



Using Path Analysis to Investigate Predictors of Problematic Internet Use Among Hong Kong Adolescents

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Abstract. This study tested perceived meaning in life (an individual variable), and adolescent-parent attachment (a systemic variable), as well as other Internet-related emotions and behaviors, as predictors of Problematic Internet use. A random selection of 479 students from six secondary schools in Hong Kong, aged between 11 and 19 years old (40.3% male and 59.7% female) completed questionnaires (C-IAT, C-MLQ, C-IPPA, DASS21) in their classrooms. Path analysis showed that only adolescent-father attachment was the strongest predictor of Problematic Internet use, with presence of meaning, time using the Internet on weekends, education level, depression and stress level also contributing significant variance. The results have implications for future research and the prevention and treatment of Problematic Internet use. Our study used a multivariate approach to test whether adolescent-parent attachment and meaning in life could predict adolescent PIU. This study is a major step towards understanding the individual and systemic variables that may play a role in the development of PIU.

Keywords: Meaning in life · Attachment · Internet addiction · Problematic Internet use · Anxiety · Depression

1 Introduction

Problematic Internet use (PIU) is associated with problems in physical health, family life, and academic performance among adolescents [1–3]. Extreme overuse (sometimes called Internet addiction) is defined as an excessive preoccupation with and engagement in online activities that cause damage or anguish and negatively affect functioning in some or all aspects of one's life [4]. Adolescents who are Problematic Internet use have been shown to exhibit low self-esteem, depression, and poor interpersonal relationships [5]; are more likely to withdraw from their family, refuse to perform family duties, and have family conflicts over Internet use [2]; and show disruptions in their academic performance, daily routines, and social life [2–4, 6].

Because adolescent Problematic Internet use is more prevalent in Hong Kong than in other parts of the world, studying Problematic Internet use in this context is especially

important. The rate of Problematic Internet use among adolescents in Hong Kong has been estimated to be between 26.4% and 30% [4, 7], compared to 4% in the United States [8], 11.3% in Germany [9], and approximately 8% in Taiwan and Mainland China [10]. Given the prevalence of adolescent Problematic Internet use in Hong Kong and evidence of its associated risks, it is important to investigate the factors that contribute to Problematic Internet use. Previous studies have examined the relationships between adolescent-parent attachment and Problematic Internet use [11, 12], meaning in life and Problematic Internet use [13], and adolescent-parent attachment and meaning in life [14], but none of the previous studies considered all three variables together. This study aimed to bridge these gaps in a sample of Chinese adolescents in Hong Kong, using attachment theory [15–17], research on meaning in life, and research on Problematic Internet use to inform the hypotheses.

2 Definition of Problematic Internet Use

In the current study we focus on the concept of PIU rather than addiction, with the assumption that overuse is a milder problem and a more appropriate focus of research in a community sample [18–22]. PIU mentions to behaviors and cognitions related with use the Internet that leads to negative consequences in daily life. [20, 22]. Meanwhile, Spada [22] pointed out that PIU shares features of an addictive behavior, for example craving, tolerance and withdrawal.

However, the two concepts often overlap in the literature. Yang and Tung [23] reported that in the past 15 years, researchers have used variety of terms including *technology addiction*, *problematic Internet use*, *pathological computer use*, *pathological Internet use*, *Problematic Internet use*, *Internet dependency*, and *Internet addiction disorder*.

In an attempt to use a consistent standard for defining PIU and addiction, earlier researchers turned to the *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition (DSM-IV), published in 1994 [26]. However, the DSM-IV listed no Internet-related diagnoses. Therefore, researchers looked to the criteria for substance use disorders and more often, the criteria for pathological gambling, a form of impulse-control disorder, as a framework for defining Problematic Internet use. Internet-related problems were still not listed in the DSM-V, published in 2013 [27]. However, Internet gaming disorder was included in a list of conditions for further study [27]. PIU and addiction are also not listed as official diagnoses in the International Classifications of Disease (ICD 11) [25], the diagnostic system used outside of the U.S.

It appears that although the concepts of PIU and Internet addiction are common topics of research and the focus of public attention, these problems are not recognized as official diagnoses.

For purposes of the current study, we define PIU as a problem in impulse control and as analogous to the DSM-IV diagnosis of pathological gambling and the DSM-5 diagnosis of gambling disorder. That is, PIU is conceptualized not in terms of how much time the person spends on the Internet, but rather preoccupation, difficulty quitting, and negative consequences of use.

