and moral, for instance, Item 06: I cherish relationships developed with people through the Internet and Item 9: I behave as a very kind and helpful person online; and (2) DIU: delinquent or anti-social Internet use, referring to behaviours that are regarded as socially undesirable, for instance, Item 15: I have been late for appointments because I was online; Item 26: I have failed in an examination because of my excessive online activity, and Item 19: I have missed family and school meetings because of online activities. Pro-social Internet use should be differentiated from normal Internet use in that 'pro-social' refers to all kinds of non-delinquent or non-deviant Internet use such as checking email, sports scores online, etc. (Ma *et al.* 2011).

Adolescent behaviour Questionnaire (ABQ) (Ma 2002): ABQ measures the pro-social and anti-social/delinquent behaviours of adolescents. Participants were asked to report the frequency in which they performed 65 individual actions in the past year on a 7-point scale ranging from none to more than 10 times. The ABQ is comprised of two general factors. First, the anti-social/delinquent behaviour (DB) factor, which measures the frequency of having performed deviant or socially disapproved acts in a classroom or school setting, socially undesirable sexual activities, anti-social acts against one's teachers or school authorities, anti-social acts against parents, and other aggressive or hostile acts. Generally, a high DB score indicates a high frequency of delinquent acts performed in the past year. Second, the pro-social behaviour factor (PB) measures the frequency of altruistic and socially acceptable or normative acts. A high PB score indicates a high frequency of pro-social acts performed in the past year. The reliability and validity of ABQ scores have been demonstrated to be good in previous studies by Ma and Leung (1991) and Ma *et al.* (1996).

3.4 Procedures

The research protocol of this study was endorsed by University's Committee on the Use of Human and Animal Subjects in Teaching and Research. The Committee employs international ethical standards in scrutinising applications. After getting the approval from the Committee, the investigators wrote to the principals of the participating schools to seek their consent for data collection. Participants were reminded that all their answers and personal information were for the use of research only and would be kept confidential. Participants were free to withdraw from the study at any stage. The questionnaires were group-

administered to the participants during their normal class periods. The researchers went through the test with the participants before they answered the questions.

4. Results

4.1 Exploratory Factor Analysis (EFA)

Principal component analysis with varimax rotation was adopted for analysing the 43 items of the AIUQ scale and the 65 items of the ABQ scale. This analysis resulted in the two latent factors of AIUQ (NIU and DIU) and of ABQ (PB and DB) being trimmed down to 7, 10, 9 and 14 items, respectively, with factor loading ranging from 0.50 to 0.78 (see Tables 1 and 2).

Table 1: Rotated Component Matrix of AIUQ.

	Factor	
	NIU	DIU
PB08: I feel closer to other people online.	.742	
PB06: I cherish relationships developed with people through the Internet.	.709	
PB01: I am happy to talk to others online.	.695	
PB38: I would talk to others online when I feel lonely.	.692	.153
PB02: I make friends online.	.677	.154
PB09: I behave as a very kind and helpful person online.	.670	
PB30: I can express myself through a better way to others online.	.600	
PB19: I have missed family and school meetings because of online activities.	.111	.641
PB25: I would pretend to be someone not in my gender.		.640
PB24: I would cheat people who chat with me online.		.628
PB42: I can use Internet to disseminate some information against someone I dislike.		.625
PB43: I would pretend to be someone not in my age while participating online activities.		.611
PB26: I have failed in an examination because of my excessive online activity.	.127	.607
PB15: I have been late for appointments because I was online.		.597
PB28: I can do anything I like online because it is not easy to be caught by others.	.273	.574
PB13: I feel restless without Internet.	.197	.556
PB34: I enjoy online pornography.	.150	.501

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

Table 2: Rotated Component Matrix of ABQ.

