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# Internet Addiction: Impact on Academic Performance of Premedical Post-Baccalaureate Students

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## Abstract

The study identified Internet addicts in a population of post-baccalaureate students ($n = 153$) enrolled in a USA-based medical school preparatory program, using a standard Internet Addiction Test (IAT). Independent sample $t$ tests, chi-square tests, and multiple regression analyses were used to compare outcomes and measure the contributions made by different predictors toward different outcomes. Of the total number of subjects, 17% met the criteria for Internet addicts. Students' age and time spent on the Internet per day were significant predictors underlying their addictive Internet usage. Internet addiction and students' academic performance also exhibited a significant negative association. A preliminary positive association between Internet addiction and students' self-reported depression was noted.

**Keywords** Internet addiction · Academic performance · Premedical students

## Background

Internet use has expanded enormously over the last decade. Whereas in 2005 there were 2.94 billion global users [1], in 2017, the numbers have risen beyond 3.77 billion [2]. The wide popularity of the Internet is driven by ease of access to worldwide information at the fingertips. While normal Internet usage can be productive for work and leisurely activities, maladaptive, excessive, and compulsive use (defined as "Internet addiction") can compromise an individual's psychological well-being [3, 4]. Recent studies conducted in Italy estimate 0.8% of young individuals [5], and in China, 8.8% of adolescents [6], fit the category of Internet addicts. Cumulative research on Internet addiction essentially convinced the American Psychiatric Association (APA) in 2013 [7], to include Internet gaming disorder in the appendix of their updated version of the *Diagnostic and Statistical Manual for Mental Disorders* (DSM-5) as a condition requiring further research for it to be accepted for inclusion in their official manual. This growing prevalence of Internet addiction [although not yet fully recognized in the annals of Western literature [8]] is clearly generating universal interest among psychiatrists and educators alike.

Today, information technology is embedded in all spheres of higher education models including premedical and medical education. For these modern students, the Internet not only serves as a conduit for accessing resources to understand evidence-based medicine, but it also provides easily accessible entertainment. Over time, however, development of a compulsion for Internet usage with significant increase in duration and frequency may be observed. Many countries already acknowledge Internet addiction as an emerging problem negatively impacting medical education [9, 10]. Such studies are convincing, as pathological Internet usage is reported to be associated with increased risk of cognitive bias, executive functioning deficit, and depression [11, 12].

The effects of Internet addiction on both premedical and medical education (particularly in the USA) remain underinvestigated. The focus of the present study is to identify predictors underlying the excessive Internet usage habits of students enrolled in a USA-based post-baccalaureate 15-week

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medical school preparatory program, and to investigate their impact on academic performance. This current study aims not only to create a general awareness of the ill-effects of excessive Internet usage among student populations of the twenty-first century, but also to encourage dialog and discussion about the subject among educators and parents alike.

## Activity

This was a quantitative educational research conducted using a convenience sample. Following approval of the research project by the Institutional Review Board (IRB), the target student population ($n = 254$) belonging to the "Medical Education Readiness Program" (MERP) was invited to take a paper survey. Their ensuing academic performance data was downloaded from the online learning platform e-college (adopted by the institution). The IBM-SPSS-22 statistical software was used for data analysis, and models with higher model fit were presented using a conventional alpha of $p \leq 0.05$.

## Survey Instrument

The survey instrument contained the original eight-item Internet Addiction Test (IAT), described by KS Young in her seminal paper presented at the American Psychological Association, Toronto, Canada (1996), and later published in 2009 [13]. Young's original IAT screened Internet addicts based on (a) preoccupation with the Internet, (b) increased usage over time for personal satisfaction, (c) history of remaining online longer than intended, (d) history of unsuccessful attempts to reduce Internet usage, (e) withdrawal symptoms from reducing usage, (f) history of loss of career/relationship/educational opportunities due to excessive usage, (g) tendency to lie about internet usage, and (h) usage to escape from real-world problems. Students with a "yes" response to at least five of eight diagnostic questionnaires (IAT) were classified as "Internet addicts" [13]. Young's IAT is considered a valid and reliable instrument used in Internet addiction research [14–16]. The survey also included questions related to students' demography, Likert scale ratings (4-point Likert scale, 1 = weak; 4 = excellent) of respondents' time management and study skills, questions related to time spent on the internet (> or < 5 h/day, Young [13]), and the broader purposes of their Internet usage (whether for general education or entertainment). A binary question (self-report) related to students' depressive symptoms was also included in the survey. Classification of addicts per their specific categories of addiction (namely smart phone, gaming, social media, and pornography) was not attempted in the study.

