ORIGINAL RESEARCH

Internet Use Behavior and Adolescent Mental Health: The Mediating Effects of Self-Education Expectations and Parental Support

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Purpose: This study focuses on how Internet use behavior affects adolescents' mental health and whether self-education expectations and parental support mediate the relationship between Internet use behavior and adolescents' mental health.

Methods: The data for this paper came from the results of the student questionnaire of the 2018 Programme for International Student Assessment (PISA 2018), which was a structured questionnaire that asked students about their family situation, school life, studies, internet use, and mental health, among other things. A sample of 336,600 children in grades 7–13 was selected for this study. The data were analyzed using STATA version 16 and the theoretical framework was tested using a mediated effects model.

Results: The results of the study showed that Internet use behavior made a positive contribution to mental health and the mediating effects of self-education expectations and parental support on the relationship between Internet use behavior and adolescent mental health were all significant.

Conclusion: It is recommended that appropriate policies should be formulated to help adolescents use the Internet rationally, and the positive effects of parental support and self-education expectations should be utilized.

Keywords: adolescent, mental health, internet use, self-education expectations, parental support

Introduction

The Internet has become an indispensable part of people's studies, work, and life, due to the widespread use of Internet technology, and this is particularly true for the youth. In 2022, 75% of the world's 15–24 year olds will use the Internet, ten percentage points higher than the rest of the population. In all regions of the world, 15–24 year olds are more connected than older or younger age groups.[1] According to a report by the United Nations Children's Fund (UNICEF) and the International Telecommunication Union (ITU), 33% of school-age children (3–17 year olds) would have access to the Internet at home globally between 2010 and 2020, which meant that by 2020, one in three school-age children would be an Internet user. The proportion of children with access to the Internet at home is directly related to the income of the country in which they live, with 86% of school-age children in high-income countries having access to the Internet at home, 60% in middle-income countries, 14% in lower-middle-income countries, and only 6% in low-income countries.[2]

Advances in Internet technology continue to change the way individuals live, work, play, and socialize; although technological advances have made access to information and communication easier, psychological problems associated with Internet overuse continue to increase.[3] Internet technology also affects minors, and digital media are integrated into the daily lives of adolescents. The Internet has potential benefits for their learning, physical and mental health, and social life,[4,5] as well as potential risks to adolescents' mental health status. A study based on 11 European countries showed that adolescents' "Pathological Internet Use" was 4.4%, with some variation by country and gender, and adolescents who lacked emotional and psychological support were at highest risk.[6] Smartphone use is one of the top contributing factors to internet addiction,[7] and the intensity of social media use has been associated with a decline in adolescent mental health.[8]

Some studies have focused on the mechanisms of action affecting the relationship between Internet use and mental health, such as the effect of parental depression on adolescent cyber-addiction, mainly through adolescent stress,[9] and the mediating role of health anxiety between neuroticism and information seeking.[10] While some studies have further explored social media use in the context of Internet use, little is known about the role of parental support in social media use and adolescent depression and anxiety. The role of parents in this association is necessary,[11] and may impact adolescent mental health.[12]

The impact of the Internet on adolescent mental health has received extensive attention from researchers, and most existing studies have simply explored the relationship between Internet use and adolescent mental health. However, little attention has been paid to the mediating mechanisms between the two. This study focused on the relationship between adolescents' Internet use behaviors, self-education expectations, parental support, and mental health.

Literature Review

Internet Use and Adolescent Mental Health

Many studies on Internet use and adolescents' mental health focus on two aspects: first, the impact of Internet use on mental health, including "Negative Impact", "Positive Impact" and "No Impact"; and second, the theoretical explanation of this effect, including the displacement explanation, social compensation theory, and the "Downward Spiral".

