Research Article

Internet Addiction of Greek Adolescent High School Students: Validity and Reliability Evidence and Relationship to Depressive Symptoms and Physical Activity

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Abstract

Objective: The present study was designed to examine: a) the validity and reliability evidence of the Chen Internet Addiction Scale - CIAS for a sample of Greek secondary students and b) the association to physical activity and depressive symptoms.

Methods: The initial sample consisted of 863 public school students, aged 13 to 19 years old, while the final sample consisted of 654 students. All students attended three public junior high schools and four senior high schools in Athens, Greece. The participants completed four questionnaires concerning internet addiction symptoms (CIAS), depressive symptoms (CES-D), physical activity level (PAQ-A) and social desirability (SDS). Specifically, construct validity, concurrent validity, face validity, internal consistency and stability across time of the CIAS were examined.

Results: Adolescents with a tendency to experience internet addiction (IA) exhibited higher depressive symptoms and lower engagement to physical activity (PA) compared to adolescents without the tendency for IA. There was a significant positive correlation between CIAS with CES-D and hours of daily internet use. Significant negative correlation was found between CIAS and PAQ-A. In addition, hours of daily use, engagement in PA and depression were significant predictors of IA. Females engaged mainly in social networks, while males engaged in both social networks and games. Concerning the reliability of the CIAS sub-factors and the total score, the internal consistency and stability across time were acceptable.

Conclusion: Overall, the adapted in Greek CIAS provided validity and reliability evidence and may be used to assess IA in Greek adolescents.

Keywords

Internet addiction; Depressive symptoms; Physical activity; CIAS; CES-D; PAQ-A

Introduction

Internet addiction (IA) refers to the compulsive, excessive use of the internet and the irritation or dysthymic behavior that occurs during its deprivation [1]. DSM-V refers to the diagnostic criteria of the disorder as a situation that requires further investigation and is linked to gambling addiction [2,3]. Davis (2001) suggested a cognitive- behavioral model in an attempt to explain the pathological internet use introducing difficulties in adaptation and causing the onset of symptoms [4]. A pre-existing sensitivity/ psychopathology is the remote but essential cause of the onset of symptoms, while the use of internet is the stressor.

According to several researchers, IA has been associated to depression [5-7], hostility [6], social phobia [6], suicidal ideation [5] and the attention deficit hyperactivity disorder [6,8]. The disorder, commonly found in East Asian countries [9], is more common in men [7,9] who engage more often in internet games and gambling [10-12], while females engage more frequently in social networks [7,13]. Respective percentages in adolescents, as reported into the literature, are 13% of medium and 1.2% of serious addiction in Canada [14], 2% addicted in Finland [15], 18 % in Japan [16], 1.6% addicted and 38% at risk of addiction in Korea [5], etc. The respective percentages in Greece are 3.1% of adolescents in Athens and Korinthos [17] and 16.1% in Kos [12].

IA has also been associated to problems in sleeping [18], bad dietary behavior and/ or skipping meals [18,19] increased BMI [20] and low physical activity levels [20]. Nevertheless, researchers have suggested that physical activity should be part of the intervention programs for the treatment of IA [20-22]. Specifically, Huang et al. [21] claimed that exercise and good health negatively correlated with the development of addiction in their study [21]. Yen et al. [20] proposed exercise to be part of intervention programs aimed at reducing the BMI, mobile and TV use of overweight adolescents preoccupied with internet use [20]. Finally, Liao [22] suggested that exercise can positively affect the exterior (characteristics of anonymity, convenience and escape), internal (loneliness and depression) and biological factors (reduced secretion amines) that provoke IA.

Several measuring instruments have been used to assess the IA, such as the Chen Internet Addiction Scale - CIAS [23], the Internet Addiction Test – IAT [24], Beard's Diagnostic Questionnaire - BDQ [25] etc. These instruments have been used in several countries, such as Japan [26], Korea [5], Italy [27], Germany [26] and Greece [11-12,17]. Their psychometric properties have been recorded in detail. Specifically, the literature revealed that the validity and reliability have been examined through: a) test retest reliability (CIAS: [23]), b) concurrent validity (CIAS: [10]), c) construct validity with exploratory factor analysis (CIAS: [10], IAT: [26-28]), confirmatory factor analysis (CIAS: [29], IAT: [27,28]), and d) detection of cut-off score (CIAS: [10], IAT: [17]).