## Results and Discussion

The overall response rate was 60% (153/254), with 50.34% representing females and 49.66%, males. The total percentage of subjects that met the Internet addict criteria (per Young's IAT [13] and its updated version as proposed by Beard and Wolf [14]) was 17% (26/153). This percentage is clearly within the 10–30% range of the Internet addict grouping as reported in student populations worldwide [9, 17]. Males comprised 57% (15/26) of the addicts, and females, 42.3% (11/26). The average age of the addicts was 26 years.

Independent sample $t$ test results highlighted significant association between Internet addiction and students' age ($p = 0.04$). Chi-square test confirmed an association between Internet addiction and students' Internet usage in hours [$\chi^2(1) = 5.92$; $p = 0.01$]. Multiple regression analyses identified age [$R^2 = 0.026$; $F (1151) = 4.021$; $p = 0.04$; (adjusted $R^2 = 0.019$)] and time spent on the Internet per day [$R^2 = 0.039$; $F (1151) = 6.078$; $p = 0.015$; (adjusted $R^2 = 0.032$); Table 1] as significant predictors of students' Internet addiction. The younger average age of Internet addicts is well supported by existing literature [18, 19]. The relatively immature cognitive control and self-control of adolescents and youths may place them at a higher risk of developing Internet addiction [18]. Of those students identified as Internet addicts in our study, 50% reported a compulsion toward long hours of Internet usage (> 5 h/day). Literature suggests that a direct consequence of increased screen time is high dopamine accumulation in the brain of addicts [20, 21], causing euphoric effects and a constant "high" [21]. Such connection might well stand true for those addicts identified in our study, though it remains speculative at this point.

$t$ test results exhibited significant differences in the academic performance ($p = 0.001$), time management ($p = 0.001$), and study skills ($p = 0.001$) between Internet addicts and normal Internet users. Multiple linear regression analyses identified Internet addiction as the most significant negative predictor of students' academic performance [$R^2 = 0.230$; $F (4148) = 11.04$; $p = 0.001$ (adjusted $R^2 = 0.209$); Table 2A]. Other identified predictors were study skills, purposes of Internet usage, and gender (Table 2A). A majority of the identified Internet addicts (65%) failed the premed program, lending support to the well-established negative association between pathological Internet usage and student academic performance as reported in literature [9, 10, 22]. Again, it would tempting to associate the poor academic performance of those addicts in our study with the much reported brain deformities [23, 24] induced by long-term, excessive, and compulsive Internet usage, though only advanced experimental research would provide positive validation.

Chi-square test results exhibited a highly significant association between students' Internet addiction and their self-reported depression [$\chi^2(1) = 70.98$; $p = 0.001$]. Multiple

**Table 1** A summary of the regression effects identifying students' age and hours spent on the Internet/day as predictors of their Internet addictive behavior

Dependent variable: Internet addiction

| Model predictors | $R$ | $R^2$ | Adjusted $R^2$ | Unstand. coef. ($\beta$) | Unstand. coef. (S.E) | Stand. coef. ($\beta$) | $t$ | Significance ($P$) |
|---|---|---|---|---|---|---|---|---|
| **Model 1** | | | | | | | | |
| | 0.161 | 0.026 | 0.019 | | | | | |
| Constant | | | | 1.569 | 0.201 | – | 7.794 | 0.000 |
| Age | | | | $-0.015$ | 0.008 | $-0.161$ | $-2.005$ | 0.047* |
| **Model 2** | | | | | | | | |
| | 0.197 | 0.039 | 0.032 | | | | | |
| Constant | | | | 0.960 | 0.090 | – | 10.656 | 0.000 |
| Internet usage (h) | | | | 0.161 | 0.065 | 0.197 | 2.465 | 0.015* |

*Significant at the 0.05 level

regression analyses identified Internet addiction as a positive predictor and time management skills as a negative predictor of students' depression [$R^2 = 0.488$; $F (2, 150) = 71.49$; $p = 0.001$ (*adjusted $R^2 = 0.481$*) Table 2B]. This preliminary data validates the well-established positive association between Internet addiction and depression [4, 12, 25]. Current in-depth studies are under progress.