The "Negative Impact Theory" suggests that Internet use is negatively correlated with adolescent mental health in general. For example, compulsive Internet use, excessive Internet use, and smartphones can lead to a deterioration in mental health.[13,14] Increased Internet technology use can lead to anxiety in adolescents[15,16] and increase the chances of depression.[17,18] There are also studies focusing on Internet use and individual traits of adolescent mental health, such as gender differences and high-trait procrastination.[19,20]

The "Positive Impact Theory" suggests that Internet use has a positive impact on adolescent mental health. For example, it has been argued that the positive and negative aspects of social media use need to be rationally assessed.3 The use of social media can be a useful way to promote adolescent mental health,[21] and the Internet offers many potential benefits for promoting adolescent health,[22] through acquiring knowledge and finding information which predicts a healthy lifestyle for adolescents.[23]

The "No Effect Theory" suggests that there is no effect of Internet use on adolescent mental health; Jensen et al's findings do not support the notion that adolescent use of digital technology is associated with elevated mental health symptoms.[24] Holtz and Appel suggest that there is neither a correlation between Internet use and social anxiety nor an association between them.[25]

There are three theoretical hypotheses as to why Internet use affects mental health. The displacement explanation suggests that adolescent Internet use reduces the amount of time spent on real-world activities, which are conducive to mental health.[26] The social compensation theory suggests that the use of technology, such as the Internet, can compensate for deficits in social skills among young people with mental health problems.[27,28] There is a "Downward Spiral" between adolescents' avoidance behaviors and Internet use, with avoidance leading to poorer mental health, and poorer mental health leading to more avoidance behaviors.[29]

Internet Use and Expectations

Educational expectancy is related to Internet use. Research on the relationship between adolescent Internet use and expectations has explored both the direct relationship between the two variables and the intermediate mechanisms.

Students with lower expectations tend to spend more time playing computer games.[30] This is supported by a study that found a direct link between positive expectations about video game use and the time spent playing,[31] while negative emotions resulting from excessive Internet use are tied to personal expectations.[32]

Turning to the role of parents or in terms of intermediate mechanisms, high parental expectations in Chinese children hinder excessive screen use and encourage sedentary behavior related to academics.[33] Parental expectations also play a mediating role in the connection between problematic Internet use and parental involvement.[34] Additionally, maladaptive thoughts stemming from parental expectations about academics influence how well adolescents can control their

online social interactions.[35] Notably, the impact of online expectations on online addiction surpasses the effects of attitudes toward online gaming and online socialization. Therefore, the study indicates a higher indirect effect of online expectations on online addiction compared to other factors.[35]

Educational Expectations and Adolescent Mental Health

Educational expectations are specific values determined by the perceived reality faced by an individual, often considering their personal abilities and other limitations.[36] There are two competing conclusions in research on educational expectations and adolescent mental health: first, educational expectations have a negative impact on adolescent mental health, and second, educational expectations do not affect adolescent mental health.

Existing research focuses on two manifestations of educational expectations that affect mental health. First, educational expectations that were either too high or too low affected adolescents' mental health. Excessive parental expectations are responsible for achievement-related mental health problems.[37] Lower educational expectations in adolescence are associated with a higher risk of depression at the age of 40.[38] Second, discrepancies in educational expectancies can lead to mental health problems among adolescents. Adolescents with aspiration-expectation discrepancy show more anxiety and mood problems,[39] and this discrepancy reduces the well-being of secondary school students.[40] Chinese children whose aspirations exceed expectations show lower self-esteem and higher rates of depression.[41] Left-behind children have worse mental health when their parents' educational expectations are higher than children's educational expectations.[42]

Some studies deny the impact of educational expectations on adolescent mental health; for example, Reynolds and Baird found that adults who did not meet their early educational expectations did not suffer psychological consequences.[43] Research also showed that young women who become mothers experience less of an impact of educational expectations on mental health.[44]

Internet Use and Parental Support

Parental support has been defined as "Parental praise, encouragement, and physical affection that shows a child that he or she is accepted and loved".[45] Research on the relationship between Internet use and parental support has yielded three conclusions: one is the positive effect of parental support on adolescent Internet use, the second is the inhibitory effect of parental support on problematic Internet use, and the third is that the variables of Internet use and parental support are affected by transmission mechanisms.