In Greece, only the Young Internet Addiction Test has been used so far [11,12,17]. However, no validity evidence has been provided yet, leaving the area open for future research. Therefore, the present study was designed to provide clinicians and researchers with another measuring instrument for the screening and treatment of IA in Greece. Specifically, the study examined: a) the validity and reliability of the CIAS for a sample of Greek secondary students and b) the association to physical activity (PA) and depressive symptoms. Specifically, construct validity evidence was provided

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through the differences between students with and without the tendency to experience IA in depressive symptoms and engagement to PA. Concurrent validity was examined through intercorrelations with depressive symptoms, engagement to physical activity (PA) and hours of internet use. Further concurrent validity evidence was provided through the association of certain clinical (depressive symptoms) and socio demographic measures (gender, age, hours of internet use, PA) classifying the participants to those with or without the tendency to experience IA. Face validity was examined through the differences in the number of males and females who had engaged in either games, social networks, both games and social networks and other applications available in the web. The reliability was examined through internal consistency and stability across time. Finally, in an attempt to enrich the conflicting research findings [7,9-10,12,15,17,19,30,31], we examined gender and age differences with respect to IA.

According to previous research findings, we anticipated that individuals with the tendency to experience IA would score higher in the depressive symptoms [5-7] and engagement to physical activity [20], compared to those without the tendency (construct validity). We further anticipated that IA score would be positively correlated to depressive symptoms [5-7] and hours of daily use [23], while there would be a negative correlation to PA [20] (concurrent validity). Concerning the face validity and based on the literature [7,9,13,15] a higher number of males who were engaged in games and a higher number of females who were engaged in social networks, was anticipated. The reliability indexes were expected as similar to the respective figures in the literature [23]. With respect to gender and age differences in CIAS, no research hypotheses were formulated due to the previous conflicting findings [7,9-10,12,15,17,19,30,31].

Methods

Participants

An initial sample of 863 public school students was examined from a population of 122.424 enrolled students in the wider area of Athens. The students attended the 1st, 2nd or the 3rd grade of their respective junior or senior high schools. The Greek educational system mandates that students are enrolled in junior and senior high school at the age of 12 and 15 respectively. At the time of data collection (late Spring semester), the students e.g. in the 1st junior high school class were at least 12 years and 6 months old and were classified in the 13 year old group. The same principle was held for all the students according to their respective 6-month age interval (e.g. a senior high school student at the age of 16 years 6 months was perceived as a 17 years old).

Data screening led to the exclusion of the 24.22% of students (N = 209) in the initial sample because they exhibited: a) total score over nine in the social desirability scale (16.33% of initial sample) or b) illness during the last seven days (7.89% of initial sample). Thus, the final sample consisted of 654 students (346 males, 308 females), aged 13 to 19 years old (M= 14.93, S.D.= 1.48), who attended three public junior high schools and four senior high schools (358 junior high school, 296 senior high school) in Athens, Greece.

Power analysis was not conducted since there was absence of previous research findings in Greece. The only study with Greek adolescents was published by Tsitsika et al. [13] who reported the frequency of males and females involved in the web, from several European countries combined. The general attempt in the present study was to maximize the generalizability of the findings. For that reason, we followed previous research suggestions [32] claiming that the sample selection has a vital role and sample size is essential for reliability estimation. According to Pedhazur and Pedhazur-Schmelkin [32] 'a random sample of 500 can be just as reliable for making inferences about a population of, say, 100.000 as about one consisting of 10.000' (p. 326). In the present study, the seven schools were randomly selected [33] from a total pool of 366 high schools, and were located in separate districts across the wide area of Athens. The initial sample therefore was considered sufficient [34] to ensure the reliability of our findings, describe the relationship among variables and examine group differences.

Measures

Chen internet addiction scale (CIAS): In order to assess the predisposition of participants to experience internet addiction, the Chen Internet Addiction Scale - CIAS [23] was used. The CIAS is comprised of 26 questions, which are rated on a 4- point Likert scale. The questions are grouped into two factors: a) main IA symptoms and b) problems associated to IA. The first factor incorporates three sub-factors (compulsive symptoms, withdrawal symptoms, tolerance symptoms) and the second incorporates two sub-factors (interpersonal and health problems, time management problems). The total score ranges from 26 to 104, and scores above 58 indicate a predisposition to IA [10]. To gather demographic information, five additional questions were incorporated: gender, age, hours of daily involvement to the Internet, and the main type of engagement in the web.

The administration of the CIAS was held in Greek. As there was not a Greek version yet, a translation validity process [33,34] was followed. Specifically, the CIAS was translated into Greek from two bilingual experts holding a PhD in a related academic field, in an English-speaking university abroad. Later, the Greek version was back-translated into English, from another two bilingual experts holding the same qualifications. The latest version was examined and compared with the original instrument of Chen et al. [23] for clarity and conceptual equivalence [33,34]. No items exhibited ambiguous meaning and the Greek CIAS was considered ready to administer. After completion of the translation validity process, a pilot study was conducted. Throughout the pilot study, the primary researcher administered the CIAS in a sample of 98 high school students (52 juniors and 46 seniors). The students reported that the wording of items and the overall clarity of the scale were acceptable and declared no difficulties in understanding and answering the questions.