2.1 Problematic Internet Use and Adolescent–Parent Attachment

Several family-based factors have been shown to be associated with adolescents' Internet use, including parental influence, the quality of parent-child relationships [28–30], the strength of family ties [31] and parental involvement [32]. Here, we focus on the specific family factor of adolescent–parent attachment. Attachment describes the relationship that a child forms with his or her caregivers, which continues to influence fundamental patterns of thinking, emotions, and motivation into adulthood [15–17]. Secure attachment implies the capacity to pursue and gain emotional support from others [33].

Several studies have examined adolescent–parent attachment in relation to PIU. One study found that among university students secure parental attachment was associated with a lower likelihood of PIU, and insecure attachment was positively correlated with PIU [30]. Jia and Jia's study [21] indicated particularly that attachment anxiety was found to be a significant predictor of PIU, but attachment avoidance was not. Another study provided indirect evidence that attachment may be important for understanding adolescent PIU. This study was conducted in Mainland China, where (as in Hong Kong) it is common for fathers to live far from their families due to work. The researchers concluded that when fathers live far from their families, "adolescents might regard the Internet as their new attachment figure or may seek new attachment figures such as online friendship, through the Internet" [30, p. 634]. Furthermore, "children's security in their relationship with their father was central to their Internet use," and "a father's rejection may threaten healthy Internet use at this age" [30, p. 637].

2.2 Problematic Internet Use and Adolescent Meaning in Life

Although PIU is assumed to be associated with multiple negative outcomes, it can paradoxically provide a sense of meaning that the adolescent may not find elsewhere. Frankl [35] argued that humans function best when they perceive a sense of meaning and purpose in their lives, and living a meaningful life has been an increasing concern in contemporary society [36]. Meaning in life refers to the human pursuit of life satisfaction [37], and the perception of meaning in life positively correlates with a sense of well-being [38]. In recent years, Steger et al. [38] argued that meaning in life has two main dimensions. The first dimension is the degree to which individuals perceive their lives as being significant and meaningful (presence of meaning in life). The second dimension is the degree to which people are involved in the search for meaning in life [39, 40].

Indirect evidence suggests that the Internet may provide some adolescents with a sense of meaning in life. Zhang et al. [41] found that a lack of meaning in life results in being more prone to boredom and a sense of emptiness; boredom was reported to be the main trigger of exhaustive online use, suggesting that adolescents may experience a sense of purpose and specialness online that they do not experience elsewhere. Kim et al. [13] found that Internet-addicted adolescents believe that the Internet is a crucial

and unique living and entertainment space that can provide them varying degrees of satisfaction. Similarly, individuals who are dissatisfied or upset with their lives have an increased likelihood of showing PIU [43].

2.3 Relationships Among Problematic Internet Use, Adolescent Meaning in Life and Adolescent–Parent Attachment

Several studies have documented associations between adolescent–parent attachment and Problematic Internet use [11, 12, 34], and between meaning in life and Problematic Internet use [3, 13]. However, these studies examined adolescent–parent attachment and meaning in life as independent, rather than mutual, predictors. There are conceptual reasons to test their mutual effects. Several previous studies have provided evidence of connections between adolescent–parent attachment and meaning in life [44, 45]. For example, one study found that adolescents’ secure attachment was associated with a higher sense of meaning [14], whereas an insecure attachment to family decreased the level of meaning in life [46]. These studies frame adolescent–parent attachment and meaning in life as potentially recursive factors in Problematic Internet use. Therefore, to bridge these gaps and investigate the association among attachment theory, meaning in life, and PIU this study used a path analysis to discover how adolescent–parent attachment and meaning in life are related to Problematic Internet use, when considered as individual and mutual predictors.

2.4 Adolescent Problematic Internet Use Related to Mental Health

Adolescent mental health is a possible confounding factor in the study of parent-adolescent attachment and meaning in life in relation to Problematic Internet use. Most research on Internet use in relation to mental health has been conducted with regard to addiction rather than overuse. Previous researchers have noted that Internet addiction is linked with higher levels of co-occurring social and psychological problems. For example, Internet addiction has been shown to positively predict depression, anxiety, and stress [42, 43]. Fu et al. [47] found that Internet addiction is associated with psychiatric and psychosocial problems such as attention-deficit hyperactivity disorder, depressive disorder, anxiety disorder, low self-esteem, social anxiety, and shyness. Furthermore, Park [48] found an association between Problematic Internet use and depressive symptoms among South Korean adolescents. Together, these findings suggest that an adolescent’s mental health may be an important precipitating factor in Internet addiction, and possibly, Problematic Internet use. In addition, to the extent that psychological distress is related to insecure parent-adolescent attachment and a lack of meaning in life, mental health problems may need to be controlled in the study of these factors in relation to Problematic Internet use.

