

Internet Addiction and Mental and Physical Fatigue

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Abstract

Although Internet addiction and fatigue are issues of concern among university students, the association between these phenomena has not been examined. In a unique contribution to the literature, this study examined if Internet addiction differentially influenced mental and physical fatigue in a sample of Moroccan students. Results indicate students with Internet addiction have significantly higher levels of mental and physical fatigue than students without Internet addiction. The findings extend understanding of Internet addiction and offer insights into reducing Internet addiction.

Keywords: Internet addiction; mental fatigue; physical fatigue; university students.

1. Introduction

Internet use, particularly among university students, continues to rise.¹ Although the Internet allows students to improve their learning experience by facilitating information research, it can, when used to excess, negatively influence academic performance.²⁻³ Moreover, compared to the general population, university students, seem to be at greater risk of Internet addiction.⁴⁻⁶

Fatigue, which may manifest physically and mentally,⁷ also appears to be more prevalent in university students,⁸⁻⁹ and has also been associated with poor academic outcomes.¹⁰⁻¹⁴

Poor academic results are costly for the student or paying parent and society as a whole.¹⁵ Thus, due to its negative impact on academic performance, greater understanding and reduction of Internet addiction and fatigue in students is called for. Yet, although Internet addiction and fatigue have been identified as issues of concern among university students, the association between these two phenomena, has not been studied.

Certainly, a number of studies have found that Internet addiction results in long periods of time spent on the Internet, a lack of physical activity and a reduction in sleeping hours,¹⁶ which could plausibly lead to mental and physical fatigue. Interestingly, however, although prior research has identified links between university student Internet addiction and health issues such as depression, stress,¹⁷ and low self-esteem,¹⁸ studies on the effects of Internet addiction on fatigue are sparse. Therefore, in a unique contribution to the literature, the present study sought to examine whether Internet addiction is associated with mental and physical fatigue, in a sample of university students. The study constructs are discussed below.

2. Theoretical Framework

2.1. Internet addiction

While there is general agreement among researchers that Internet addiction does exist, agreement has not yet been reached as to a standard definition for this

phenomenon.² Further, this phenomena is not yet included in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5), used by health professionals for diagnosis.¹⁹ However, Internet addiction, variously termed: problematic Internet use²⁰; excessive Internet use²¹; pathological Internet use²²⁻²³; compulsive Internet use²⁴; cyberspace addiction²⁵; and high Internet dependency,²⁶ has been associated with a need to spend increasing amounts of time on Internet-related activities,²⁷ feelings of psychological distress if Internet access is not available²⁸, disregard as to the impact of being on-line,²⁹ and denial of problematic behaviors.⁴

A number of models have been used to try and understand Internet addiction. For example, Davis,²² proposes Internet addiction can be explained using cognitive behavioral theory, Caplan,³⁰ suggests Internet addiction is a function of deficient social skills, and Shaffer,³¹ argues Internet addiction is related to sensation-seeking behavior. Although current theories appear to explain some dimensions of Internet addiction, none appear to explain this complex phenomenon entirely. Moreover, there is still a lack of clarity as to whether it is the act of typing, the need for information, the need to communicate, the need to play video games, or some other underlying psychopathology that Internet users become addicted to.³²

That said, there does appear to be agreement that younger adults, including university students, have a greater propensity for Internet addiction.⁴⁻⁶ Sahin,⁶ for example, in a Turkish study among various age groups, found those aged over 30 had significantly lower levels of Internet addiction than those aged under 19 years. Moreover, Internet addiction in students, appears to transcend borders, with the issue being reported in countries across the globe, including: America^{33,23}; China³⁴; Cyprus³⁵; Greece³⁶; Italy³⁷; Iran¹⁸; Taiwan^{3,38}; Turkey³⁹; and the United Kingdom.⁴⁰ Young,⁴¹ suggests that university students are at greater risk of Internet addiction because they have large blocks of unstructured time; often free and unlimited Internet access provided by their university; little monitoring of their online activity; and encouragement from university staff to use the technology. Indeed, nowadays, most universities provide pervasive wireless internet access and information technology support for students both on and off campus.⁴²

Although Internet use can be advantageous to study,⁴³ Internet addiction has been associated with a number of negative outcomes for students including depression, stress,¹⁷ low self-esteem¹⁸ and notably, poor academic performance.^{2,17,26,44} Derbyshire et al.,¹⁷ for instance, in a study of 6,000 university students, found that overall grade point average (GPA) was impacted by Internet use, with the lowest GPA correlating with the highest level of Internet use.