In terms of positive effects, parents in the fast-paced context of technology are particularly concerned about how to support their children through digital learning.[46] Adolescents who received more family support had a lower risk of going online.[47] Parental support is closely related to adolescents' computer self-efficacy.[48] Children from higher socioeconomic backgrounds received slightly more supervision than those from poorer families.[49]

In terms of negative effects, parental support is one of the factors negatively associated with the tendency toward smartphone addiction,[50] with an increasing number of children using the Internet without adult supervision,[51] and a lack of parental emotional support being significantly associated with an increase in online gaming disorders and problematic cell phone use.[52]

Regarding the transmission mechanisms, parental support increases adolescent self-esteem, which negatively affects problematic adolescent smartphone use.[53] How parents deal with misbehavior is a significant predictor of excessive Internet use in late adolescence, with the direction of the association depending on the type and frequency of discipline.[54] When parental support was negatively associated with problematic Internet use, filial piety mediated this relationship.[55]

Parental Support and Adolescent Mental Health

This research on parental support and adolescent mental health has two main objectives: first, to demonstrate the importance of parental support for adolescent mental health from both positive and negative perspectives, and second, to explore the mechanisms between parental support and adolescent mental health.

The first objective highlighted the importance of parental support. This positive view suggests that parental support is beneficial for adolescent mental health. Higher levels of parental support are associated with lower levels of depression.[56] Greater parental support is negatively associated with adolescent mental stress.[57] Parental support can moderate the

effects of stressful conditions on the mental health of adolescent sexual minorities,[58] and protect transgender adolescents from depression.[59] The contrasting view is that adolescents are at a high risk of mental health problems if parental support is inadequate.[60] A lack of emotional support is associated with poorer psychosocial functioning in children.[61] The lower the level of parental support perceived by the child, the higher the risk of mental health problems.[62]

The second objective was to explore the mechanisms of action between parental support and mental health. This mechanism focuses on the fact that parents support adolescents' increasing independence by expressing concern for their children,[63] which helps reduce their emotional distress.[64] The relationship between parental support and adolescent mental health problems is influenced by other variables, such as parental unemployment affecting parental support for adolescents and the reduced protective effect of parental support on health.[65] School climate mediated the relationship between parental support and students' psychological complaints.[66]

Research Hypotheses

Family Systems theory posits that the family is a hierarchically organized system comprised of smaller subsystems (eg, parents, marriage, and siblings) but also embedded in larger systems (eg, community) in which mothers, fathers, and children interact with each other.[67] The Self-Discrepancy theory refers to the idea that individuals have an ideal self and an actual self,[68] and that differences between the two self-statements are associated with poor mental health outcomes.[69,70]

Regarding the relationship between Internet use and mental health, there are many valuable studies on the relationship between educational expectations and adolescent mental health, and the relationship between parental involvement and adolescent mental health. However, existing studies have focused more on the negative effects of problematic Internet use on adolescent mental health, ignoring the fact that Internet use behaviors may positively affect adolescent mental health. In addition, few studies have explored whether other mediating factors influence the relationship between Internet use behavior and adolescents' mental health, including parental support and self-education expectations.

According to these two theories and existing research, Internet use behavior is only one of the many factors affecting adolescent mental health, and in addition to its direct influence, self-education expectations and parental support may be mediating factors for both variables of Internet use and adolescent mental health. Whether self-education expectations and parental support are affected by Internet use, thereby reducing or strengthening the intensity of the Internet's influence on adolescent mental health, is an issue worth exploring. To fill the gaps in existing studies, we developed the following mediating effect model (Figure 1):