3 The Present Study

Typically, studies on problematic Internet use only consider the direct effect of one or two variables at a time without controlling for other influencing factors or mediating effects

[44]. Tests of the conceptual model in the current study address this problem in three ways. First, adolescent-parent attachment and meaning in life are tested individually and together as predictors of Problematic Internet use. Second, under the assumption that time on the Internet may be a way of coping with these factors, we tested whether time on the Internet mediated the effects of adolescent-parent attachment and meaning in life on the one hand, and Problematic Internet use on the other. Importantly, Problematic Internet use is defined not in terms of time spent on the Internet, but in terms of consequent problems. Third, the associations in our conceptual model are tested while taking into account related conditions, namely anxiety, depression and stress. See Fig. 1.

In the current study, path analysis was used to test this conceptual model in a sample of Chinese adolescents in Hong Kong. The hypotheses were:

3.1 Hypotheses

This study proposed the following alternative hypotheses:

H1_a. Adolescent-parent attachment and meaning in life will be negatively associated with Problematic Internet use.

H2_a Time spend online is mediating variable in between Problematic Internet use, meaning in life and Parent adolescent attachment (see Fig. 1).

3.2 Hypothesized Model

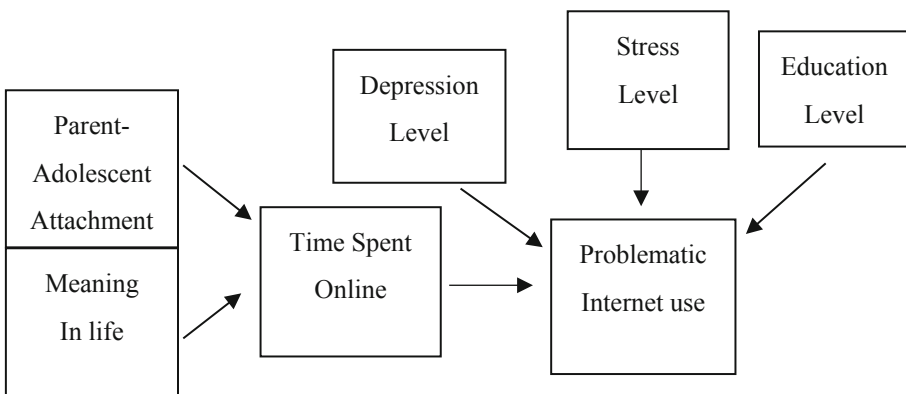


Fig. 1. Hypothetical model of adolescent-parent attachment and meaning in life as predictors of Problematic Internet use through the mediating effect of hours spent online, after controlling for adolescent depression, stress and grade level

4 Method

This study was approved by the Education University of Hong Kong Human Research Ethics Committee (HREC), which monitored all aspects of the research process (EDUHK 2017-2018-0361).

4.1 Participants

A clustered random sample of 500 adolescents was recruited from six secondary schools in Hong Kong. Data from 21 participants were deemed unusable and were removed. These data came from eight students who reported feeling neutral or having no opinions on all items; four students who provided answers for meaning in life outside the score range (e.g. 1–7 range scores they provide the answer 8); and nine students whose questionnaires were incomplete, thus leaving 479 valid surveys from 193 male and 286 female students. Participants' ages ranged from 11 to 19 ($M = 14.77$, $SD = 2.16$). There were 264 students from junior forms (forms 1–3, equivalent to United States grades 7–9) and 216 from senior forms (forms 4 and 5, equivalent to United States grades 10 and 11).

4.2 Instruments

Chinese Version of Young's Internet Addiction Test (IAT). This 20-item questionnaire [13] measures the degree to which Internet use affects a respondent's daily routine, social life, productivity, sleeping pattern, and feelings, based on the DSM-IV criteria for pathological gambling. The measure was translated into Chinese and the psychometric properties were tested by Chang and Man [13]. Respondents use a 5-point scale, ranging from 1 (*rarely*) to 5 (*always*) regarding the frequency with which the negative consequences of Internet use were experienced during the past year. The total possible score ranges from 20 to 100. Young [24] suggest thresholds of 20–39 to indicate average use, 40–69 to indicate frequent problems with Internet use, and 70–100 to indicate significant problems. In the current study, scores were treated as continuous rather than categorical. Widyanto and McMurrin [49] found that the English language scale showed moderate to good internal consistency, with Cronbach's alpha coefficients for the six IAT subscales ranging from .54 to .82. In this study, we used the overall score and the Cronbach's alpha was .89.