In conclusion, we propose that Internet overuse may be negatively associated with students' academic performance. A premedical student with bad time management skills (spending inordinate amounts of time fishing or playing football) may equally underperform as the Internet preoccupied the student, but the critical distinction though is, in the former case, preventive measures and/or proactive intervention could improve student performance [26]. In the latter case, however, with Internet addiction classified as a compulsive disorder [3],

the addict may find it much more challenging to refocus. Retention and the processing of information, in this case, may be compromised due to the possible deformities that might have been induced in certain areas of the addict's brain, a consequence of long-term problematic Internet usage [27]. Thus, the creation of a general awareness of the possible ill-effects of excessive Internet usage among student populations, we believe, may have to fall under the moral responsibility of all educators in the foreseeable future.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflicts of interest.

**Table 2** A summary of the regression effects of different predictor variables on students' academic performance and self-reported depression

| Model predictors | $R$ | $R^2$ | Adjusted $R^2$ | Unstand. coef. ($\beta$) | Unstand. coef. (S.E) | Stand. coef. ($\beta$) | $t$ | Significance ($P$) |
|---|---|---|---|---|---|---|---|---|
| **A. Dependent variable: academic performance** | | | | | | | | |
| | 0.479 | 0.230 | 0.209 | | | | | |
| Constant | | | | 69.554 | 5.772 | – | 12.05 | 0.000 |
| Internet addiction | | | | $-8.681$ | 2.012 | $-0.339$ | $-4.314$ | 0.000* |
| Purpose of Internet usage | | | | 2.854 | 0.980 | 0.213 | 2.913 | 0.004* |
| Study skills | | | | 2.501 | 1.174 | 0.167 | 2.130 | 0.035* |
| Gender | | | | $-2.866$ | 1.399 | $-0.149$ | $-2.048$ | 0.042* |
| **B. Dependent variable: students' self-reported depression** | | | | | | | | |
| | 0.699 | 0.488 | 0.481 | | | | | |
| Constant | | | | 0.712 | 0.157 | – | 4.548 | 0.000 |
| Internet addiction | | | | 0.645 | 0.070 | 0.603 | 9.21 | 0.000* |
| Time management | | | | $-0.101$ | 0.038 | $-0.174$ | $-2.66$ | 0.009* |

*Significant at the 0.05 level

# References

1. Statistica. The statistics portal. http://www.statista.com/statistics/273018/number-of-internet-users-worldwide/. Accessed July 23rd, 2017.

2. Digital in 2017: A global overview. https://wearesocial.com/special-reports/digital-in-2017-global-overview. Accessed July 17th 2017.

3. Young KS, Rodgers RC. The relationship between depression and internet addiction. Cyberpsychol Behav. 2009;1:25–8.

4. Davis RA. A cognitive-behavioral model of pathological Internet use. Comput Hum Behav. 2001;17(2):187–95. https://doi.org/10.1016/S0747-5632(00)00041-8.

5. Poli R, Agrimi E. Internet addiction disorder: prevalence in an Italian student population. Nord J Psychiatry. 2012;66(1):55–9. https://doi.org/10.3109/08039488.2011.605169.

6. Xu J, Shen LX, et al. Personal characteristics related to the risk of adolescent internet addiction: a survey in Shanghai, China. BMC Public Health. 2012;12(1):1106. https://doi.org/10.1186/1471-2458-12-1106.

7. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5). Arlington: American Psychiatric Association; 2013. https://doi.org/10.1176/appi.books.9780890425596.