To examine the relationship between Internet use, parental support, self-education expectations, and adolescent mental health, we proposed the following theoretical hypotheses based on the research framework:
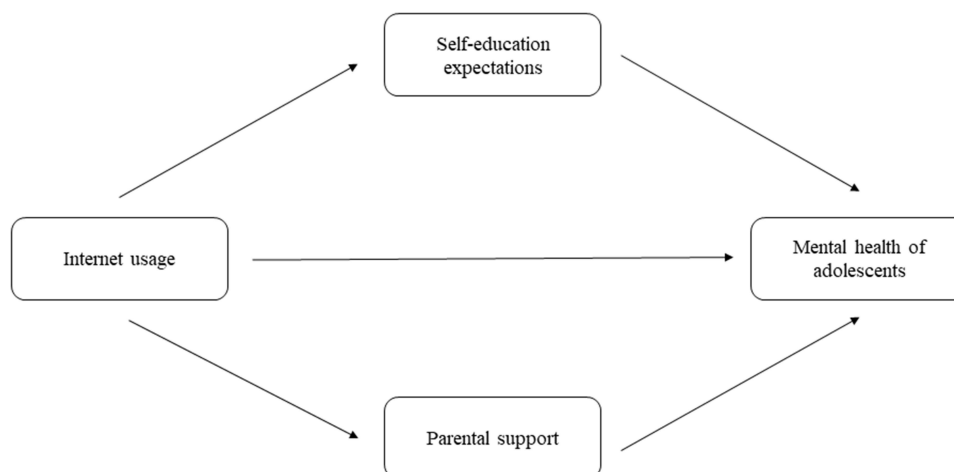

Figure 1 Conceptual framework.

H1: Internet use behaviors have a positive impact on adolescents' mental health.

H2: Higher Internet use behaviors by adolescents lead to higher self-education expectations. Self-education expectations mediate the relationship between Internet use behavior and adolescents' mental health.

H3: Parental support plays a mediating role between Internet use behavior and adolescents' mental health.

Data, Variables and Methods
Data
The data for this study came from the PISA 2018 data of the Organization for Economic Co-operation and Development. The Program for International Student Assessment (PISA) was developed by the Organization for Economic Co-operation and Development (OECD) and is currently one of the world's most influential and wide-ranging assessments of international student learning; it aims to measure the readiness of students near the end of compulsory education to meet the challenges of today's knowledge society. PISA2018 administers questionnaires in 79 countries and economies and assesses school students in grades 7–13, with sample sizes ranging from 4500 to 10,000 students in each country and economy. Student questionnaire data were used for this study, and 336, 600 student questionnaire responses were selected from the final sample. The study received ethics approval for survey and behavioral research from the Survey and Behavioral Research Ethics Committee, School of Sociology and Population Studies, Nanjing University of Posts and Telecommunications (Ethics approval number: 803/SBREC/SSPS/NJUPT/2023). Informed consent was obtained from the respondents, and the questionnaire stated that the responses were anonymized, and therefore, the respondents could not be personally identified.

Measurement
Dependent Variables
The PISA questionnaire measures the mental health status of adolescents using a four-level Likert scale entitled "Think about yourself and how you usually feel: how often do you feel the way you describe below?" The scale measures the frequency of occurrence of the following emotions: "scared, miserable" for negative emotions, "happy, lively" for positive emotions, etc. The options in the scale are "never, rarely, sometimes, always". Positive emotions were coded positively, whereas negative emotions were coded negatively. Positive indicators were assigned the following values: never =1, rarely =2, sometimes =3, always =4. All negative indicators were assigned the following values: never =4, rarely =3, sometimes =2, always =1. We summed the frequencies of various emotions to synthesize the mean value for the indicator of mental health status. The respondents' scores for mental health status were in the range of one to four. The higher the respondents' scores, the better their mental health status.

Independent Variables
The core independent variable of this study is "internet use behavior" and the frequency of Internet access is used to measure this variable. Related questions in the questionnaire are "How often do you participate in the following activities: reading emails, chatting online, reading online news, and participating in online group discussions or forums?" Each of these activities contains the following options, which are assigned the values: I do not know what it is =0; Never or almost never =1; Several times a month =2; Several times a week =3; Several times a day =4. Summing up these options and taking the average, the respondents' scores of Internet use were between one and five; the higher the number, the higher the frequency of Internet use.

Mediating Variables
One of the mediating variables is self-education expectations, which is usually measured by asking adolescents the highest number of years of education they wish to obtain in school.[71] This study measured adolescents' self-education expectations with the question, "Which of the following do you hope to accomplish?" The measurement of self-education expectations in the questionnaire was based on the International Standard Classification of Education (ISCED) of 2011 developed by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The response options

and the assigned values, from lowest to highest, were none =0, ISCED level 2 =1, ISCED level 3B or C =2, ISCED level 3A =3, ISCED level 4 =4, ISCED level 5B =5, ISCED level 5A, or 6 =6. The respondents' self-education expectation scores range from 0–6, and the higher the score, the higher their expectations.