	Factor	
	DB	PB
AB32: Lying to teacher.	.781	.136
AB41: Refusing to comply with parents' orders to their face.	.756	
AB45: Lying to or cheating parents.	.750	
AB30: Copying others' assignments.	.711	
AB12: Not listening to parents.	.703	
AB16: Being scolded for not taking teachers' words.	.696	.152
AB40: Not handing in assignments.	.689	
AB34: Speaking foul language.	.683	
AB37: Acting as one likes disregarding to parents objections.	.680	
AB07: Hurting or insulting others without caring one's feelings.	.662	.139
AB05: Littering.	.662	
AB39: Threatening or terrifying others.	.656	.106
AB18: Reading materials other than the required text stealthily during class.	.656	
AB10: Retorting teachers to his/ her face.	.649	
AB51: Joining the Fund-raising activities.		.660
AB55: Praised by the teacher or the principal for doing well in school.	.124	.655
AB48: Helping the disables to cross the roads.		.654
AB53: Praised by parents for doing well in school or at home.		.650
AB01: Giving presents to parents.		.639
AB57: Gaining awards in the school competition.	.102	.622
AB61: Participating in voluntary works.		.622
AB33: Giving seats to kids, the disables or the elderly while taking public	.199	.606
AB64: Advising classmates not to make troubles or engage in fighting.	.160	.556

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

The Cronbach's alpha of PB, DB, NIU and DIU ranged from 0.81 to 0.91 (see Table 3), indicating that the internal consistency of the four latent factors is acceptable. The range, mean and standard deviation for each item of NIU, DIU, PB and DB are depicted in Table 4.

Table 3: The Cronbach's alpha of PB, DB, NIU and DIU.

	Cronbach's α	% Variance explained
PB	0.81	30.0
DB	0.91	16.0
NIU	0.80	21.5
DIU	0.82	20.5

Table 4: The ranges, means and standard deviations of AIUQ and ABQ items.

Item	Range	Mean	SD	Item	Range	Mean	SD
<u>DIU</u>				<u>DB</u>			
PB13	4	2.46	1.19	AB05	6	2.03	1.61
PB15	4	1.51	.852	AB07	6	1.59	1.28
PB19	4	1.94	.969	AB10	6	1.86	1.59
PB24	4	1.78	.847	AB12	6	3.60	2.17
PB25	4	1.76	.986	AB16	6	2.13	1.70
PB26	4	2.08	1.13	AB18	6	2.62	1.90
PB28	4	2.25	1.06	AB30	6	3.26	2.17
PB34	4	2.42	1.22	AB32	6	1.93	1.60
PB42	4	1.87	.956	AB34	6	3.66	2.50
PB43	4	1.99	1.05	AB37	6	2.15	1.85
				AB39	6	1.48	1.23
				AB40	6	2.95	2.12
				AB41	6	2.65	1.97
				AB45	6	2.41	1.82
<u>NIU</u>				<u>PB</u>			
PB01	4	3.89	.867	AB01	6	2.61	1.46
PB02	4	3.15	1.12	AB33	6	2.89	1.71
PB06	4	3.45	1.00	AB48	6	1.55	1.08
PB08	4	3.50	.988	AB51	6	1.74	1.18
PB09	4	3.43	.903	AB53	6	2.34	1.47
PB30	4	3.48	.861	AB55	6	2.09	1.38
PB38	4	3.40	1.20	AB57	6	1.76	1.24
				AB61	6	2.38	1.54
				AB64	6	2.10	1.56

4.2 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) using LISREL 8.8 was performed to examine the factor structures of the two scales. The number of items of each of the four latent factors was further reduced to ensure the set of fitting indices obtained are of reasonably good size. The factor loadings and their corresponding statistics for each of the four latent factors are listed in Table 5. The value of Satorra-Bentler χ^2 is 1805 with a corresponding p-value less than .0001, which is well below .05. The Root Mean Square Error of Approximation (RMSEA) value was .0498, which is less than the .05 criterion. The fit indices, which include the Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Relative Fit Index (RFI), Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI), were all well above the .9 cut-off value, indicating adequate fit of the CFA measurement model (see Table 6). The squared correlation coefficient matrix of DIU, NIU, DB and PB is presented in Table 7. The correlations among the four latent factors were significant with $p < 0.01$.

Table 5: Parameter Estimates for the CFA Measurement Model.