A variety of physical problems have also been associated with increasing amounts of Internet use in adolescents and university students, including: imbalances in nutritional intake due to skipping meals and eating unhealthy snacks⁴⁵; and greater propensity to smoke, drink alcohol or coffee, or to take drugs.⁴⁶ Furthermore, studies have found that students with Internet addiction tend to forgo sleep in order to spend more time on the Internet.^{16,43} Young,¹⁶ for instance, in an exploratory study of Internet addiction, found students regularly went without sleep in order to spend up to 80 hours a week (and single sessions of up to 15 hours) on the internet.

2.2. Mental and physical fatigue

Lack of sleep or sleep deprivation is associated with fatigue.⁴⁷⁻⁴⁸ Fatigue, a related but different construct to sleepiness,⁴⁹ can be defined as the decreased capability to perform mental or physical work due to inadequate sleep.⁵⁰ Although some researchers treat fatigue as a one-dimensional construct,⁵¹ most researchers agree fatigue is a multidimensional construct.⁵² However, the number of fatigue dimensions is still contentious, with some authors suggesting two dimensions⁷ and others up to five dimensions.⁵³ That said, there does appear to be general agreement that at least a physical and mental dimension of fatigue exists.⁵² Mental fatigue reflects a deficiency in cognitive functioning, such as reduced ability to concentrate.⁵⁴ Physical fatigue reflects physical symptoms of tiredness such as musculoskeletal pain or feeling weak.⁵³

As has been found with Internet addiction, fatigue also appears to be more prevalent in university students.⁸⁻⁹ Indeed, compared to the general population, almost twice as many students report symptoms associated with fatigue.⁵⁵⁻⁵⁶ Brown, Soper and Buboltz,⁵⁶ suggest that this could be due, in large part, to university lifestyle, and calls for greater exploration of this issue. Yet, it is difficult to find any studies related to Internet addiction

that have focused on mental and physical fatigue in university students, although one study did identify a link in female nurses.⁵⁷ This is surprising for several reasons. First, numerous experimental studies, although focused on the outcomes of mental fatigue rather than antecedents of this phenomena, have successfully used cognitively demanding computer-based tasks to induce mental fatigue in student subjects.^{14,58-59} Kato et al.,⁵⁸ for example, induced mental fatigue within 60 minutes by requiring participating students to respond to a continuous stream of stimuli by either pressing a designated computer key or not pressing the key (a go/no-go task). Use of the Internet also tends to involve dealing with a continuous stream of stimuli, thus, it seems highly plausible, all things being equal, that students who use the Internet to excess, are more likely, due increased to cognitive load, to suffer mental fatigue than those who do not use the Internet to excess.

Second, a number of studies have found an association between prolonged use of a computer by office workers and physical fatigue reflected in musculoskeletal discomfort such as neck, shoulder,⁶⁰⁻⁶¹ or hand and arm pain.⁶²⁻⁶³

Based on these prior studies, it would seem reasonable to suspect there may be significant differences in levels of mental and physical fatigue among university students with Internet addiction and university students without. However, this relationship has not yet been empirically examined. Thus, as depicted in Figure 1, this study sought to address an important knowledge gap by examining the following hypotheses:

Hypothesis 1. *Students with Internet addiction will have significantly higher levels of perceived mental fatigue than students without Internet addiction.*

Hypothesis 2. *Students with Internet addiction will have significantly higher levels of perceived physical fatigue than students without Internet addiction.*