8. Kuss DJ, Fernandez OL. Internet addiction and problematic Internet use: a systematic review of clinical research. World J Psychiatry. 2016;6(1):143–76. https://doi.org/10.5498/wjp.v6.i1.143.

9. Malviya A, et al. A study to evaluate internet addiction disorder amongst students of a medical college and associated hospital in central India. Natl J Community Med. 2014;5:93–5.

10. Liu X, Bao Z, Wang Z. Internet use and internet addiction disorder among medical students: a case from China. Asian Soc Sci. 2010;6: 28–34. (www.ccsenet.org/ass)

11. Yau YHC, et al. Problematic Internet use, mental health and impulse control in an online survey of adults. J Behav Addict. 2013;2:7.

12. Khoshakhlagh H, Faramarzi S. The relationship of emotional intelligence and mental disorders with Internet addiction in Internet user university students. Addict Health. 2012;4(3-4):133–41.

13. Young KS. Internet addiction: the emergence of a new clinical disorder. Cyberpsychol Behav. 2009;1(3):237–44. https://doi.org/10.1089/cpb.1998.1.237.

14. Beard KW, Wolf EM. Modification in the proposed diagnostic criteria for internet addiction. Cyberpsychol Behav. 2001;4(3): 377–83. https://doi.org/10.1089/109493101300210286.

15. Widyanto L, McMurran M. The psychometric properties of the internet addiction test. Cyberpsychol Behav. 2004;7(4):443–50. https://doi.org/10.1089/cpb.2004.7.443.

16. Farcia P, et al. Internet Addiction Test (IAT): which is the best factorial solution? J Med Internet Res. 2013;15(10):e225. https://doi.org/10.2196/jmir.2935.

17. Ghamari F, Mohammadbeigi A, Mohammadsalehi N, Hashiani AA. Internet addiction and modeling its risk factors in medical students, Iran. Indian J Psychol Med. 2011;33(2):158–62. https://doi.org/10.4103/0253-7176.92068.

18. Soule LC, et al. Exploring Internet addiction: demographic characteristics and stereotypes of heavy Internet users. J Comput Inf Syst. 2003;44:64–73.

19. Alavi SS, Maracy MR, Jannatifard F, Eslami M. The effect of psychiatric symptoms on the internet addiction disorder in Isfahan's University students. J Res Med Sci. 2011;16(6):793–800.

20. Koepp MJ, Gunn RN, Lawrence AD, Cunningham VJ, Dagher A, Jones T, et al. Evidence for striatal dopamine release during a video-game. Nature. 1998;393(6682):266–8. https://doi.org/10.1038/30498.

21. Liu M, Luo J. Relationship between peripheral blood dopamine level and internet addiction disorder in adolescents: a pilot study. Int J Clin Exp Med. 2015;8(6):9943–8.

22. Akhter N. Relationship between internet addiction and academic performance amongst university undergraduates. Educ Res Rev. 2013;8:1793–6.

23. Wang H, et al. The alteration of grey matter volume and cognitive control in adolescents with internet gaming disorder. Front Behav Neurosci. 2015;9:64. https://doi.org/10.3389/fnbeh.2015.00064.

24. Weintein AM. An updated overview on brain imaging studies of internet gaming disorder. Front Psychiatry. 2017;8:185. https://doi.org/10.3389/fpsyt.2017.00185.

25. Yen JY, Ko CH, Yen CF, Wu HY, Yang MJ. The comorbid psychiatric symptoms of Internet addiction: attention deficit and hyperactivity disorder (ADHD), depression, social phobia, and hostility. J Adolesc Health. 2007;41(1):93–8. https://doi.org/10.1016/j.jadohealth.2007.02.002.

26. Kalet A, Chou CL. Remediation in medical science: a midcourse correction. In: Kalet A, Chou CL, editors. 1st ed. New York: Springer-Verlag; 2014. https://doi.org/10.1007/978-1-4614-9025-8.

27. Yuan K, Qin W, Wang G, Zeng F, Zhao L, Yang X, et al. Microstructure abnormalities in adolescents with internet addiction disorder. PLoS One. 2011;6(6):e20708. https://doi.org/10.1371/journal.pone.0020708.