Factors	Indicators	Measurement Model					
		FL [†]	t	p	R ²	CR*	AVE [#]
DIU	PB13	0.754*	26.4	0.028	0.569	0.751	0.433
	PB19	0.688*	31.8	0.021	0.473		
	PB26	0.624*	34.8	0.017	0.389		
	PB28	0.548*	47.5	0.011	0.300		
NIU	PB01	0.598*	35.4	0.016	0.358	0.799	0.447
	PB02	0.756*	18.7	0.040	0.572		
	PB06	0.655*	35.2	0.018	0.429		
	PB08	0.771*	18.9	0.040	0.594		
	PB09	0.531*	33.4	0.015	0.282		
DB	AB05	0.623 ⁺	80.7	0.007	0.388	0.928	0.50
	AB07	0.686 ⁺	73.2	0.009	0.471		
	AB10	0.657 ⁺	75.1	0.008	0.432		
	AB12	0.726*	43.6	0.016	0.527		
	AB16	0.718*	51.7	0.013	0.516		
	AB18	0.681*	67.2	0.010	0.464		
	AB30	0.665*	63.6	0.010	0.442		
	AB34	0.707*	59.9	0.011	0.500		
	AB37	0.782*	35.9	0.021	0.612		
	AB39	0.700 ⁺	82.8	0.008	0.490		
	AB40	0.664 ⁺	75.1	0.008	0.441		
	AB41	0.797*	21.8	0.036	0.635		
PB	AB45	0.766*	33.8	0.022	0.587	0.752	0.347
	AB33	0.627*	32.5	0.019	0.393		
	AB51	0.446*	34.8	0.012	0.199		
	AB53	0.403*	35.8	0.011	0.162		
	AB55	0.550*	27.1	0.020	0.303		
	AB57	0.620*	31.5	0.019	0.384		
	AB64	0.800*	20.8	0.038	0.640		

[†]FL: Factor Loading; *CR: Composite reliability; [#]AVE: Average Variance extracted;

*p < .05; ⁺p < 0.01; [#]p < 0.005

Table 6: A Summary of Fitting Indices of Different Structural Equation Models.

Goodness of fit index	CFA (Measurement Model)	Model A	Model B	Model C
Satorra-Bentler Chi-square (d.f.)	766.1 (344)	755.3 (345)	766.1 (344)	766.1 (344)
p-value of chi-square test	.00	.00	.00	.00
Root Mean Square Error of Approximation (RMSEA)	0.0498	0.0491	0.0498	0.0498
Normed Fit Index (NFI)	0.998	0.998	0.998	0.998
Non-Normed Fit Index (NNFI)	0.999	0.999	0.999	0.999
Comparative Fit Index (CFI)	0.999	0.999	0.999	0.999
Incremental Fit Index (IFI)	0.999	0.999	0.999	0.999
Relative Fit Index (RFI)	0.998	0.998	0.998	0.998
Goodness of Fit Index (GFI)	0.997	0.996	0.997	0.997
Adjusted Goodness of Fit Index (AGFI)	0.996	0.995	0.996	0.996

Table 7: Squared Correlation Coefficients

Latent Factor	DIU	NIU	DB	PB
DIU	1	0.083*	0.179*	0.078*
NIU	0.083*	1.000	0.065 [#]	0.020 [#]
DB	0.179*	0.065 [#]	1.000	0.066 [#]
PB	0.078*	0.020 [#]	0.066 [#]	1.000

Note: NIU = Normal/ Pro-social Internet Use; DIU = Delinquent/ Anti-social Internet Use; PB = Pro-social behaviour; DB = Delinquent behaviour *p < .05 ⁺p < 0.01 [#]p < 0.005

4.3 Convergent and Discriminant Validity

The convergent validity of the four latent factors was assessed by considering the sizes of the standardized loading estimates, composite reliability and average variance extracted. The results presented in Table 5 and Table 7 confirm the convergent validity by the facts that (1) all the standardized loading estimates ranged from .4 to .8 with an average value of 0.66 which were greater than 0.5, (2) the composite reliability of NIU, DIU, DB and PB ranged from .75 to .93 which was well-above 0.7, and (3) the average variance extracted (AVE) ranged from .35 to .5 with an average value of 0.43. The discriminant validity was assessed by comparing the relative size between the average variance extracted and the correlation between factors and the reliability. The discriminant validity was confirmed by the fact that the average variance extracted (see Table 5) was greater than the square of the off-diagonal elements of the correlation matrix (see Table 7).

