Online activities as risk factors for internet addiction among students in Bahir Dar University, North West Ethiopia: Hierarchical regression model

Kerebih Asrese  kerebih2000@yahoo.com
Bahir Dar University
Corresponding Author

Habtamu Muche
Wodya University

DOI:
10.21203/rs.2.14939/v1

SUBJECT AREAS
Health Policy

KEYWORDS
Online activities, Internet addiction, Students, Bahir Dar University
Abstract

Introduction: Internet addiction among the youth has become a public health concern. It leads to impairments in several aspects of life. Previous studies identified individual and environmental risk factors for internet addiction. The effect of online activities on youth internet use behavior is not well investigated. This study assessed the prevalence of internet addiction and determined the roles of online activities for internet addiction among students in Bahir Dar University.

Methods: Data were collected from 812 randomly selected undergraduate regular program students recruited from 10 departments. Participants completed a pre-tested structured questionnaire.

Results: The results indicated that 35.2% of students were classified as being addicted to the internet. The four most important online activities students engaged on the internet are social networking (75.5%), entertainments (73.6%), academic works (72.5%), and online game (60.8%). Including online activity variables improved the explanation of internet addicted behavior over the individual and environmental attributes. Online activities explained 48.4% of the variance in internet addiction. Students who did not use the internet for social networking (AOR = .11; 95% CI: .06 - .21) and online game (AOR = .31; 95% CI: .21 - .46) were less likely to be internet addicted.

Conclusions: Our findings revealed that more than one third of the participants were addicted internet users. Online activities better predict students’ addicted internet use behavior than individual and environmental attributes. Thus, university authorities and other concerned bodies need to be aware of the prevalence of IA and introduce regulatory mechanisms to limit the usage of potentially addictive online internet applications and promote responsible internet use behavior.
Background

In the contemporary world, the internet is becoming an important part of daily people's life [1]. It is widely used in diverse areas of life such as education, academic activities and research, information exchange, interpersonal communication, commerce, science, and entertainment [2]. Internet becomes available and affordability at homes, schools, colleges, libraries, and Internet cafes [3]. Recently, the prevalence of internet users has increased rapidly, with the current estimated world's number of internet users in 2019 is 4.3 billion [4]. In Ethiopia, internet users increased from 360,000 in 2008 forming .43 % of the population [5] to 16,437,811 internet users in 2019 forming 14.9% of the country's population [4].

While use of internet has enhanced the social and economic well-being of people [2], excessive internet use is becoming a concern due to increasing dependence on the internet for various aspects of our lives [6]. Evidences indicated that internet overuse or improper internet usage is resulting in higher vulnerability to the phenomenon of Internet Addiction (IA) [7, 8]. IA is a compulsive behavior related to any online activities in which individuals have inability to control internet usage despite its negative consequences [2] leading to marked functional impairments in several aspects of life [9, 10] including social isolations [11, 12], unfriendly behavioral patterns [13], attention deficit hyperactivity disorder [14], physical health [15], and performance and work difficulties [16].

IA is a global phenomenon, especially among university students [17 – 19]. Possible reasons suggested for this are: universities provide free and unlimited access to the internet, students are away from parental control and without anyone monitoring what they do online, and students are encouraged by faculty members to use different internet applications [12]. In addition, the universities’ settings foster a new student culture which necessitates the internet as a tool for communication, information sharing and community formation [20] and that in order to cope within such contexts, students engage in internet activities excessively [21].

With a broader education quality improvement initiative in higher institutions, the government of Ethiopia has deployed improved information communication technologies within the universities [22]. These institutions provide free and unlimited access to the internet; hence, students may use the internet more so than other population groups in the country [23] (Young, Yue, & Ying, 2011). Whether such context contributed for internet
addicted behavior among university students in Ethiopia is not assessed.

To date, efforts to explain risk factors for IA focused on analyzing individual-level attributes such as age and sex [24, 25], poor academic performance [26, 27], and psychological states (loneliness, stress, and low self-esteem) [28] as factors for internet addicted behavior. Environmental contexts such as weak family support and low parental supervision [28], peer pressure [29], and having free and easier internet access [20, 30] are also identified contribute for developing internet addicted behavior. Others argued that online internet applications such as social networking [31, 32] and gaming [33] are more predictive of IA than individual and environmental attributes.

The existing literature appeared that both individual-level and environmental factors as well as online activities are predictive of internet addiction. However, to the authors’ knowledge, no research has been conducted to date taking into consideration all of them in a single model. In addition, as most studies on risk factors have been conducted in western societies, our understanding of the risk factors for IA in African context is limited. Thus, the purposes of this study were to document the online activities students log in the internet, the prevalence of IA, and to identify risk factors for IA in a sample of university students in Ethiopia. Based on previous research, we hypothesized that students’ engagement in online activities better explain internet addicted behavior than their individual and environmental attributes. We also predicted that lower self-esteem, poor academic performance, limited parental supervision, and peer pressure would be risk factors for IA.