Meaning in Life Questionnaire (MLQ). This 10-item self-report tool is used to measure the presence of meaning in life and the search for meaning in life [51–53]. Wang and Dai [53] developed a Chinese version of the MLQ, on which respondents rate items using a 7-point scale ranging from 1 (*absolutely untrue*) to 7 (*absolutely true*). A sample item is "I understand my life's meaning." In the English language version, the two subscales, namely presence of meaning (MLQ-P) and search for meaning (MLQ-S), had alpha coefficients of .85 and .82, respectively. In the Chinese version, test-retest reliabilities were .74 and .76 [53]. Steger and Shin [54] reported that the internal consistency coefficient for the MLQ score was above .80, and the Cronbach's alpha for the overall score in our study was .74.

The Chinese Version of the Revised Inventory of Parent and Peer Attachment (C-IPPA). This 25-item self-report questionnaire measures adolescents' perceptions regarding their attachment relationships with their mother, father, and close friends, yielding three attachment scores [4]. A Chinese version was developed by Song, Thompson and Ferrer [55]. This study applied only the mother and father attachment scales. Sample items include "My father/mother respects my feelings" and "I wish I had a different father/mother." Items are rated using a 5-point Likert scale ranging from 1 (*almost never true*) to 5 (*almost always true*). Item scores are averaged to create scale scores, with higher scores indicating more secure attachment and lower scores indicating less secure attachment. Armsden and Greenberg [52] reported that the Cronbach's alpha coefficients for the revised version of the IPPA were .87 and .89 for mother and father attachment, respectively. The test-retest correlations ranged from .86 to .93. Furthermore, the scales demonstrated strong correlations with other constructs relevant to attachment theory [3]. The Chinese revised version of the IPPA showed high internal consistency across the three subscales (alphas > 0.87) and a test-retest reliability of 0.86 [57]. In this study the Cronbach's alpha was .80.

Depression, Anxiety, and Stress Scales—Short Form (DASS-21). The DASS-21 consists of three 7-item self-report scales that measure depression (e.g., "I found it difficult to work up the initiative to do things"), anxiety (e.g., "I was aware of dryness in my mouth"), and stress (e.g., "I found it hard to wind down"). A 4-point severity scale, ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time), measures the extent to which each state has been experienced over the past week. The DASS-21 has a number of advantages over the full-length DASS; it is less time-consuming while still showing adequate reliability [31]. The measure has also been shown to have adequate construct validity [36]. The Chinese-language version has been widely used in Chinese samples [57]. According to Oei et al. [57], both the English and Chinese versions of the DASS-21 have high internal consistency, with the Cronbach's alpha scores being higher than .70. In our study Cronbach's alpha was .93.

4.3 Procedure

In Hong Kong's education system, assessments at the end of Primary 5 (end of 10th grade in the U.S.), at the middle of the year of Primary 6 (middle of 11th grade), and at the end of Primary 6 (end of 11th grade) are used to assign students to one of three allocation bands based on academic achievement. We sent an invitation letter to the administrators of secondary schools of various bands, asking them to randomly select one to two classrooms of students to participate in the study. Administrators who agreed to have this research conducted at their schools were sent a letter that explained the study, and an informed consent form for students' parents. Students whose parents signed the consent form were told the purpose and procedures of the research study, and that the data would be confidential and anonymous. They were informed that participation was voluntary and that they could withdraw from the study at any time. They were then asked to sign an assent form if they agreed to participate. Completion of the study's questionnaires took 20–25 min. Participants provided information about their age, gender, family status (e.g. live with parent/ live with single parent), the estimated average amount of time that they spent online per day on weekdays (Monday–Friday) and weekends (Saturday

and Sunday). Then they completed the C-IAT, MLQ, C-IPPA, and DASS-21 scales. To address any confusion or negative feelings following participation, the researcher held a debriefing session to ensure that the students were feeling well; however, none of the participants required further follow-up after the debriefing. All data were entered into SPSS 21 and AMOS for analysis.

5 Results

Each student was asked to offer demographic information as part of the questionnaire. The mean age of the participants was 14.77 years ($SD = 2.2$) and the age range was from 12 to 19. Students reported that they spent an average of 2.9 h per day on the Internet on weekdays and 3.9 h per day on the Internet on the weekend. The IA Test was scored within the possible range of 20–100. In this study, the lowest score was 20, the highest score was 74, the median was 35, and the mean was 36.75. Additionally, 320 (66.8%) students were classified as average Internet users (scores between 20 and 39), 155 (32.4%) showed frequent problems (scores between 40 and 69), and 4 (0.8%) student showed significant problems (scores between 70 and 100). Moreover, all the descriptive statistics are reported in Table 1.

Table 1. Demographic Information Table (N = 479).