4.4 Model Comparison

To explore the interplay between Internet use, pro-social and anti-social behaviours, three structural equation models: Model A, Model B and Model C were constructed and compared in this study. The three models were then analysed using LISREL 8.8. In Model A, DIU was made exogenous to DB, PB and NIU and DB served as a mediating factor of the relationship between DIU and NIU and between DIU and PB (see Figure 1). As depicted in Table 8, all the coefficients of the structural equations associated with Model A were statistically significant. The first structural equation given by Model A indicated that delinquent/anti-social Internet use, DIU had strong positive association with delinquent/anti-social behaviours, DB as reflected by its large effect size of 0.159. With a large effect size of 0.178, the second structural equation indicated that DIU associated negatively with pro-social behaviours, PB while DB associated positively with PB. Likewise, the third structural equation of Model A revealed that both DIU and DB had positive association with pro-social Internet use, NIU.

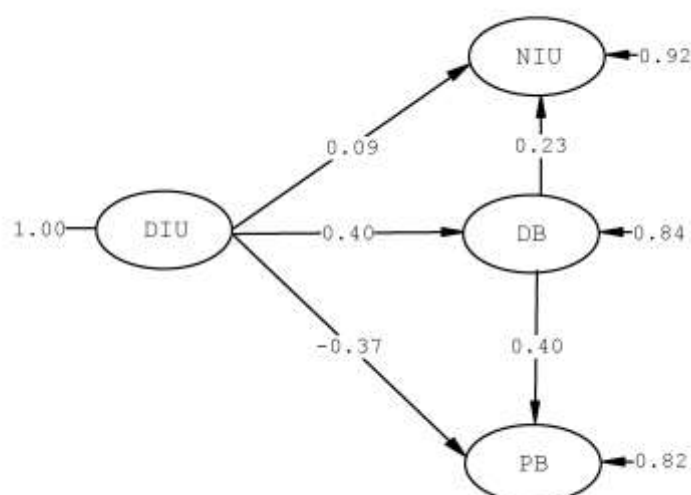


Figure 1: Model A – A structural equation model in which DIU is made exogenous to NIU, DB and PB.

Table 8: Structural Equations for Model A, Model B and Model C

Model		β	t	R^2
<u>Model A</u>				
1	Dependent factor: DB			
	DIU	.399	26.147*	.159
2	Dependent factor: PB			
	DB	.402	20.06*	.178
	DIU	-.367	-14.67*	
3	Dependent factor: NIU			
	DB	.228	24.68 ⁺	.075
	DIU	.087	13.81 ⁺	
<u>Model B</u>				
1	Dependent factor: DIU			
	NIU	.228	21.03 ⁺	
	DB	.477	44.36 ⁺	.388
	PB	-.433	-28.56*	
<u>Model C</u>				
1	Dependent factor: DIU			
	DB	.530	46.43*	.340
	PB	-.415	-29.34*	
2	Dependent factor: NIU			
	DIU	.321	7.487*	.138
	DB	.062	2.802*	
	PB	.213	8.815*	

Note: NIU = Normal/ Pro-social Internet Use; DIU = Delinquent/ Anti-social Internet Use; PB = Pro-social behaviour; DB = Delinquent behaviour;

* $p < .05$ ⁺ $p < 0.01$

In Model B, DB, PB and NIU were chosen as exogenous factors for DIU as depicted in Figure 2. The structural equation associated with Model B indicated that NIU and DB associated positively with DIU while PB associated negatively with DIU, with a large effect size of 0.388.