Methods

Study setting, design and sample

An institution-based cross-sectional study was conducted in Bahir Dar University from February to March, 2018. Bahir Dar University is one of the first generation universities in Ethiopia. The university has five campuses. Through education quality improvement initiative in higher institutions, free Wi-Fi is available in all campuses and private internet café services are also available around the campuses. At the time of the survey, the university enrolled more than 25,000 undergraduate students of which 14,884 are regular program students.
A single population proportion formula was used to estimate the sample size with assumptions of 5% precision, 95% confidence, and a 10% non-response rate. There is no prior report about the estimated proportion of population with the phenomenon considered (internet addiction) in Ethiopian Universities. Therefore, we assumed this proportion to be 50% to increase the sample size of this study. The university is stratified by campuses and departments. And students in each department are stratified by years of study. We selected two departments randomly from each campus and students from year I to year IV were considered to participate in the study. To obtain representative respondents we used multi-stage stratified random sampling technique. Thus, to reduce the error that might incur during such multistage stratification, we multiplied the sample size by two (design effect). Therefore, the total sample size for the study was 844 students. Data obtained from 32 students were not complete, hence excluded. Data obtained from 812 students (about 96% response rate) are presented.

The sample size was proportionally allocated to the selected departments, based on the number of regular students enrolled in the department. Then systematic random sampling technique was used to select participants from each selected department. Selected students were approached through their section mentors assigned by selected departments. The inclusion criteria included regular class undergraduate student, reside in the university dormitory, used internet at least for six months, and not diagnosed with anxiety or depression disorders for a year and above.

Study procedure

The study received ethical approval from Ethical Review Committee of Bahir Dar University. We initially developed the instrument in English and then translated into Amharic (national language) to ease understanding. Prior to the main study, a pretest was conducted on 25 regular undergraduate students (not included in the main survey) to check reliability and suitability of the instrument.

A week before data collection, we communicated selected departments with formal letter and we selected students who would participate in the study. Written consent of individual participants was obtained after being fully informed of the study purpose and procedures. It was also made clear to the participants that participation was voluntary, and there would be no direct benefit or reward. We ensured confidentiality by removing all personal identities from the questionnaire. At each department, the questionnaires were
self administered in a free lecture hall when students had free period. The principal investigators and two research assistants were available throughout the administration of the questionnaires to answer questions from individual students.

Measurement

*Socio-demographical and online internet application questionnaire*

The researchers developed a questionnaire to collect information regarding students' individual characteristics such as age, sex, year of study, field of study, and academic performance. These attributes are reported have important role for internet addiction [24, 34]. Online internet application variables that contributed IA such as social networking, online gaming, entertainment, and Google search for academic works [35] were also collected.

**Self-esteem**: The tool was developed to measures what respondents feel about themselves and what they think others think of them. It was adapted from Rosenberg [36] self-esteem test questions. The tool consisted of 10 items (e.g., On the whole, I am satisfied with myself, At times, I think I am not good at all, I wish I could have more respect for myself) with four point responses ranging from 1 (strongly disagree) to 4 (strongly agree). The internal consistency of the items was good (α = 0.882). The value ranges from 10 to 40, higher value indicating higher self-esteem.

**Parental supervision**: The tool was adapted from [37] developed to measure perceived social support. It was used to measure students’ perception of their parents’ support/supervision after they enrolled into the university. The instrument has seven items (e.g., I count on my parents’ warm call and encouragement; I get the emotional help and support I need from my parents; I can talk about my problems with my parents) with four point responses ranging from 1 (strongly disagree) to 4 (strongly agree). The items have good internal consistency (α = 0.93). The score ranges from seven to 28, higher score indicating greater parental control/support.

**Peer pressure**: This tool was developed to assess the tendency of individuals to affiliate with like-minded friends. It was adapted from Steinberg and Monahan [38] developed to measure resistance to peer influence. The instrument has seven items (e.g., I often try what my friends do, I go along with my friends and do what they do to keep them happy of me, I sometimes do things that I knew wrong just to stay on my friends’ good side) with
four point responses ranging from 1(strongly disagree) to 4(strongly agree). The score ranges from seven to 28, with higher scores indicating greater peer pressure. The items have good internal consistency (α=0.91).

*Internet addiction test:* The 20-item Internet Addiction Test developed by Young [39] was adopted to measure the level of Internet use in this study. The test has been widely adopted globally to measure the IA levels of individuals [40]. In assessing the degree to which respondents’ Internet usage affected their daily routine, productivity, social life, psychological dependence, and time management [41], respondents were asked to rate items on a five-point Likert scale (1=not at all and 5=always). Item scores are added to create a final score, categorized as normal internet use: 20–49; mild addictive use: 50–79; severe addictive use: scores over 80 [35]. In this study, students with scores 50 and above were identified as individuals with internet addiction. The instrument has good internal consistency (α = 0.93).

*Data analysis*

All returned questionnaires were checked for completeness and consistency of responses manually. After cleaning, raw data were entered into SPSS for Windows versions 23 for analyses. Descriptive analysis was used to summarize the background characteristics of the respondents, their online activities, and to determine the prevalence of addictive internet use behavior. Between groups comparisons (non-addictive and addictive internet users) were performed using the Chi-square test of independence for categorical variables and independent samples t-test for continuous variables.

The dependent variable in the analysis was internet addiction (coded 1 = addicted and otherwise 0). Independent variables included individual-level variables, environmental variables, and online internet application variables (social networking, online gaming, entertainment, and Google search for academic works). Thus, hierarchical multivariate logistic regression analyses were used to assess the relationship between independent variables and outcome variable. Hierarchical regression can be useful for evaluating the contributions of predictors above and beyond previously entered predictors, as a means of statistical control, and for examining incremental validity [42]. Nested models were employed to show the unique contribution of online internet application variables to the understanding of outcome variable. The first was a reduced model including only individual-level and environmental variables. The second model
added online internet application variables to the reduced model. Since model I was nested into model II, we used a likelihood ratio statistic (G²) to test whether the addition of online internet application variables significantly improved the fit of the model [43, 44] in explaining the dependent variable. Those variables with significant association to the dependent variable during bivariate analyses were entered during the logistic regression analysis.