Baseline characteristics	Mean	Median	SD	Skewness	kurtosis	Range
1 Internet addiction scores	36.7	35	10.6	.95	.71	54
2 Academic performance (school banding)	1.98	3	.80	.034	-1.44	2
3 Adolescent–Father attachment	84.92	84	17.59	.05	-.35	88
4 Adolescent–Mother attachment	87.74	87	16.8	-.03	-.33	85
5 Age	14.77	15	2.16	-.23	-1.08	8
6 Anxiety	5.53	5	3.89	.67	-.093	18
7 Depression	5.16	4	4.13	.87	.517	20
8 Education level (grade)	3.45	3	1.89	.057	-1.36	5
9. Family status	1.19	1	.67	3.94	15.48	4
10. Gender	1.6		.49	-.40	-1.85	1
11 Meaning in life Presence scores	15.66	16	5.6	-.78	.77	24
12 Time spent online (weekdays)	2.9	2	2.74	2.25	6.78	20
13 Time spent online (weekends)	3.9	3	3.21	1.52	2,81	21
14 Perceived stress level	6.8	7	4.56	.45	-.36	20

Table 2. Correlation Matrix for All Study Variables (N = 479).

1 Internet addiction scores																				
2 Academic performance (school banding)	.25**	1																		
3 Adolescent–Father attachment	-.55**	-.27**	1																	
4 Adolescent–Mother attachment	-.43**	-.17**	.83**	1																
5 Age	.34**	.70**	-.30**	-.25**	1															
6 Anxiety	.33**	.12*	-.26**	-.19**	.18**	1														
7 Depression	.35**	.05	-.25**	-.26**	.15**	.77**	1													
8 Education level (grade)	.35**	.71**	-.27**	-.19**	.91**	.20**	.15**	1												
9. Family status	.14**	.15**	-.12**	-.08	.12*	.06	.08	.08	1											
10 Meaning in life Presence scores	-.29**	-.19**	.31**	.30**	-.12**	-.22**	-.23**	-.11*	-.11*	1										
11 Time spent online (weekdays)	.30**	.08	-.28**	-.29**	.20**	.06	.09	.12**	.13**	-.15**	1									
12 Time spent online (weekends)	.32**	.13**	-.26**	-.27**	.25**	.05	.07	.16**	.17**	-.17**	.79**	1								
13 Perceived stress level	.38**	.30**	-.26**	-.16**	.31**	.79**	.70**	.37**	.06	-.21**	.30	.01	1							

*Correlation is significant at the 0.05 level (2-tailed).

**Correlation is significant at the 0.01 level (2-tailed).

5.1 Correlations of Problematic Internet Use Behaviours

Adolescent–father attachment was significantly negatively correlated with Problematic Internet use, $r(479) = -.55, p < .05$, as was adolescent–mother attachment, $r(479) = -.43, p < .05$. Together, these results show that the more secure the adolescent-parent attachment was, the lower the Problematic Internet use. Meaning in life and Problematic Internet use were also negatively correlated, $r(479) = -.29, p < .05$. The more meaning in life the student experienced, the less the student used the Internet.

The correlation matrix for all variables is presented in Table 2. The correlations were consistent with the hypothesized model shown in Fig. 1.

5.2 Multivariate Predictors of Problematic Internet Use

Based on the results of the bivariate correlations, we next conducted a stepwise multiple regression, in which the score on the Problematic Internet use test was the dependent variable, the meaning in life presence score and adolescent–parent attachment scores (father, mother) were the independent variables. We also included the variables representing hours online (weekdays and weekends), the hypothesized mediators. Other variables that were significantly correlated with Problematic Internet use were included for further evaluation. These variables were scores on the DASS-21 (depression, and stress level), and education level. All the other variables were excluded from the stepwise multiple regression models as they did not contribute significantly to the explained variance.

There was no multicollinearity before running the multiple stepwise regression analysis, the VIFs among the variables were ranged from 1.105 to 3.387. The results showed that adolescent-father attachment significantly predicted Problematic Internet use ($F(1, 477) = 207.9, p < .05, R^2 = .30, R^2_{Adjusted} = .30$), explaining 30% of the variance in IAT scores. In the second steps, stress level was added, and together the variables also resulted in a significant outcome ($F(2, 476) = 135.4, p < .05, R^2 = .36, R^2_{Adjusted} = .36$).

Table 3. Summary of the Stepwise Regression Analyses Predicting Problematic Internet use among Adolescents in Hong Kong (N = 479).