The second mediating variable was parental support, which was measured by the question, "To what extent do you agree or disagree with the following statements this school year: 'My parents support my academic endeavors and grades.' 'My parents support me when I have trouble at school.' 'My parents encourage me to be confident'". The options are "strongly disagree", "disagree" "agree" and "strongly agree" each assigned the following values "strongly disagree =1" "disagree =2" "agree =3" "strongly agree =4". The scores for the three questions were totaled and averaged, and the respondents' scores for parental support were in the range of one to four, with higher values indicating stronger parental support.

Control Variables

There are several control variables in this study: gender (female= 0, male=1), grade level, immigration status (non-immigrant=0, immigrant=1), parental education level, and family educational resources. Parental education level was defined as the highest level of education among the parents and assigned the following values: Did not complete =1; ISCED level 1 =2; ISCED level 2 =3; ISCED level 3B or 3C =4; and ISCED level 3A =5. Home educational resources were measured using the following seven items: the availability of a desk, a quiet study space, a computer for doing homework, classical literature, teaching aids, dictionaries, art books, etc; yes =1, no =0; and the seven items were accumulated to obtain the total score.

Statistical Analysis

This study used Stata16 for empirical analysis as follows: First, descriptive statistics of the main variables were conducted. Second, a baseline regression analysis of the effects of Internet use on adolescents' mental health was conducted. Third, a mediation effect model was used to test the mechanism of self-education expectations and parental support in the influence of Internet use on adolescents' mental health. Fourth, to explore the influence of adolescents' family economic conditions, a heterogeneity analysis was conducted based on the baseline regression.

Results

Descriptive Statistical Results

The mean value of the participants' mental health status was 2.974 (SD=0.452), the mean value of the frequency of Internet use behaviors was 3.609 (SD=0.718), the mean value of self-education expectations was 5.048 (SD=1.432), and the mean value of parental support was 3.292 (SD=0.717); for more detailed descriptive statistics, please refer to Table 1.

Results of Model Testing

Table 2 presents the baseline regression model results. The results of Model (1) show that without adding other variables, ordinary linear regression of adolescents' mental health with Internet use is significantly positive at the 1% level, implying that the higher the frequency of Internet use, the better the mental health of adolescents (β=0.042, P<0.01). Model (2) adds control variables to Model (1) with the direction of the coefficients unchanged, implying that after controlling for variables such as gender, grade level, migration, parents' education, and family education resources, the positive effect of Internet use on adolescents' mental health is still significant (β=0.039, P<0.01). Models (1) and (2) both control for country-fixed effects; the direction of the coefficients remains the same, and the conclusions are somewhat robust. The results in Table 2 validate H1, indicating that Internet use positively contributes to adolescents' mental health.

In this study, three approaches were used to conduct robustness tests. The first approach was to replace the ordinary linear regression model with an ologit model by converting the rounded mental health scores in the dependent variable to a four-point scale of 1–4. We then converted the original continuous mental health variables to discrete variables (1, 2, 3, 4), and used the ologit model to conduct a robustness test, as shown in Model (3). The second approach was to replace the ordinary linear regression model with a oprobit model, while still converting the original continuous mental health variables to discrete variables (1, 2, 3, and 4) and using the oprobit model to perform a robustness test, as shown in model

Table 1 Descriptive Statistics of the Sample

Variables	Observed Value	Average Value	Standard Deviation	Minimum Value	Maximum Values
Adolescent mental health	336,600	2.974	0.452	1	4
Internet usage	336,600	3.609	0.718	1	5
Self-education expectations	336,600	5.048	1.432	0	6
Parental support	336,600	3.292	0.717	1	4
Gender[a]	336,600	0.483	0.500	0	1
Grade	336,600	9.646	0.669	7	13
Immigration[b]	336,600	0.931	0.254	0	1
Mother's education	336,600	4.188	1.070	1	5
Father's education	336,600	4.148	1.056	1	5
Family education resources	336,600	5.474	1.455	0	7

Notes: [a]1=male, 0=female; [b]1=immigration, 0=non-immigration.