Results

Background characteristics of respondents

Eight hundred twelve students (66% males and 34% females) participated in the study. Respondents’ age ranges from 18 to 27 years old with mean age of 21.38 years. Students’ fields of studies are social sciences (36%), law and Land Administration (21.6%), engineering (19%), textile (16%), and agriculture (7%). Majority of the respondents (30%) are 2nd year students followed by 3rd year (25%) and fourth year and freshman (22%). The four most important online activities of students were social networking (75.5%), entertainment (watching videos, sports, music, news) (73.6%), Google search for academic works (72.5%), and online game (61%) Respondents’ cumulative grade point average ranges from 1.84 to 3.92 with mean grade point average 3.05. Respondents’ measure of parental supervision score ranges from 7 to 28 with mean score 20.07, measure of self-esteem ranges from 10 to 40 with mean score 30.84, and measure of peer pressure ranges from 7 to 28 with mean score 12.95 (Table 1).
Table 1. Distribution of respondents by background characteristics, online activities, and internet use status (n = 812)

| Background characteristics                  | n(%)     |
|---------------------------------------------|----------|
| **Sex**                                     |          |
| Male                                        | 535(65.9) |
| Female                                      | 277(34.1) |
| **Field of study**                          |          |
| Social sciences                             | 293(36.1) |
| Engineering                                 | 154(19)  |
| Law and land administration                 | 175(21.6) |
| Agriculture                                 | 59(7.3)  |
| Textile                                     | 131(16.1) |
| **Year of study**                           |          |
| 1<sup>st</sup> year                         | 177(21.8) |
| 2<sup>nd</sup> year                         | 247(30.4) |
| 3<sup>rd</sup> year                         | 207(25.5) |
| 4<sup>th</sup> year and above               | 181(22.3) |
| **Social networking**                       |          |
| Use                                         | 613(75.5) |
| No use                                      | 199(24.5) |
| **Entertainment**                           |          |
| Use                                         | 598(73.6) |
| No use                                      | 214(26.4) |
| **Google search (for academics)**           |          |
| Use                                         | 589(72.5) |
| No use                                      | 223(27.5) |
| **Online game**                             |          |
| Use                                         | 494(60.8) |
| No use                                      | 318(39.2) |
| **Age**                                     | 21.38(1.70)* |
| **Cumulative grade point average**          | 3.05(.45)* |
| **Parental supervision**                    | 20.07(5.15)* |
| **Self-esteem**                             | 30.84(5.52)* |
| **Peer pressure**                           | 12.95(4.13)* |
| **Internet use status**                     |          |
| Non-addicted                                | 526(64.8) |
| Addicted                                    | 286(35.2) |

* mean (standard deviation)

Prevalence of internet addiction

Of all students participated in the study, 35.2% were classified as addicted internet users (Table 1). Proportion of students with IA increases with increasing year of study, 16.9% for 1<sup>st</sup> year, 34.8% for 2<sup>nd</sup> year, 42.5% for 3<sup>rd</sup> year, and 45.3% for 4<sup>th</sup> year students ($\chi^2 (3) = 38.80, p < .001$). Students using the internet for social networking were more likely to be internet addicted than those who did not use the medium for such
purposes (44% vs. 8%, $\chi^2(1) = 85.36, p < .001$). Greater proportion of students using the internet for online game were also more likely to be internet addicted than those who did not use the medium for the same purpose (43.3% vs. 22.6%, $\chi^2(1) = 36.25, p < .001$). Students using the internet for academic works were less likely to be internet addicted than those using the medium for non-academic purpose (31.2% vs. 45.7%, $\chi^2(1) = 14.91, p < .01$). Compared to non-addicted, addicted students were significantly older ($t(810) = -3.31, p < .05$), had lower grade point averages ($t(810) = 10.65, p < .001$), had lower parental supervision ($t(810) = 4.57, p < .001$), had lower self-esteem ($t(810) = 8.15, p < .001$), and experience higher peer pressure ($t(810) = -10.70, p < .001$) (Table 2).

Table 2. Distribution of respondents’ background characteristics and online activities by internet use status (n=812)
Background characteristics | Internet use status
---|---
| Non-addicted | Mild addicted | $\chi^2$
| n (%) | n (%) |
| **Sex** | | |
| Male | 335(66.4) | 180(33.6) | 1.71 |
| Female | 171(61.7) | 106(38.3) | |

| Field of study | | |
| Social sciences | 192(65.5) | 101(34.5) | 7.24 |
| Engineering | 92(59.7) | 62(40.3) |
| Law | 123(70.3) | 52(29.7) |
| Agriculture | 42(71.7) | 17(28.8) |
| Textile | 77(58.8) | 54(41.2) |

| Year of study | | 38.80*** |
| 1st year | 147(83.1) | 30(16.9) |
| 2nd year | 161(65.2) | 86(34.8) |
| 3rd year | 119(57.5) | 88(42.5) |
| 4th year and above | 99(54.7) | 82(45.3) |