	β	Sig	R^2	R^2 Adjusted
Step 1			.30	.30
Adolescent-father attachment	-.55	.00		
Step 2			.36	.36
Adolescent-father attachment	-.49	.00		
Stress level	.25	.00		
Step 3			.40	.40
Adolescent-father attachment	-.43	.00		
Stress level	.27	.00		
Time spent on internet (weekends)	.20	.00		
Step 4			.42	.41
Adolescent-father attachment	-.41	.00		
Stress level	.22	.00		
Time spent on internet (weekends)	.19	.00		
Educational level (school of year)	.13	.00		
Step 5			.42	.42
Adolescent-father attachment	-.40	.00		
Stress level	.13	.00		
Time spent on internet (weekends)	.18	.00		
Educational level (school of year)	.15	.00		
Depression level	.12	.00		
Step 6			.43	.42
Adolescent-father attachment	-.38	.00		
Stress level	.13	.00		
Time spent on internet (weekends)	.17	.00		
Educational level (school of year)	.15	.00		
Depression level	.11	.00		
Presence of meaning	-.08	.00		

The third steps, time spent on internet (weekends) was added and together the variables also resulted in a significant outcome was found ($F(3, 475) = 105.96, p < .05, R^2 = .40, R^2_{Adjusted} = .40$), explaining 40% of the variance. Additionally, education level was included in the fourth steps and significantly predicted Problematic Internet use ($F(4, 474) = 84.05, p < .05, R^2 = .41, R^2_{Adjusted} = .41$). The fifth steps included depression level as a predictor, and a significant increase in R^2 was found ($F(5, 473) = 69.07, p < .05, R^2 = .42, R^2_{Adjusted} = .42$). In the final model, the presence of meaning score was entered, and the analysis yielded an increase of 0.005 in the R^2 value ($F(6, 472) = 58.71, p < .05, R^2 = .43, R^2_{Adjusted} = .42$). Therefore, presence of meaning was a significant predictor of Problematic Internet use beyond adolescent-father attachment, stress level, depression level, and time spent on the Internet during weekends. The effect sizes of the above variables were ranged from 0.34 to 0.42.

In the full model, these six variables combined explained 43% of the variance in Problematic Internet use. Table 3 summarizes the results of the stepwise multiple regression analysis.

These six significant predictors of IAT were used to create a new, smaller path model than the one that was originally hypothesized. The goodness of fit was tested by composing a measuring model. The goodness of fit values were $\chi^2 = 692, p > .001, \chi^2/df = 2.91, GFI = .903, RMSEA = .061$; the goodness of fit indices satisfied the basis $> .90$, and the RMSEA value satisfied the basis $< .08$ with LO 0.054 and HI 0.071 (see Table 4).

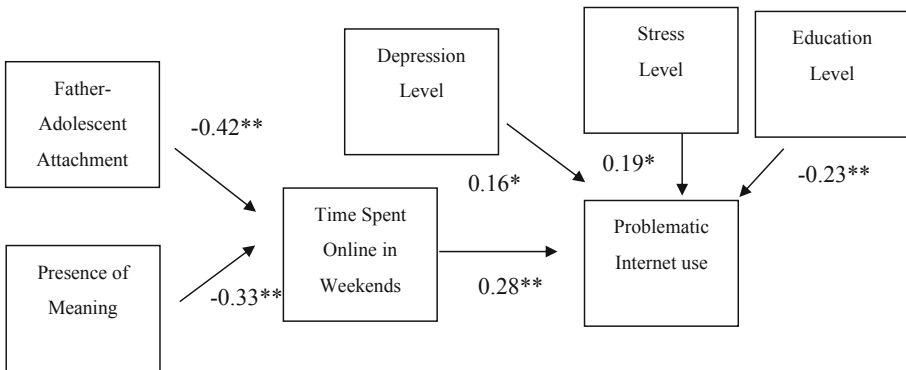


Fig. 2. Final Path Model Showing Significant Predictors of Problematic Internet use. * Correlation is significant at the 0.05 level (2-tailed). ** Correlation is significant at the 0.01 level (2-tailed).

Table 4. Goodness-of-Fit indices for the Final Path Model.

	GFI	RMSEA	SRMR	Hoelter's CN
Acceptable fit threshold	>0.90	<0.08	<0.08	>200
Path Model	0.903	0.061	0.089	203

According to the above results, the final, trimmed model showed that father-adolescent attachment and meaning in life predicted Problematic Internet use, and these associations were mediated by time spent online on weekends. Adolescent depression, stress, and grade were direct predictors of Problematic Internet use. See Fig. 2.

6 Discussion

Previous studies examined PIU and addiction only in terms of individual characteristics, and typically did so by examining only one predictor at a time. This study expands on this earlier work by examining both a systemic variable from the family perspective (adolescent–parent attachment) [15–17] and an individual variable from individual perspective (meaning in life) [38–40] as individual and mutual predictors of PIU. Results based on path analysis showed that adolescent–father attachment and the presence of meaning in life both individually and together predicted PIU, even after controlling for adolescent depression, stress, and grade.