Center for epidemiological studies depression scale (CES-D): To evaluate the susceptibility of participants to experience depression, the Greek version of the Center for Epidemiological Studies Depression Scale (CES-D) [35] was used. The CES-D consists of 20 questions, which are rated on a 4- point Likert scale. The scale is addressed to the 'general population' and can be used with individuals aging 13 years and above. The total score ranges from 0 to 60 and scores above 16 indicate a predisposition to experience depression during the last 30 days.

Physical activity questionnaire for adolescents (PAQ- A) : To evaluate the involvement in physical activity, the Greek version of the Physical Activity Questionnaire for Adolescents (PAQ-A) [36] was used. The PAQ-A contains eight questions, which are rated on a 5-point Likert scale. The questionnaire is aimed at teens, aging 14-20 years, and assesses the level of their involvement in PA during the last

seven days. The total score is derived from the average of the eight questions. The maximum score five indicates high engagement to PA while the minimum score one indicates low engagement. If the participants' PA level differed the last seven days because of illness, they were excluded from further analyses.

Social desirability scale (SDS): To control the participants' tendency to give socially desirable responses, the Greek short form of the Social Desirability Scale - SDS [37], with 13 questions was used. The participants answered with the designation «True» if they agreed or «False» if they disagreed with each question. Each response was rated either with zero or one point and the total score was obtained from the sum of the 13 responses. Participants whose social desirability score was over nine were excluded from further analyses.

Procedure

Initially, a list of all high schools in Athens was obtained from the relevant department of the Ministry of Education (N = 366). Through random selection, seven high schools were selected from Athens, three junior high and four senior high. Accordingly, the Ministry of Education was contacted, asking for permission to visit the above schools and proceed with the study's demands.

After the random selection of schools, the researchers visited the schools in order to give information and sensitize the headmasters, teachers and parents to participate in the study. Teachers and parents were given letters concerning the content of the research study, while the participants signed the inform consent form. Then the researchers proceeded, after consulting with the teachers and without disrupting the operation of the school program, to the administration of the demographic, and the four assessment tools (CIAS, PAQ-A, CES-D and SDS questionnaires), during the Spring semester. The students were advised to declare their exact age, in years and months. Students were classified in their respective age group, according to the age interval they declared (e.g. 14 years and 6 months was recorded as a 15 years old). Finally, a random re-assessment of 66 participants conducted after 10 – 15 days [33] was used to estimate the stability across time.

Statistical analysis

The Statistical Package for Social Sciences (SPSS for Windows - Version20) was used for data analysis. The construct validity was assessed with the multivariate and univariate differences of students with and without the tendency to exhibit IA (scores at or above 58 in the CIAS scale), with respect to their engagement in physical activity (PA) and depressive symptoms. The eta squared (η^2) values were used for estimating effect size and interpreting group differences (> 0.80 large, 0.51 - 0.80 moderate, 0.21 - 0.50 low moderate and < 0.20 small) [38]. The Levene test, Box M and Bartlett test of Sphericity evaluated the conditions for MANOVA [39].

The concurrent validity of the CIAS was examined by calculating the Pearson correlation coefficient between CIAS, depression and PA scales. The criteria for the correlations were as follows: low (< 0.20), moderate (0.21 – 0.50) and high (> 0.50) [38]. Further concurrent validity evidence was provided through a discriminant function analysis. Specifically, the discriminant function examined the clinical (depressive symptoms) and socio-demographic measures (gender, age, hours of internet use, PA) which classified the participants according to their tendency to experience (or not) IA. The Canonical Correlation Coefficient-CCC, the % of explained variability and the correct predictions from the regression equation were used for post hoc analyses.

The face validity of the measurements was also evaluated with chi-square (χ^2) analysis. The standardized residual near or over two was used for post hoc comparison when the results were significant [40]. Specifically a 2 x 4 (gender x engagement) analysis assessed the differences in the number of males and females who had engaged with: a) games, b) social networks, c) both games and social networks and d) other applications available in the web.

The Cronbach a coefficient was used to examine the internal consistency. Correspondingly, the Intraclass coefficient was used to examine the stability across time, 10 to 15 days apart [33,40].