| Social networking | | 85.36*** |
| Use | 343(46) | 270(44) |
| No use | 183(92) | 16(8) |

| Entertainment | Use | 390(65.2) | 208(34.8) | .92 |
| No use | 136(63.6) | 78(36.4) |

| Google search (for academics) | Use | 405(68.8) | 184(31.2) | 14.91** |
| No use | 121(54.3) | 102(45.7) |

| Online game | Use | 280(56.7) | 214(43.3) | 36.25*** |
| No use | 246(77.4) | 72(22.6) |

| Age | 21.23 | 21.64 | -3.31* |
| Grade point average | 3.16 | 2.83 | 10.65*** |
| Parental supervision | 20.67 | 18.96 | 4.57*** |
| Self-esteem | 31.96 | 28.78 | 8.15*** |
| Peer pressure | 11.88 | 14.92 | -10.70*** |

$^a$ = mean (standard deviation), *p<.05, **p<.01, ***p<.001

### Risk factors for internet addiction

Table 3 presents the results of multivariate logistic regression analyses of the association between internet use behavior and various individual, environmental, and online activity behaviors of respondents. Model 1 included only individual-level and environmental attributes of students. As indicated in Model 1, year of study significantly predicted IA. Compared to first year students, second year students were 3.86 times (95% CI: 2.19 – 6.83, p < 0.001), third year students 5.02 times (95% CI: 2.68 – 9.49, p < 0.001), and fourth year and above students 9.19 times (95% CI: 4.48 – 18.43, p < .001) more likely to be internet addicted.
The data in Model I also revealed that parental supervision, peer pressure, academic performance, and self-esteem significantly predicted IA. With one point increase in parental supervision (range from 7 – 28) students were .95 times (95% CI: .92 - .98) less likely to be internet addicted, with one point increase in grade point average (range 1.84 – 3.92) students were .18 (95% CI: .12 -.27, p < 0.001) times less likely to be internet addicted, and with one point increase in self-esteem score (range 10 – 40) students were .95 times (95% CI: .92 - .98, p < .01) less likely to be internet addicted. On the other hand, with one point increase in peer pressure score (range 7 – 28) students were 1.16 times (95% CI: 1.11 – 1.22, p < 0.001) more likely to be internet addicted (Table 3).

Model II added three online activity variables to Model I (social networking, Google search for academic works, and online game). Those variables significant in Model I remain significant in Model II. As illustrated in Model II, online activity variables were significantly associated with IA behavior of students. Compared to students using the internet for social networking, those who did not use the medium for such purpose were .11 times (95% CI: .06 - .21) less likely to be internet addicted. Students who did not use internet for online gaming are also .31 times (95% CI: .21 - .46) less likely to be internet addicted than those who were using the internet for the same purpose.

As illustrated in Table 3, Model II had smaller G² value than Model I (701.835 vs. 802.109). The inclusion of online activity variables significantly improved the goodness-of-fit of Model II as compared to Model I ($\chi^2 (11) = 151.830, P <0.001$). While model I explained 36.7% of the variance in IA (Nagelkerke $R^2 = .367$), model II explained 48.4% of the variance in IA (Nagelkerke $R^2 = .484$). The results indicated that there is statistically significant improvement in predicting IA behavior of students with the online activity variables after controlling individual-level and environmental variables. Thus, the results revealed that students’ online activity variables better predict their IA behaviors than their individual attributes and environmental factors.
Table 3. Hierarchical Logistic Regression analysis of students’ individual attributes, environmental characteristics, and their online activities predicting internet addiction (N=812)

| Background characteristics          | Odds Ratio(95% confidence interval) |
|-------------------------------------|-------------------------------------|
|                                     | Model I                              | Model II                             |
| **Year of study**                   |                                     |                                     |
| 1st year^R                         | 1                                   | 1                                    |
| 2nd year                            | 3.86 (2.19 - 6.83)***               | 3.63 (2.01 - 6.73)***               |
| 3rd year                            | 5.02 (2.68 - 9.40)***               | 4.33 (2.20 - 8.50)***               |
| 4th year and above                  | 9.19 (4.48 - 18.43)***              | 6.97 (3.22 - 15.07)***              |
| Age                                 | .99 (.87 - 1.13)                    | 1.09 (.94 - 1.26)                   |
| Parental supervision                | .95 (.92 -.98)*                     | .95 (.92 - .99)*                    |
| Peer pressure                       | 1.16 (1.11 - 1.22)***               | 1.15 (1.10 - 1.21)***               |
| Grade point average                 | .18 (.12 - .27)***                  | .19 (.12 - .30)***                  |
| Self-esteem                         | .95 (.92 - .98)**                   | .94 (.91 - .98)**                   |
| **Social networking**               |                                     |                                     |
| Use^R                               | 1                                   | 1                                    |
| No use                              | .11 (.06 - .21)***                  |                                     |
| **Academic works**                  |                                     |                                     |
| Use^R                               | 1                                   | 1                                    |
| No use                              | .964 (.63 - 1.43)                   |                                     |
| **Online game**                     |                                     |                                     |
| Use^R                               | 1                                   | 1                                    |
| No use                              | .31 (.21 - .46)***                  |                                     |
| Model G^2 (-2Loglikelihood)         | 802.109                             | 701.835                              |
| Degree of freedom                   | 8                                   | 11                                   |
| Nagelkerke R^2                      | .367                                | .484                                 |
| Changed Chi-square                  | 121.555***                          | 151.830***                           |

^R = reference category, *p < .05, **p<.01, ***p<.001

Discussion

This study investigated the prevalence of IA and associated risk factors for the phenomenon in a sample of undergraduate regular program students in Bahir Dar University. To the authors' knowledge, this study is the first in Ethiopia that estimated internet addiction among university students and identified relative risk factors for internet addiction in the Ethiopian cultural context.