Fig. 1 Hypothesized relationships

3. Research Methodology

3.1. Method

Data was collected using a written survey and a convenience sample of Moroccan university students. Morocco was chosen as the study site because it has Africa's highest Internet penetration rate.⁶⁴ Moreover, most Moroccan Internet users are aged under 24 years,⁶⁴ an age group that reflects the traditional undergraduate university student.⁶⁵

Twelve universities, six private and six public, located in key areas of Morocco, namely, Casablanca, Fes, Ifrane, Meknes, Marrakech, Rabat, and Tangier,⁶⁶ were used as data collection sites. Data was collected between one and two weeks before the mid-way point in the semester, a time that tends to be lower in academic pressure.⁶⁷ In line with other studies,⁶⁸ in each university, students were intercepted in common areas such as the student cafeteria, the library, and student activity buildings. An intercept approach allowed screening of potential respondents, the opportunity to address any respondent queries, and the opportunity to check that respondents completed all survey questions. Every tenth student was approached in an effort to randomize the sample. After intercepting a potential respondent and briefly describing the study, eligible respondents were invited to complete a self-administered questionnaire. Only Moroccan students were considered eligible. The rejection rate was estimated to be less than five percent. A total of 560 surveys were obtained. However, seven observations were deleted due to missing data, leaving a sample of 553.

3.2. Questionnaire development and measures

The questionnaire contained 49 questions, covering perceived mental and physical fatigue, Internet addiction during the past 6 months, and several general or socio-demographic questions. Draft questionnaires were reviewed by a number of university professors and edited as needed. The final questionnaire was translated into French, using Brislin's,⁶⁹ back-translation procedure. Although Arabic is the official national language in Morocco, and English is popular, it is French that is most widely used in higher education.⁷⁰ A pilot study, mirroring the method used in the main study, was undertaken with 24 students, to ensure the questions were easy to comprehend. This resulted in minor amendments to question wording. The pilot study data were not included in the study analysis.

The main constructs in the present study were measured using previously validated items and a seven-point Likert Scale ranging from 1 (strongly disagree) to 7 (strongly agree). Fatigue was measured using the Chalder Fatigue Scale (CFS).⁷ This popular scale, which comprises four items that measure mental fatigue, and seven items that measure physical fatigue, has been found to have good validity and internal consistency.⁷¹⁻⁷² In line with Chandler et al.'s⁷ recommendations, the four mental fatigue items and the seven physical fatigue items were individually summed to provide an overall mental fatigue score ($\alpha=.82$) and an overall physical fatigue score ($\alpha=.84$). Higher scores indicated greater levels of either mental or physical fatigue.

Internet addiction was measured using the Chen Internet Addiction Scale (CIAS).⁷³ This scale, which comprises 26 items has been found to have excellent internal consistency across a variety of populations.⁷⁴ Responses to each of the items were summed to provide an overall Internet addiction score ($\alpha=.94$). Thus, scores had the potential to range from 26 to 182, with higher scores indicating greater levels of Internet addiction. As recommended by Ko et al.,⁷⁵ a cut-off point was used for screening cases of Internet addiction. In the present study, this figure was 130, reflecting respondents who averaged 5 or more on each of the 7-point scale items. Respondents scoring 130 or more were designated an Internet addiction case and those scoring less than 130 were designated a non-case of Internet addiction. Similar to other studies,^{33,38} a total of 103 (18.6%) respondents were deemed to be cases of Internet addiction.