In an attempt to clarify previous conflicting research findings, a chi square 2 x 2 analysis (gender x addiction) examined the number of males and females with or without the tendency to exhibit IA. Further multivariate and univariate gender and age comparisons were conducted, with respect to CIAS and the five sub-factors.

Results

The CIAS cut-off score (58 and above) was used to divide the participants in those with or without the tendency to experience IA symptoms. The CES-D cut-off score (above 16) was used to divide the participants in those with or without the tendency to experience depression. The predisposition to experience symptoms of either IA and/ or depression, separate for males and females may be found in Table 1.

Concerning the construct validity, the multivariate comparison examining the differences in depressive symptoms and engagement in PA between high school students with and without the tendency to experience IA symptoms was significant (Λ = 0.890, F = 24.689, p < 0.0001, η^2 = 0.110). The univariate findings were significant for both physical activity (F = 17.403, p =< 0.0001, η^2 = 0.042) and depressive symptoms (F = 40.094, p < 0.0001, η^2 = 0.091). Examination of the t-parameter estimates revealed that the group without addiction (coded 2) had a significantly higher mean score than the group with addiction (coded 1) in PA (t = 4.172, p < 0.0001, η^2 = 0.042). On the other hand, the group with addiction had a higher mean score than the group without addiction in depressive symptoms (t = 6.332, p < 0.0001, η^2 = 0.091).

Accordingly, the concurrent validity was examined through the intercorrelations between the CIAS scores with depression, engagement to PA and hours of daily internet use. With respect to depression, the intercorrelations were significant and positive with the total CIAS score (r = 0.426, p < 0.01), the respective five CIAS sub-factors and negative to PA (Table 2). Finally, a significant positive intercorrelation was found (r = 0.535, p < 0.01) between hours of daily use and CIAS.

Further concurrent validity evidence was provided through a discriminant function analysis. Specifically, the dependent variable was internet addiction, classified in two levels according to the respective cut-off score (with vs without the tendency to experience IA symptoms). The independent variables were the hours of internet use, depression, PA, age and gender. The analysis revealed that the following variables were significant predictors of internet addiction: hours of daily use, engagement in PA and depression. The canonical correlation coefficient (CCC= 0.491) indicated that 24.11% of the variability was explained from the differences between adolescents with and without addiction. The structured coefficients of 0.875 for hours use, 0.561 for depression and - 0.369 for PA indicated that the group with addiction spent more hours daily using the internet, had

Table 1: Predisposition to experience internet addiction and depression, for both genders.

	Frequency	Percentage (%)
With addiction		
Males	50	14.5
Females	66	21.4
Total sample	116	17.7
Without Addiction		
Males	296	85.5
Females	242	78.6
Total sample	538	82,3
With depression		
Males	74	21.4
Females	148	48.1
Total sample	222	33.9
Without Depression		
Males	272	78.6
Females	160	51.9
Total sample	432	66.1

Table 2: Intercorrelations between CIAS, depression, PA and hours of daily use.

	Depression	PA	Hours of daily use
CIAS total score	0.426	- 0.228	0.535
CIAS F1: Compulsive symptoms	0.304	- 0.231	0.460
CIAS F2: Withdrawal symptoms	0.232	- 0.170	0.343
CIAS F3: Tolerance Symptoms	0.346	- 0.212	0.486
CIAS F4: Interpersonal & Health Problems	0.414	- 0.207	0.403
CIAS F5: Time Management Problems	0.460	- 0.120	0.532
Depression		- 0.241	0.261
PA	-0.241		- 0.109

All intercorrelations were significant at the 0.01 level

higher depressive scores and were less engaged in PA during the last week. The respective regression equation ($Y = - 0.827 + 0.324 \cdot X^{hours} - 0.343 \cdot X^{PA} + 0.039 \cdot X^{Depr}$) revealed a total of 80.6% of cases correctly classified. The respective percentages of correct classifications may be found in Table 3.

The face validity hypothesis was examined with a 2 x 4 (gender x type of engagement) chi square analysis. The results were significant with respect to the number of males and females engaged in social networks, games, both and other applications ($\chi^{2(3)} = 102.753$, p< 0.0001). With respect to males, the standardized residuals revealed that the significance was attributed to the: a) higher number engaged with games (SR= 5.8) and b) lower number engaged with social networks (SR= -3.4), than expected. With respect to females, the significance was attributed to the: a) higher number engaged in social networks (SR= 3.6) and b) lower number engaged with games (SR= -6.1), than expected. These findings are presented in Figures 1a and 1b.