Of all students who participated in the study, 35.2% were addicted internet users.
The results are comparable with rates of 35% reported in Hong Kong [45] and the rate of 34.7% reported in Greek [26]. However, the result is lower than the rates of 59.2% reported in Namibia and the rates of 70.3% reported in Uganda university students [46] in Africa. The result in the current study, on the other hand, is higher than the rates among university students; 3.2% in England [47], and 15.1% in Taiwan [19]. Variations in the prevalence of IA could be due to cultural diversity among communities, different tools used for diagnoses, sample size and sampling techniques, or the time frame when the research was conducted [24, 25]. The findings in our study has demonstrated that IA is relatively higher in Ethiopia despite internet penetration is much more limited than other countries [22].

As we hypothesized, the analyses of factors for IA revealed those students’ online activities predict students’ IA behaviors more so than their individual and environmental attributes. As compared to the model included individual and environmental attributes, the inclusion of the online activity variables improved the fit of the model predicting internet addicted use behavior. The results demonstrated that internet addicted use behavior was better predicted with the addiction of the online activity variables than the individual and environmental attributes alone. The results corroborate previous claims [48] that online activities people engage in the internet are potentially addictive. Among the online variables assessed in this study, social networking and online game application were found risk factors for IA. These findings are consistent with earlier researchers that gaming [33] and social networking [31, 32] have been found to be associated with internet addiction. Thus, university and government bodies may put regulatory mechanisms in place to limit the usage of potentially addictive internet applications such as social networking and online game.

This study also proposed that individual attributes such as lower self-esteem and poor academic performance would be risk factors for internet addiction. As expected, self-esteem significantly predicted IA. Students with higher self-esteem were found less likely to be internet addicted. The result is consistent with previous studies [49, 50] reporting that lower self-esteem was related to the internet addicted behaviors. If people have a low opinion of themselves and find it difficult to socialize because of their low self-esteem, they may use the internet as an alternative form of socializing, in which they can open up and gain confidence without having to interact face to face [50]. Researchers on self-esteem and use of the internet reported that adolescents with low self-esteem tend to spend more time on social networking sites than those with higher self-esteem [51].

Consistent with previous studies [18, 24, 26], the finding of this study revealed a
statistically significant negative relationship between academic grade point average and IA. Every unit increase in the academic grade point average score decreased the odds of being addicted to the internet by 81%. Existing studies [52] noted that students with poor academic performance may experience stress and may develop low self-esteem; therefore, they use the internet as a way to cope these stressors. Others [12, 53] argued that internet addicted users often experienced lack of sleep since they stay awake during late-night hours in order to surf through various web pages. The lack of sleep causes lack of concentration and loss of interest in everyday lectures, resulting in reduced reading of the course material and eventually lower marks at exams. Our finding did not indicate whether poor academic performance or IA is precursor for the observed relationship. Therefore, future longitudinal study is called for uncovering such causal relationships.

This study also anticipated that environmental factors such as limited parental supervision, and peer pressure would be risk factors for IA. The current findings revealed that parental supervision was significantly and negatively predicted students’ IA. This negative association between parental supervision and adolescent IA was repeatedly reported in studies conducted in different communities [54, 55]. Adolescents living in universities apart from their parents may be vulnerable to internet addiction [56], thus, parents’ maintaining a positive relationship with students (e.g., phone call) may sustain their supervision on their daily activities. Positive relationship between adolescents and their parents retains trust so that adolescents may willingly disclose their daily activities to their parents [57]. Thus, our finding demonstrates the need for parental supervision of students’ internet use behavior.

Our findings revealed positive significant relationship between peer pressure and the risk of being internet addicted. Every unit increase in peer pressure score increased the odds of being internet addicted by 16%. Social norm theory assumes that adolescents’ beliefs about the norms that are prevalent among their peers influence their behavior [58] through descriptive and injunctive peer norms [59]. Descriptive peer norms are adolescents’ perceptions about the quantity and frequency of a certain behavior among peers. Injunctive peer norms are beliefs about the approval of a behavior among peers [59]. In this study, it is not clear whether the students’ perceptions of their peers’ internet use behavior or their approval of internet use that serve as factors for IA. Regardless of the direction, the findings highlight the importance of peer pressure in students’ internet use addicted behavior. Thus, programs designed to reduce internet addicted behavior may focus on students’ perception of normative behavior.
Our finding that year of study is a risk factor for IA was unexpected. The proportion of students addicted to the internet sequentially increased with increasing years in the university (freshman to fourth year). This finding is consistent with previous studies in Nigeria [60] reporting the likelihood of internet addiction among university students vary with respect to year of study in that senior students were more likely to be internet addicted than their juniors. This could be attributed to the fact that parents might have limited supervision of senior students expecting that they adapted to the university life. Students who successfully accomplished university’s expectations in each year will be seniors in turns. These students may have sufficed time to use internet for different purposes; thus they may become addicted internet users. On the other hand, as seniority increases (second year and above), students may be expected to accomplish difficult tasks accordingly (e.g., assignments and research projects) that might cause stress, and students might potentially use the internet as a method to cope the context [12]. Though these explanations are intuitive, the current result that senior students are significantly more likely to be internet addicted than their junior counterparts is informative for the university administrators to design internet addiction prevention interventions at the beginning of students’ university life.