3.3. Respondent characteristics

Of the 553 respondents, 252 (45.6%) were male and 301 (54.4%) were female, suggesting the sample was slightly skewed toward females, as in Moroccan universities, females comprise only 49% of the student body.⁷⁶ However, with respect to age, figures seemed to be fairly representative,⁷⁷ with the majority 536 (97%) of respondents indicating they were aged between 18 and 24 years. In keeping with the age range distribution, 426 (77%) of the sample stated they were undertaking an undergraduate degree, with the remaining 127 (23%) undertaking a graduate degree, all covering a broad range of majors. The majority of respondents (68%) also indicated that searching for information was their main Internet activity. In terms of work and study commitments, 452 (81.6%) of respondents indicated they were studying full-time, with the remainder studying part-time. In a reflection of the scarcity of part-time work available for students in Morocco, only 56 (10.1%) of the sample stated they worked in addition to studying, shown by a maximum of 10 hours and an average of 4.68 hours of paid work a week. In keeping with the sampling frame, respondents came from across Morocco, including the ten largest metropolitan areas.⁶⁶ However, the majority 458 (83%) of respondents indicated they lived on their university campus, with the remainder either living with family or independently. Finally, in answer to a question that asked respondents to rate their current perceived general health, 58 (10.5%) rated their health as satisfactory, 236 (42.7%) rated their health as good, and the remaining 259 (46.8%) rated their health as unsatisfactory.

4. Analysis

To determine if Internet addiction differentially influenced physical and mental fatigue in university students, a one-way between-group multivariate analysis of variance (MANOVA) was used for analysis, the independent grouping variable being dichotomous (case/non-case of Internet addiction) and the dependent variables (physical fatigue and mental fatigue), being summed Likert scales and thus treated as continuous variables.⁷⁸ The p-value for the MANOVA was set at .01 to control for Type 1 error and the Pillai's Trace statistic was used due to its greater robustness.⁷⁹ The multivariate effect size was determined by partial eta

squared (η^2). Preliminary analysis confirmed there were no serious violations of the MANOVA assumptions.

Results indicated a statistically significant difference between cases and non-cases of Internet addiction on the combined dependent variables of physical fatigue and mental fatigue, Pillai's Trace=13, $F(2, 550)=41.74$, $p < .001$; $\eta^2 = .13$. When the results for the dependent variables were considered separately, both mental fatigue ($F(1, 551)=31.93$ $p < .001$, $\eta^2 = .06$), and physical fatigue ($F(1, 551)=81.55$, $p < .001$, $\eta^2 = .13$) reached statistical significance. Although, physical fatigue had a larger effect size.

Table 1. Summary results of a one-way MANOVA for Internet addiction and mental and physical fatigue.

Dependent Variable	F	d.f	P	η^2
Mental Fatigue	31.93	1, 551	.000	.055
Physical Fatigue	81.55	1, 551	.000	.129

To reduce potential confounding bias in the results, a one-way multivariate analysis of covariance (MANCOVA) was then performed.⁸⁰ In a preliminary MANCOVA conducted with gender, age, place of residence, perceived health status, university program, degree status, and working hours as covariates, only age and perceived health status emerged as significant. Thus, age (an interval variable) and perceived health status (a categorical variable) were included as covariates in a final MANCOVA.

Results for the one-way MANCOVA, Pillai's Trace = .12, $F(2, 548) = 35.62$, $p < .001$, multivariate $\eta^2 = .12$, indicated a statistically significant difference among the Internet addiction case and non-case groups on a linear combination of mental and physical fatigue, with the two covariates. The multivariate $\eta^2 = .12$ indicated that approximately 12% of the multivariate variance of the dependent variables was associated with the group factor, a modest effect size.⁸¹ When the results for the dependent variables, controlling for age and perceived health status were considered separately, both mental fatigue ($F(1, 549) = 29.36$, $p < .001$, $\eta^2 = .05$), and physical fatigue ($F(1, 549) = 68.98$, $p < .001$, $\eta^2 = .11$), reached statistical significance. Interestingly, the covariate, age, was significantly associated with mental

fatigue $F(1, 549) = 19.28$, $p < .001$, $\eta^2 = .03$), but not physical fatigue ($F(1, 549) = .933$, $p = .335$, $\eta^2 = .002$). However, only 3% of the variance of mental fatigue was explained by age; a very small effect size.⁸¹ The covariate, perceived health status, was associated with both mental fatigue $F(1, 549) = 11.39$, $p = .001$, $\eta^2 = .02$), and physical fatigue ($F(1, 549) = .15.24$, $p < .001$, $\eta^2 = .03$), although similarly, only 2% of the variance of mental fatigue was explained by perceived health status and only 3% of the variance of physical was explained by perceived health status, both very small effect sizes.