Table 2 Benchmark Regression Model

Models	(1)	(2)
Variables	**Mental Health Status**	**Mental Health Status**
Internet usage behavior	0.042*** (0.001)	0.039*** (0.001)
Gender		0.133*** (0.002)
Grade		−0.010*** (0.001)
Immigration		0.037*** (0.003)
Mother's education		−0.003*** (0.001)
Father's education		0.000 (0.001)
Family education resources		0.018*** (0.001)
Nation FE	YES	YES
Observations	336,600	336,600
Adjusted R-squared	0.004	0.046

Notes: ***$p<0.01$; () represents the standard deviation.

(4). The third way was to replace the independent variable of Internet use behavior with Internet political participation, which includes behaviors such as donating money, signing petitions, and contacting politicians.[72] This study used the questions "Do you participate in the following activities: I sign environmental or social petitions online, I keep up to date

with world events through Twitter or Facebook, I often visit websites about international social issues (eg, poverty, human rights)". The options for these three questions were assigned as yes =1 and no =0, and the values of the three questions were summed up to 0, 1, 2, or 3, which represent the frequency of political participation on the Internet from low to high, respectively. The results are shown in Model (5) using an ordered regression model. The robustness test results in Table 3 indicate that Internet use behavior significantly promotes mental health, confirming the robustness of the regression results of the benchmark regression model.

The above results show that adolescents' Internet use behavior has a significant positive effect on their mental health, but different family economic conditions may influence this process differently. Therefore, based on the baseline regression model, the researchers further conducted a sub-sample regression taking into account different family economic conditions to explore the heterogeneity of the impact of adolescents' Internet use behavior on their mental health under different family economic conditions. Table 4 presents the empirical results of the heterogeneity analysis in the form of sub-samples. The results of the heterogeneity analysis of Models (6)–(8) indicate that the degree of mental health promotion by Internet use is inversely proportional to family economic conditions, which implies that the economically disadvantaged group benefited more from Internet use than youths with better family economic conditions. A possible explanation for this is that better-off families have more resources at their disposal, and youth are more likely to receive mental stimulation from a number of different channels, such as socialization and consumption, whereas less well-off families rely more on the Internet as a lower-threshold way to receive more positive feedback.

Table 3 Robustness Test

Models	(3)	(4)	(5)
Variables	Adolescent Mental Health	Adolescent Mental Health	Adolescent Mental Health
Internet usage behavior	0.166*** (0.006)	0.086*** (0.003)	
Political participation on the Internet			0.017*** (0.003)
Gender	0.623*** (0.008)	0.326*** (0.004)	0.133*** (0.002)
Grade	−0.037*** (0.007)	−0.019*** (0.004)	−0.008*** (0.001)
Immigration	0.155*** (0.017)	0.083*** (0.009)	0.020*** (0.003)
Mother's education	−0.017*** (0.005)	−0.009*** (0.002)	−0.000 (0.001)
Father's education	−0.003 (0.005)	−0.001 (0.002)	0.003*** (0.001)
Family education resources	0.079*** (0.003)	0.042*** (0.002)	0.024*** (0.001)
Nation FE	YES	YES	YES
Observations	336,600	336,600	336,286
R-squared	0.0231	0.0229	0.081

Notes: ***p<0.01; () represents the standard deviation.

Table 4 Heterogeneity Analysis

Models	(6)	(7)	(8)
Variables	**Less Favorable Economic Conditions**	**General Economic Conditions**	**Better Economic Conditions**
Average hours of Internet use	0.068*** (0.013)	0.039*** (0.001)	0.031*** (0.003)
Gender	0.104*** (0.021)	0.124*** (0.002)	0.164*** (0.003)
Grade	−0.006 (0.011)	−0.010*** (0.001)	−0.013*** (0.003)
Immigrant	0.135** (0.054)	0.022*** (0.004)	0.067*** (0.007)
Education of_mother	−0.012 (0.009)	−0.003*** (0.001)	−0.005** (0.002)
Education of_father	−0.005 (0.009)	0.001 (0.001)	−0.002 (0.002)
Educational_resources	0.034*** (0.007)	0.018*** (0.001)	0.016*** (0.001)
Nation FE	YES	YES	YES
Observations	1940	257,239	77,419
Adjusted R-squared	0.131	0.037	0.088

Notes: ** $p<0.05$, *** $p<0.01$; () represents the standard deviation.