This study has limitations that should be considered. The participants were obtained from a single government university which might not be representative of the entire university students in Ethiopia. Data were collected using self administered structured questionnaire. Students may give responses which they believed to be expected or acceptable, thus there might be measurement bias. We also collected data only from students who participated in the study. The lack of data from other informants (e.g., network members) is the weakness of the study. In addition, the cross-sectional nature of the study limited the interpretation of the findings in terms of cause-effect relationships. There are also many factors this study did not assess, including environmental influences (university settings) and intrapersonal influences (e.g., anxiety, depression, and substance abuse). Future research may attempt to address these factors into consideration to predict risk behaviors for students’ IA. Studies on factors contributing to responsible internet use behavior are also needed to assess the assets in and outside students so that interventions and programs which can foster such behavior can be developed and implemented.

Conclusions

This study assessed prevalence of IA and risk factors for IA among undergraduate
regular program students in Bahir Dar University. The findings indicated that more than one third of the students (35.2%) were internet addicted users. The hierarchical logistic regression results revealed that students’ engagement into online activities better predict their internet addicted behavior than the individual and environmental attributes alone. Students who used the internet for social applications such as social networking and online gaming were more likely to be internet addicted. Lower self-esteem, lower grade point averages, lower parental supervision, and peer pressure were also found risk factors for IA. The findings in this study are important and timely as the internet has become the primary medium for information access in our universities. Thus, university authorities need to be aware of the prevalence of IA and its antecedents so that interventions can be designed to prevent adverse outcomes. Interventions should focus on identifying students with IA, creating awareness on the negative effects of IA, counseling services to develop students’ self image, introduce a regulatory mechanisms to limit the usage of potentially addictive internet applications, and promoting responsible use of the internet at the beginning of students’ university life.

Declarations

**Abbreviation**

IA: Internet addiction

Ethical approval and consent to participate

The study received ethical approval from Ethical Review Committee of Bahir Dar University. A week before data collection, we communicated selected departments with formal letter and we selected students who would participate in the study. Written consent of individual participants was obtained after being fully informed of the study purpose and procedures. It was also made clear to the participants that participation was voluntary, and there would be no direct benefit or reward. We ensured confidentiality by removing all personal identities from the questionnaire.

Consent for publication: Not applicable.

**Availability of data and materials**

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests
The authors declare that they have no conflict of interests.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Authors’ contributions: KA conducted literature search, developed the questionnaire, supervised the data collection, interpreted the findings as well as wrote the manuscript. HM designed the study, developed the questionnaire, supervised the data collection, analyzed the data and wrote the paper. Both authors read and approved the final manuscript.

Acknowledgements: The authors would like to thank students who generously gave their time to complete the questionnaire. We would like also acknowledge the deans of the faculties who facilitated our data collection.

Authors’ information

KA is Assist. Professor of Social Work and Social Development, Social Work Department, Bahir Dar University, Bahir Dar, Ethiopia. HM is senior lecturer in Sociology Department, Faculty of Social Sciences and Humanities, Woldya University, Woldya, Ethiopia

References

1. Correa T, Hinsley A, de Zúniga H. Who interacts on the web? The intersection of users' personality and social media use. Computers in Human Behavior 2010; 26(2): 247 - 253.

2. Goel D, Subramanyam A, Kamath R. (2013). A study on the prevalence of Internet addiction and its association with psychopathology in Indian adolescents. Indian Journal of Psychiatry 2013; 55(2): 140.

3. United Nations. Internet as a catalyst for change: Access, development, freedoms and innovation. Nairobi, Kenya: The sixth Internet Governance Forum, 27 – 30 September 2011. 2011. https://www.intgovforum.org/cms/documents/publications/176-internet-as-a-catalyst-for-change-access-development-freedoms-and-innovations/file. Accessed 15 April,
4. Internet World Stats. (2019). Internet usage statistics. 2019. https://www.internetworldstats.com/stats.htm. Accessed 15 April 2019.

5. Chekol A. Ethiopian free & open source software network (EFOSSNET). In A. Finlay & L. Nordstrom (Eds.). Global information society watch: Focus on access to online information and knowledge – advancing human rights and democracy (pp. 123 – 126). 2009. https://www.giswatch.org/country-report/20/ethiopia. Accessed 1 January 2019

6. Nie J, Zhang W, Liu Y. Exploring depression, self-esteem and verbal fluency with different degrees of internet addiction among Chinese college students. Comprehensive Psychiatry 2017; 7: 114-120.

7. Esen E, Siyez DM. An investigation of psycho-social variables in predicting internet addiction among adolescents. Turkish Psychological Counseling & Guidance Journal 2011; 4(36): 137-138.

8. Li C, Dang J, Zhang X, Zhang Q, Guo J. (2014). Internet addiction among Chinese adolescents: The effect of parental behavior and self-control. Computers in Human Behavior 2014; 41: 1 - 7.