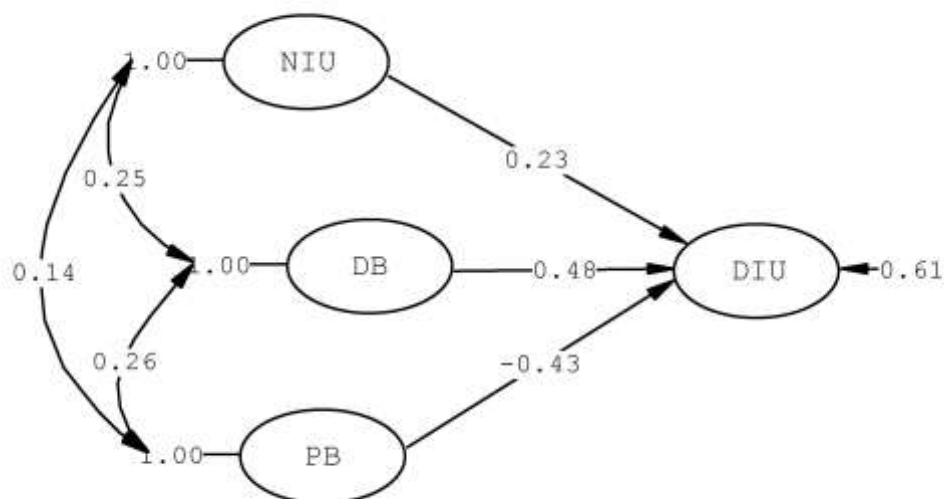


Figure 2: Model B – A structural equation model in which to NIU, DB and PB are made exogenous to DIU.

In Model C, DB and PB were made exogenous to both DIU and NIU, and DIU was made exogenous to NIU. With a large effect size of 0.34, the first structural equation of Model C indicated that DB and PB exerted positive and negative association with DIU respectively. The second structural equation showed that DIU, DB and PB associated positively with NIU, with an effect size of 0.138.

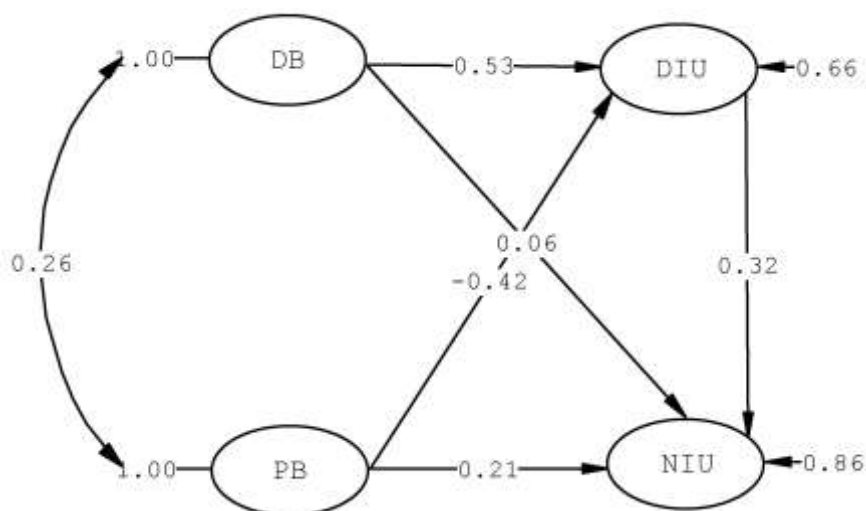


Figure 3: Model C – A structural equation model in which to NIU, DB and PB are made exogenous to DIU.

As depicted in Table 6, the fitting indices: NFI, NNFI, CFI, IFI, RFI, GFI and AGFI were well above 0.9 in conjunction with having RMSEA less than 0.05, indicating that Model A, Model B and Model C were structural equation models with good fit. The three competing structural equation models were further compared against their expected measures of Root Mean Square Error of Approximation (RMSEA), Cross-Validation Index (ECVI), Akaike Information Criterion (AIC) and Consistent Akaike's Information Criterion (CAIC), as shown in Table 9. The assumptions of RMSEA, ECVI, AIC and CAIC state that, between competing

models, the lower the values the stronger the fit of the model. Thus, the results given in Table 9 indicated that Model A had a stronger fit among the three. The total percentage variance explained also suggested that Model A has better fit than the other two.