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5. Discussion

Results indicated that students with Internet addiction reported significantly more physical and mental fatigue than students without Internet addiction, supporting both hypothesis one and hypothesis two.

In terms of the finding that those with Internet addiction report more mental fatigue than those without, perhaps, as proposed, this is linked to cognitive load, with greater amounts of time spent on the Internet requiring greater amounts of cognitive resources, that unless replenished by sufficient sleep, (something often lacking in Internet addicted students), results in a reduced ability to perform mental tasks, including, for students, the ability to concentrate on academic studies. With respect to physical fatigue, findings extend the association between prolonged use of a computer and physical fatigue in office workers,⁶⁰⁻⁶¹ to Internet addiction and university students.

The results also indicated that Internet addiction had a stronger impact on physical fatigue than on mental fatigue, a finding, as discussed below, with theoretical implications.

5.1. Theoretical and practical implications

From a theoretical perspective, this study extends understanding of Internet addiction in several ways. First, although prior research with university students has identified links between Internet addiction and health issues such as depression, stress and low self-esteem, studies on the effects of Internet addiction on fatigue are difficult to find. The present study goes some way to addressing this literature imbalance.

Second, the finding that Internet addiction had a greater effect on physical fatigue than on mental fatigue,

suggests not all dimensions of fatigue have the same relative importance, supporting assertions of scholars such as de Raaf et al.⁵² that physical and mental fatigue, whilst related, are two very different constructs. Moreover, the finding suggests future research might benefit from considering mental and physical fatigue as separate versus aggregate constructs. The underlying reason for this difference might also provide an avenue for future research as might the development of new indicators for these discrete constructs.

Future research might also extend the present study to use of controlled experiments to examine questions such as whether physical and or mental fatigue is felt when students are not using the Internet, and the amount of time those with Internet addiction and those without Internet addiction spend on the Internet before feeling fatigued.

Third, the present study indicates a direct relationship between Internet addiction and fatigue. Interestingly, prior studies have found a direct link between Internet addiction and poor academic performance,³ and a direct link between fatigue and poor academic performance.¹¹ Thus, is it possible, that fatigue acts as a mediator between Internet addiction and poor academic performance? This might be another avenue for future research.

In terms of practical implications, the results suggest that awareness campaigns on Internet addiction, its association with fatigue and its impact on academic life should be provided regularly by universities including during student orientation; the objective being to encourage Internet usage at levels that do not induce fatigue. Universities might also consider offering incentives for students who are able to limit their time online. Another consideration should be the implementation of early intervention policies where students showing signs of Internet addiction such as missing, or being late for classes, difficulty performing tasks requiring logical reasoning, problem solving or mental arithmetic, reduced ability to retain information, sleepiness in class, or poor grades, are identified early by faculty and referred to professionals such as university psychologists. Indeed, cognitive behavioral therapy has been used by psychologists to successfully treat Internet addiction.⁸² For universities with resident students, preventative strategies such as the introduction of policies to prevent late-night Internet use might also prove beneficial.⁸³

5.2. Limitations

Naturally, there are some limitations to this research. The findings must be considered in light of the representative bias associated with use of a convenience sample of students. Thus, future research might use a more representative sample to help validate present study findings. Further, the use of self-reports about Internet use and levels of fatigue may have influenced results. Therefore, it would be beneficial if future studies used more direct evidence of individual Internet addiction and mental and physical fatigue.

6. Conclusion

In summary, this research examined whether Internet addiction differentially influenced mental and physical fatigue in a sample of Moroccan university students, and in doing so provides a unique contribution to the literature. Findings provide evidence of a significant difference between those respondents with Internet addiction and those without Internet addiction in terms of both physical and mental fatigue. Given mental and physical fatigue are both likely to negatively impact academic performance, an outcome that is costly for the student or paying parent, the University and society as a whole, this study also highlights the importance of universities developing policies aimed at regulating Internet use or educating students about its potential risk.

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