9. Weinstein A, Feder LC, Rosenberg K, Dannon P. (2014). Internet addiction disorder: Overview and controversies 2014. http://scciteconnect.elsevier.com/wp-content/uploads/2014/10/Internet-Addiction-Disorder.pdf. Accessed 20 June 2019.

10. Young, K. & Rogers, R. (1998). The relationship between depression and internet addiction. Cyberpsychol Behav 1998; 1(1):25-28.

11. Jackson L, Fitzgerald H, Zhao Y, Kolenic A, von Eye A, Harold R. (2008). Information Technology (IT) use and children’s psychological well-being. Cyberpsychol Behav 2008; 11(6):755-757.

12. Young K S. Internet Addiction: A new clinical phenomenon and its consequences. American Behavioral Scientist 2004; 48: 402-415.

13. Yen J, Ko C. Yen C, Chen S, Chung W, Chen C. Psychiatric symptoms in adolescents with internet addiction: comparison with substance use. Psychiatry Clin Neurosci, 2008; 62(1):9-16.

14. Yoo H, Cho S, Ha J, Yune S, Kim S, Hwang J, et al. Attention deficit hyperactivity symptoms and internet addiction. Psychiatry Clin Neurosci, 2004; 58(5):487-494.

15. Kuss DJ, Griffiths MD. Internet and gaming addiction: A systematic literature review of neuroimaging studies. Brain Sciences 2012a; 2: 347-374.

16. Lee BW, Stapinski LA. Seeking safety on the internet: Relationship between social anxiety and problematic internet use. Journal of Anxiety Disorders 2012; 26(1):197 - 205.

17. Chen Y, Peng S. University students’ internet use and its relationships with academic performance, interpersonal relationships, psychosocial adjustment, and self-evaluation. CyberPsychology & Behavior 2008; 11(4):467-9.

18. Frangos C, Fragkos C, & Kiohos A. Internet addiction among Greek university students: Demographic associations with the phenomenon, using the Greek version of Young's internet addiction test. International Journal of Economic Sciences and Applied Research 2010; 3(1): 49 - 74.
19. Lin M, Ko H, Wu J. (2011). Prevalence and psychosocial risk factors associated with Internet addiction in a nationally representative sample of college students in Taiwan. CyberPsychology, Behavior and Social Networking 2011; 14(12):741-746.

20. Kandell J. (1998). Internet addiction on campus: the vulnerability of college students. CyberPsychology and Behavior 1998; 1(1): 11-17.

21. Castiglione J. (2008). Internet abuse and possible addiction among undergraduates: A developing concern for library and university administrators. Library Review 2008; 57(5): 358-371.

22. Adam L. Understanding what is happening in ICT in Ethiopia: Evidence for ICT Policy, Policy Paper 3 2012. https://www.researchictafrica.net/publications/Evidence_in_Ethiopia.pdf/. Accessed 1 January 2019.

23. Young, K., Yue, X., & Ying, L. Prevalence Estimates and Etiologic Models of Internet Addiction. In: Young K, Aberu C, editors. Internet addiction: A handbook and guide to evaluation and treatment. New Jersey: John Wiley & Sons, Inc; 2011. p. 3–17

24. Malak M, Khalifeh A, & Shuhaiber A. Prevalence of internet addiction and associated risk factors in Jordanian School students. Computers in Human Behavior 2017; 70: 556 – 563.

25. Durkee T, Kaess M, Carli V, Parzer P, Wasserman C, Floderu, B. Prevalence of pathological internet use among adolescents in Europe: Demographic and social factors. Addiction 2012; 107(12): 2210-2222.

26. Frangos C, Frangos C, & Sotiropoulos I. Problematic internet use among Greek university students: An ordinal logistic regression with risk factors of Negative psychological beliefs, pornographic sites, and online games. Cyberpsychology, Behavior, and Social Networking 2011; 14(1-2): 51 – 58.

27. Sasmaz T, Oner S, Kurt A, Yapıcı G, Yazıcı A, Bu_gdaycı R, et al. Prevalence and risk factors of internet addiction in high school students. European Journal of Public Health 2013; 24(1): 15 - 20.

28. Ko C, Yen J, Yen C, Lin H, Yang M. Factors predictive for incidence and remission of internet addiction in young adolescents: A prospective study. Cyberpsychology & Behavior 2007; 10(4): 545 – 551.

29. Gunuc S. Peer Influence in internet and Digital Game Addicted Adolescents: Is Internet Digital Game Addiction Contagious? Int J High Risk Behav Addiction 2017; 6(2):e33681. doi: 10.5812/ijhrba.33681.

30. Kapahi A, Ling SC, Ramadas S, Abdullah N. Internet addiction in Malaysia: causes and effects. Journal of scientific research 2013; 5: 72-76. DOI: 10.4236/ib.2013.52009.

31. Kuss DJ, Griffiths M D. Online social networking and addiction - A review of the psychological literature. International Journal of Environmental Research and Public Health 2011; 8(9): 3528-3552.

32. Leung L, Lee P S. The influences of information literacy, internet addiction and parenting styles on internet risks. New Media & Society 2012; 14(1): 117–136.

33. Kuss D J, Griffiths M D. Internet gaming addiction: A systematic review of empirical research. International Journal of Mental Health and Addiction 2012b; 10(2): 278–296.
34. Lam L, Peng Z, Mai J, Jing J. Factors associated with internet addiction among adolescents. Cyberpsychology & Behavior 2009; 12(5): 551 – 555.