Table 9: A Summary of Model Comparison Indices for Model A, Model B and Model C.

Goodness of fit index	Model A	Model B	Model C
Root Mean Square Error of Approximation (RMSEA)	.0491	.0498	.0498
Cross-Validation Index (ECVI)	1.776	1.802	1.802
Akaike Information Criterion (AIC)	877.3	890.1	890.1
Consistent Akaike's Information Criterion (CAIC)	1195	1213	1213

5. Discussion

The above results indicate that the AIUQ and ABQ scales had high internal consistency (with a Cronbach's α ranging from .8 to .9) and produced better CFA model fit parameters, as compared to those given by (Pratarelli et al. (2002)). In the SEM analysis, the DIU, NIU, DB and PB factors were found to have a certain degree of correlation with one another. All three models pointed to the fact that delinquent social behaviours, DB associated positively with the delinquent Internet use, DIU. This result is in line with the findings given by Young et al. (1998), which suggest that excessive Internet use increases the levels of social isolation and depression. Pratarelli et al. (2002) further argued that Internet addiction is the causal factor that leads to undesirable social behaviours. To shed light on the casual relationship between DIU and DB, we followed the procedure suggested by Pratarelli et al. (2002) by making DIU exogenous to DB in Model A and endogenous to DB in Model B and Model C.

Nonetheless, the results remain ambivalent with regard to the claim on the casual relationship between anti-social behaviours and delinquent Internet use as elucidated by Pratarelli et al. (2002). Our arguments are twofold: (1) the RMSEA, ECVI, AIC and CAIC indices and the percentage variance extracted of both Model A and Model B are commensurate with one another that both of them can be regarded as plausible and good-fit models; and (2) more importantly, the data obtained in our present study is cross-sectional in nature that we are by no means certain about the temporal relationship between DIU and DB. As such, no conclusive remarks on the issue of causality can be made. The negative association between PB and DIU as found in the three models suggests that helping adolescents develop pro-social behaviours may alleviate their delinquent Internet use. Conversely, increasing delinquent Internet use may reduce pro-social behaviours. The positive association between (1) DIU and NIU; (2) DB and NIU and (3) DB and PB can be interpreted in a way that pro-social behaviours and delinquent behaviours are not mutually exclusive and most adolescents exhibit both types of behaviours. For instance, the association between DB and NIU suggests that adolescents exhibiting anti-social behaviours may develop pro-social Internet use. This finding echoes with Chou et al. (2000) claim that Internet use has remarkably positive influences on relationships with peers, parents and teachers among groups deemed to be addicts and non-addicts.

6. Implications

The positive association between DIU and NIU implies that most adolescent behaviours in the cyber-world are not purely delinquent or pro-social. An individual's desire to seek friendship or pleasure online may eventually turn into overuse or delinquent Internet use. Further, adolescents exhibiting anti-social behaviours in the real world are prone to delinquent Internet use and vice versa. The feelings of being neglected in the real world may underline his/her desire to seek satisfaction in the virtual world. Conversely, pro-social

behaviours or emotional satisfaction in the real world may deter an individual from delinquent Internet use. It suggests that helping adolescents to develop pro-social behaviours in the real world could reduce their delinquent behaviours in the cyber-world. In fact, the boundary between cyber-world behaviours and real-world behaviours blurs when Internet use becomes more pervasive and integral to people's daily-life experiences. Anti-social behaviours in the real world and delinquent behaviours in the cyber-world are so inextricably interwoven that they can be exogenous to one another at different times and in different contexts. To substantiate the present findings and to shed more light on the abovementioned issues, further empirical research, such as longitudinal studies or cross-cultural comparative studies is deemed necessary.

7. Limitations

The use of the self-report method in the present study of the pro-social and anti-social Internet behaviour has its own limitations, for instance, participants may not always answer honestly. Second, there are no data on the personality, mental disorder, and academic performance in the present study. This kind of data may shed some light on the explanation of the causes of the pro-social and anti-social Internet behaviours, and future studies should include this kind of data. Third, the present study is a cross-sectional study, and further research should include a longitudinal study to explore the casual relationships among the factors.

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