6.1 The Importance of Adolescent–Father Attachment in Problematic Internet Use

Previous research has shown that a secure parent attachment style is negatively correlated with adolescent PIU [11, 12, 34]. In this study, only the adolescent–father attachment predicted PIU. Even though mothers play important roles as the primary caregivers during early childhood, as children grow up, the father’s influence on their children’s behavior and development becomes equivalent to the mother’s [30]. This result is especially interesting in the Chinese context, where there has been a focus on the influence of adolescent–father attachment on adolescents’ Internet use [46]. In Chinese culture, fathers play an important role in the empowerment and preparation of children for the outside world, but in mainland China and Hong Kong, it is common for fathers to live far from their families due to work. In this context, father acted as a playmate with adolescent [58], they may be more likely to seek other forms of attachment playmate figure online. When fathers live far from their families, “adolescents might regard the Internet as their new attachment figure or may seek new attachment figures such as online friendship, through the Internet” [30, p. 634]. Even though mothers play important roles as the primary caregivers during early childhood, as children grow up, the father’s influence on their children’s behaviour and development becomes more important the mother’s [30].

Census and Statistics Department ([59] found that more 0.6 million male employees worked an average of 55 h per week in Hong Kong. That translates to an average of 11 h a day, assuming a five-day working week. The findings regarding father-adolescent attachment are consistent with the findings regarding family status. Our results indicated that adolescents living with both parents spent less time on the Internet when compared to adolescents who did not live with both parents. In traditional Chinese culture, the responsibility for nurturing and educating the child tends to fall on the mother because the Chinese believe that “Men are chiefly responsible for activity in society, while women are responsible for the home” [Lamb, 59, p. 353]. However, the current evidence suggests that fathers are more important than we had expected as influences on adolescents’

Internet use at home not only in terms of time spent with but also in terms of companion as a playmate or a buddy.

Adolescents who have actively involved fathers are more emotionally secure, are more confident in exploring their surroundings, and have better social connections [21]. Lamb [56] indicated that a warm, understanding, and loving child-rearing style has a positive influence on Chinese students' learning outcomes. Lamb [56] also pointed out that Chinese fathers' parenting styles affect their children's verbal expression, motivation for achievement, academic performance, and creativity. Symbolic communication becomes increasingly more important than physical approximate-seeking behavior in later childhood. How fathers play with their children also influences adolescents' emotional and social development. Fathers engage with their children in one-on-one interactions and engage in more playful activities than mothers do. As a result of these interactions, children learn how to regulate their feelings and behaviors [60]. In addition, Lamb [56] noted that, in Chinese culture, fathers have more effect on children's study tactics and motivation than their mothers do. When adolescents do not have secure father attachments, they may turn to the Internet to seek other emotional and social attachments.

In the current study, fathers were more important than we expected as influencers of adolescents' Internet use at home. Subsequently, fathers may consider playing a more active role in the family if they want to avoid their children from being predisposed to PIU. Based on our current findings, therapists might consider inviting fathers to participate in therapy sessions, as the father's participation may create a critical change in the adolescent's PIU.

6.2 The Importance of Meaning in Life for Problematic Internet Use

Previous studies have shown that higher levels of meaning in life are associated with less PIU [13, 18]. Our study examined the presence of meaning and the search for meaning as two aspects of meaning in life [38]. Our results show that only the presence of meaning predicts PIU.

The presence of meaning refers to, the extent to which people comprehend, make sense of, or see significance in their lives, accompanied by the degree to which they perceive themselves to have a purpose, mission, or over-arching aim in life [66, p.43]. The search for meaning means that "people are trying to gain more understanding of the meaning and the purpose of their lives" [40]. Whether or not adolescents are seeking meaning or purpose in their lives does not increase their risk of PIU. Therefore, when adolescents perceive purpose in their lives, they are less likely to become addicted to the Internet.

According to Bonder et al. [63], older adults perform a higher presence of life when compared with adolescents. Thus, the presence of life scores is more important in later life stages. A higher search for meaning in adolescents "was attributed to their active exploration of issues such as personal identity, career and social roles" (64, p. 1043). Since the presence of meaning may play a more important role in adolescents' perceptions of meaning in life, and as a result, may only cause the presence of meaning to influence adolescent PIU.