35. Xin M, Xing J, Pengfei W, Houru L, Mengcheng G, Hong Z. Online activities, prevalence of Internet addiction and risk factors related to family and school among adolescents in China. Addictive Behaviors Reports 2018; 7: 14-18 doi: 10.1016/j.abrep.2017.10.003.

36. Rosenberg M. Society and the adolescent self-image 1965. Princeton, NJ: Princeton University Press.

37. Zimet G, Dahlem N, Zimet S, Farley G. The Multidimensional Scale of Perceived Social Support. Journal of Personality Assessment 1998; 52(1): 30-41.

38. Steinberg L, Monahan K. (2007). Age Differences in Resistance to Peer Influence. Dev Psychol 2007; 43(6): 1531-1543. doi:10.1037/0012-1649.43.6.1531.

39. Young, KS. Clinical Assessment of Internet-Addicted Clients. In: Young K, Aberu C, editors. Internet addiction: A handbook and guide to evaluation and treatment. New Jersey: John Wiley & Sons, Inc; 2011. p. 19 – 34.

40. Chen L, Nath R. Understanding the underlying factors of internet addiction across cultures: A comparison study. Electronic Commerce Research and Applications 2016; 17: 38 – 48.

41. Widyanto L, McMurran M. (2004). The psychometric properties of the internet addiction test. Cyberpsychology and Behavior 2004; 7(4):443-50.

42. Lewis M. Stepwise versus hierarchical regression: Pros and cons. https://files.eric.ed.gov/fulltext/ED534385.pdf (2007). Accessed 9 September 2019.

43. Aron A. Statistics for behavioral and social sciences. New York: Prentice Hall; 1997.

44. Petrocelli J. Hierarchical multiple regressions in counseling research: common problems and possible remedies. Meas Eval Couns Dev. 2003; 36:9–22.

45. Mak K, Lai C, Watanabe H, Kim D, Bahar N, Ramos M, et al. (2014). Epidemiology of internet behaviors and addiction among adolescents in six Asian countries. Cyberpsychology, Behavior and Social Networking 2014; 17(11), 720–728.

46. Nath R, Chen L, Muyingi H, Lubega J. Internet Addiction in Africa: A study of Namibia and Ugandan college students. International Journal of Computing and ICT Research 2013; 7 (2): 9-22.

47. Kuss D, Griffiths M, Binder J. Internet addiction in students: Prevalence and risk factors. Computers in Human Behavior 2013; 29(3): 959-966. doi: 10.1016/j.chb.2012.12.024.

48. Widyanto L, Griffiths M. Internet addiction: A critical review. International Journal of Mental Health and Addiction 2006; 4: 31–51.

49. Bahrainian S, Alizadeh H, Raeisoon M, Gorji H, Khazaee A. Relationship of Internet addiction with self-esteem and depression in university students. J prev med hyg 2014; 55(3): 86-89.

50. Niemz, K., Griffiths, M., Banyard, P. Prevalence of pathological internet use among university students and correlations with self-esteem, the general health questionnaire (GHQ), and disinhibition. Cyberpsychology & Behavior 2005; 8(6): 562 – 570.
51. Ellison N, Steinfield C, Lampe C. The benefits of Facebook “friends”: social capital and college students’ use of online social network sites. Journal of Computer-Mediated Communication 2007; 12: 1143–1168. doi:10.1111/j.1083-6101.2007.00367.x.

52. Gencer S L, Koc M. Internet abuse among teenagers and its relations to internet use patterns and demographics. Educational Technology & Society 2012; 15(2): 25 - 36.

53. Kubey R, Lavin M, Barrows J. Internet use and collegiate academic performance decrements: Early findings. Journal of Communication 2001; 51:366-82.

54. Bleakley A, Ellithorpe M, Romer D. The role of parents in problematic internet use among US adolescents. Media and Communication 2016; 4 (3); 24-34.

55. Ding Q, Li D, Zhou Y, Dong H, Luo J. Perceived parental monitoring and adolescent internet addiction: A moderated mediation model. Addict. Behav 2017; 74: 48–54.

56. Ko C, Wang P, Liu T, Yen C, Chen C, Yen J. Bidirectional associations between family factors and internet addiction among adolescents in a prospective investigation. Psychiatry and Clinical Neurosciences 2015; 69(4): 192 - 200. doi:10.1111/pcn.12204.

57. Shek D T. Perceived parental control processes, parent-child relational qualities, and psychological well-being in Chinese adolescents with and without economic disadvantage. J. Genet. Psychol 2005; 166: 171-188. doi: 10.3200/GNTP.166.2.171-188.

58. Berkowitz AD. An overview of the social norms approach. In: Lederman LC, Stewart LP, editors. Changing the culture of college drinking: A socially situated health communication Campaign. Cresskill, NJ: Hampton Press; 2005. p. 193 – 214.

59. Borsari B, Carey K. Descriptive and injunctive norms in college drinking: A meta-analytic integration. Journal of Studies on Alcohol 2003; 64(3):331–341.

60. Okwaraji F, Aguwa E, Onyebueke G, Shiweobi-Eze C. (2015a). Assessment of Internet Addiction and Depression in a Sample of Nigerian University Undergraduates. International Neuropsychiatric Disease Journal 2015a; 4(3): 114 – 122. doi: 10.9734/INDJ/2015/19096.