Table 5 presents the results of the mediated-effects model. Model (9) was used to test the effect of Internet use behavior on adolescent mental health. The results show that the positive effect of Internet use behavior on adolescents' mental health is significant (β=0.039, $P<0.01$). Model (10) was used to test the effect of Internet use behavior on

Table 5 Test of the Mediating Effect of Self-Education Expectations and Parental Support

Models	(9)	(10)	(11)	(12)	(13)
Variables	**Adolescent Mental Health**	**Self-Education Expectations**	**Adolescent Mental Health**	**Parental Support**	**Adolescent Mental Health**
Internet usage	0.039*** (0.001)	0.154*** (0.004)	0.038*** (0.001)	0.102*** (0.002)	0.024*** (0.001)
Self-education expectations			0.007*** (0.001)		
Parental support					0.152*** (0.001)
Control variable	Yes	Yes	Yes	Yes	Yes
Nation FE	Yes	Yes	Yes	Yes	Yes
Observations	336,600	336,600	336,600	336,600	336,600
Adjusted R-squared	0.046	0.131	0.047	0.052	0.102

Notes: *** $p<0.01$; () represents the standard deviation.

adolescents' self-education expectations. The results showed that the positive effect of Internet use behavior on adolescents' self-education expectations was significant (β=0.154, P<0.01). Model (11) tested the effects of self-education expectations on adolescents' mental health. The results showed that the positive effect of self-education expectations on adolescents' mental health was significant (β=0.007, P<0.01). The coefficients of Models (10) and (11) are all positive, and the mediating effect of self-education expectations on adolescents' Internet use behavior and mental health is significant, which verifies the theoretical hypothesis of H2.

Model (12) in Table 5 was used to test the effect of Internet use behavior on parental support. The results show that the positive effect of Internet use behavior on parental support is significant (β=0.102, P<0.01). Model (13) was used to test the effects of parental support on adolescents' mental health. The results showed that the positive effect of parental support on adolescent mental health was significant (β=0.152, P<0.01). The coefficients of Models (12) and (13) are positive, and the mediating effect of parental support on adolescents' Internet use behavior and mental health is significant, verifying hypothesis H3.

Discussion

Our study used PISA2018 data to validate the positive effects of Internet use behavior on adolescent mental health. This study identified a research gap by examining the mediating effects of self-education expectations and parental support on the relationship between Internet use behavior and adolescent mental health and established a new conceptual framework to bridge this gap. In addition, Internet use behavior positively influenced self-education expectations, while self-education expectations and parental support exerted a mediating effect between Internet use behavior and adolescent mental health.

H1 was validated, indicating that adolescents' mental health is associated with the frequency of Internet use behavior, a finding that is inconsistent with the "Negative Impact Theory" and more consistent with the "Positive Impact Theory". The relationship between Internet use and mental health is not U-shaped, as postulated by existing research.[73] This discrepancy in results may be due to differences in the content of Internet use among adolescents. In this study, Internet use behaviors such as reading emails, chatting, reading the news, participating in online group discussions or forums, and searching for practical information on the Internet were healthy lifestyle choices for adolescents.[23] These behaviors are completely different in nature from the content of problematic Internet use, such as online gambling and games. Therefore, when exploring the relationship between adolescents' mental health status and Internet use, not only is it important to examine the intensity of adolescents' use of the Internet, but there also needs to be a further breakdown of the types of use and the Internet content they are exposed to, and an assessment of the positive and negative impacts of adolescents' use of the Internet.[3] Moderate use of digital technology is not inherently harmful, and in the interconnected world may be beneficial.[5] These benefits include avenues for communication, creativity, and development.[4]