Steger et al. [40] stated that Chinese and Americans may have different philosophies about the meaning of life compared to people of other cultures. For example, "American

predictions seemed to be based on the prospect of stability and consistency. However, Chinese individuals might possess the presentiment of cyclical change, that current happiness is likely to become sadness soon...happiness and unhappiness are likely to transform into each other” [40, p. 663]. Therefore, the level of the presence of meaning may differ between people from independent cultures and people from interdependent cultures. Inconsistencies between our results and those of other studies may be due to the differences in cultures. Nevertheless, the presence of meaning is an essential element of meaning in life, and our results suggest that adolescents who already perceive their lives as significant and meaningful are less likely to engage in PIU.

6.3 The Path Analysis Model and Problematic Internet Use

The results in our path model are consistent with other research. Our study found that education level was associated with PIU. This outcome matches Shek and Yu’s [2] study, in which they stated that PIU progressively decreases throughout the adolescent years: “The gradual decrease might be due to increased cognitive maturation and engagement in meaningful activities, which attract young people to stay away from Internet addiction” [2, p. 27]. The findings regarding father-adolescent attachment are also similar to those of Tonioni et al. [61], who suggested that Internet addicted adolescents, characterized by many hours spent online and avoiding interpersonal relationships, have poor attachments with their fathers, much like as in this study.

Consistent with Tonioni study, PIU impact the quality of life in adolescents and PIU does not establishing and maintaining relationships with real life people. Tonioni suggests that future study should be aimed at finding a psychopathological basis to this behavior [61]. As a result, current studies found that in addition to meaning in life and father-adolescent attachment, depression and stress also predicted PIU; these findings coincide with the argument that the loss of interest in interacting with real people and psychological symptoms such as depression could be appropriate markers for distinguishing typical Internet use from PIU [61].

Instead of using an individual perspective to understand the causal factors in PIU, we wanted to broaden the view by assessing the interrelationships among individual factors, family factors, and PIU. The outcome shows that no single perspective explains adolescent PIU. The path model provides a comprehensive view from which to understand which factors affect adolescent PIU.

Our conceptualization was one in which individual and family factors predict PIU. However, research also suggests that these factors could be the consequence, rather than the cause of problems with Internet use. Young and Abreu [24] reported that excessive Internet use disrupts many aspects of adolescents’ daily lives, significantly and negatively affecting their relationships. Chou et al. [62] and Gu [50] demonstrated that PIU is associated with a reduction in family communication and the size of the user’s social network. Moreover, the longer the period of PIU, the higher the number of conflicts between adolescents and their parents, making PIU-based problems more difficult to resolve over time. Meaning in life and PIU might also be correlated. Since a lack of meaning in life enhances proneness to boredom and feeling of emptiness [41], adolescents with low meaning in life may be more at risk for excessive Internet use as an escape from unhappy circumstances [24]. Finally, although low meaning in life may

predict PIU, PIU may paradoxically predict an increase in meaning in life by providing opportunities for success that adolescents might not otherwise be able to obtain. However, this success may be at the cost of healthy functioning in the real world.

7 Limitations and Future Research

Several limitations may have affected the results of this study. First, the results were based on self-reported data, which are subject to bias due to social desirability [51]. Future studies should include information reported by parents and peers. Another limitation is that the data are cross-sectional and therefore “developmental” interpretations cannot be made. Future research should use longitudinal data to investigate intent to use the Internet and the various outcomes of interest, as well as the inter-correlations among these outcomes. Finally, the results of this study are based on an examination of urban Hong Kong secondary school students aged 11–19 years. The outcomes may not be valid for other countries, rural adolescents, adolescents not attending school, or persons outside the age range of 11–19 years.

7.1 Recommendations for Prevention and Treatment

Multiple regression analyses showed that adolescent-father predicted PIU, as did lower presence of life meaning. The results have implications for the prevention and treatment of PIU. Future researchers might consider assessing the effectiveness of family therapy to help adolescents engaged in PIU. Because the different studies showed evidence-based treatments for adolescent PIU, for which the most effective are family therapy, which can solve family-of-origin issues and improve communication patterns might be beneficial in treating PIU [64, 65]. The results also suggest that if we want to reduce the level of adolescent PIU, instead of simply seeking to change adolescents’ immediate behavior, a therapist may also need to consider helping youth develop a strong sense of meaning in life, including a sense of well-being, identity, and purpose.

8 Conclusions

This study used a multivariate approach to test whether adolescent–parent attachment and meaning in life could predict adolescent PIU. Both father-child attachment and meaning in life significantly predicted PIU after accounting for Internet hours of use, education level, and psychological distress. This study is a major step towards understanding the individual and systemic variables that may play a role in the development of Problematic Internet use.

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The data were collected, coded, and analyzed by Fung Chin, after collaborating with Chi Hung Leung to develop the study design. Fung Chin wrote the manuscript, and Chi Hung Leung provided valuable feedback on the writing.

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