The theoretical hypothesis of H2 was validated by the empirical data in our study, in which self-education expectations played a mediating role in the relationship between Internet use behaviors and adolescent mental health. More Internet use behaviors affect educational expectations, and the more positive Internet use behaviors adolescents have, the more information they are able to access through the Internet, which helps broaden their horizons and leads to higher educational expectations. This finding is at odds with Holloway et al's study, which concluded that educational expectations are directly related to a child's academic performance,[74] and that Internet overuse may be a cause of academic burnout,[75] which in turn lowers educational expectations. Different purposes for Internet use can lead to different psychological states, and it is important to consider the content of Internet use. Previous studies may have focused more on "Problematic Internet Use" (eg, Internet addiction, Internet gambling, etc), which may affect academic performance more,[76] which in turn reduces educational expectations. In the present study, Internet use behaviors were found to have a positive effect on self-education expectations, as Internet use behaviors were more positive in this study, thus positively affecting both mental health and self-education expectations. Online learning and working had a positive effect only on cognitive functioning and were not significantly related to depression levels.[77]

H3 tested the hypothesis that parental support exerts a mediating effect on Internet use behavior in adolescents' mental health. This finding is consistent with existing research, in which parental support was negatively associated with children's despair and depressive symptoms.[78] For adolescent children, parental support should also encompass how to

properly guide and supervise their Internet use. Parental mediation theory suggests that parents utilize different interpersonal communication strategies to mediate and mitigate the negative impact of the media on their children's lives.[79] A helpful role that parents can play in adolescent Internet use is to provide resources.[80] Parents should prioritize the creation of a caring and supportive atmosphere in the home that encourages children to disclose and self-regulate to prevent the onset of Internet Gaming Disorder (IGD) symptoms,[81] and reduce the negative impact of problematic Internet use on adolescents' mental health.

Conclusion

This study tested the Family Systems and Self-Discrepancy Theories, proved that Internet use behavior can have a positive effect on adolescent mental health, and established a new theoretical framework to explain the relationship between Internet use behavior, parental support, and adolescent mental health. This study has both theoretical and practical implications.

In terms of theoretical value, our findings support Family Systems and Self-Discrepancy theories. This finding implies that two variables, parental support and self-education expectations, mediate the effect between Internet use behavior and mental health. This finding provides theoretical support for future research and helps to further explore the effects of Internet use on mental health.

In terms of practical significance, Internet use in the digital era is an unavoidable behavior for adolescents, and effective measures need to be taken for Internet use to play a positive role and enhance adolescents' mental health. First, appropriate policies should be formulated to help adolescents to rationally use the Internet. For example, parents should be educated about the risks of online activities, and the criteria for dangerous and pathological use of the Internet should be identified. These criteria should be adopted in the Internet game rating system.[82] Internet companies must guide adolescents appropriately through technological means to use the Internet to improve their mental health. For example, a fantasy role-playing game (SPARX) based on CBT for depression is no less effective in treating depression than a therapist-led CBT program.[83] Second, parental support and self-education expectations played positive roles. From the perspective of Family Systems theory, parental support is valuable because it is negatively associated with problematic Internet use.[52] Parents should pay attention to their children's Internet use behaviors to enhance their mental health. Parental support can help adolescents develop emotionally close relationships with their parents, which contributes to their positive academic representations of themselves.[84] Parental support helps adolescents establish reasonable educational expectations and reduces adverse mental health outcomes. For those who are depressed because of the discrepancy between their ideal and real selves, clinicians can encourage helpers to change their selves.[70]

There are some limitations to this study. First, the age limitation of the sample group, with only data from adolescents in grades 7–13 in each country, so subsequent studies will have to further validate whether data from adolescents in other age groups are consistent with this theoretical hypothesis. Second, the data of this study are limited to 2018 only, and the consistency of the findings in the long term must be verified; the next step needs to be further explored by tracking the data over multiple years. Third, since the sample of this study's data did not report Internet use problems such as Internet addiction and Internet pornography, the relationship between exposure to negative information such as Internet pornography and adolescents' mental health could not be verified; further in-depth research on this relationship is expected.

Data Sharing Statement

The data can be found at https://www.oecd.org/pisa/.

Disclosure

The authors declare that this study was conducted in the absence of any commercial or financial relationships that could be construed as potential conflicts of interest.

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