The reliability (internal consistency and temporal stability) of CIAS, CES-D and PAQ-A was examined by calculating the Cronbach and Intraclass coefficients respectively. The results revealed coefficients ranging from .717 to .918 for Cronbach and .706 to .939 for ICC respectively. The overall findings may be found in Table 4.

To enrich previous conflicting research findings, a 2 x 2 chi square (gender x addiction) analysis and separate multivariate and univariate gender and age comparisons were conducted. With respect to the chi square analysis, the results revealed significant differences

in the number of male and female students with or without tendency to exhibit IA symptoms ($\chi^{2(1)} = 5.762$, p= 0.021). Examination of the standardized residuals revealed that the significance was attributed to the: a) less observed than expected males (SR= -1.5) and b) more observed than expected females (SR= 1.6) with IA. The results may be found in Figure 2.

An independent samples t-test was used to assess gender differences with respect to the total CIAS score. The female group scored higher than males, but the results were not significant (t= -1.816, p= 0.070). Accordingly, the multivariate comparison was not significant across gender ($\Lambda = 0.986$, F = 1.855, p = 0.100, $\eta^2 = 0.014$), with respect to the five sub-factors. The univariate comparisons however, were significant for the first (compulsive symptoms) (F= 6.745, p= 0.010, $\eta^2 = 0.010$) and approached significance for the third (tolerance symptoms) sub-factor respectively (F= 3.706, p= 0.055, $\eta^2 = 0.006$). With respect to the second (withdrawal symptoms) (F= 0.904, p= 0.342, $\eta^2 = 0.001$), fourth (interpersonal & health problems) (F= 1.142, p= 0.286, $\eta^2 = 0.002$) and fifth (time management problems) (F= 1.176, p= 0.279, $\eta^2 = 0.002$) sub-factors, the results were not significant. Examination of the t-parameter estimates revealed that the female group (coded 2) had higher mean scores compared to

Table 3: Classification results.

	Predicted Group Membership		
Original Group Membership		With addiction	Without addiction
	With addiction	64.60%	35.40%
	Without addiction	16.30%	83.70%

Figure 1a: X² analysis for males (gender X type of engagement).

Figure 1b: X² analysis for females (gender X type of engagement).
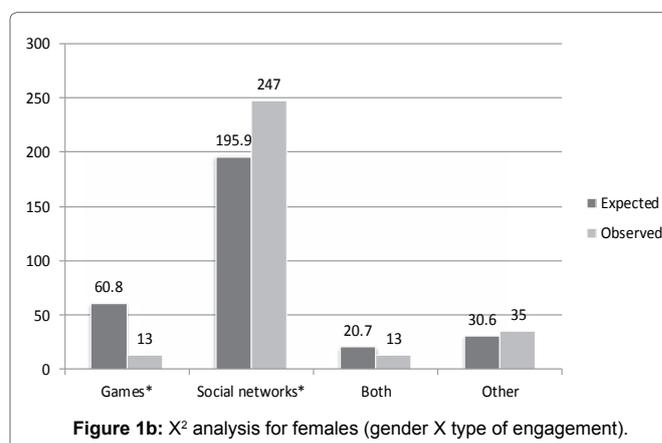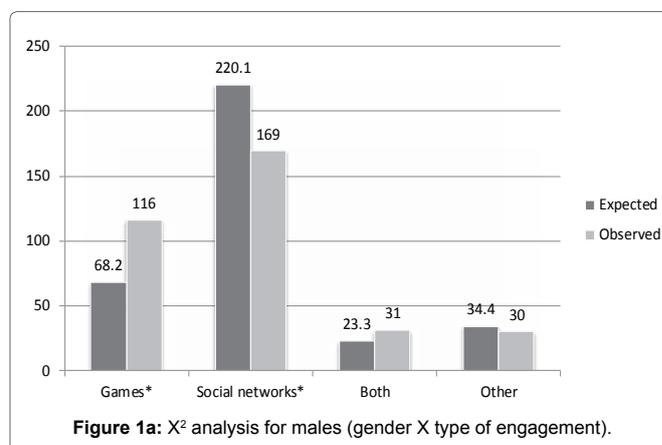
Table 4: Reliability results.

|	ICC	Cronbach a
CIAS F1: Compulsive symptoms	0.835	0.751
CIAS F2: Withdrawal symptoms	0.706	0.797
CIAS F3: Tolerance Symptoms	0.843	0.720
CIAS F4: Interpersonal & Health Problems	0.881	0.752
CIAS F5: Time Management Problems	0.865	0.717
Internet Addition Core Symptoms	0.880	0.891
Internet Addition Related Problems	0.907	0.830
CIAS total score	0.939	0.918
CES-D total score	0.902	0.881
PAQ-Q total score	0.866	0.840
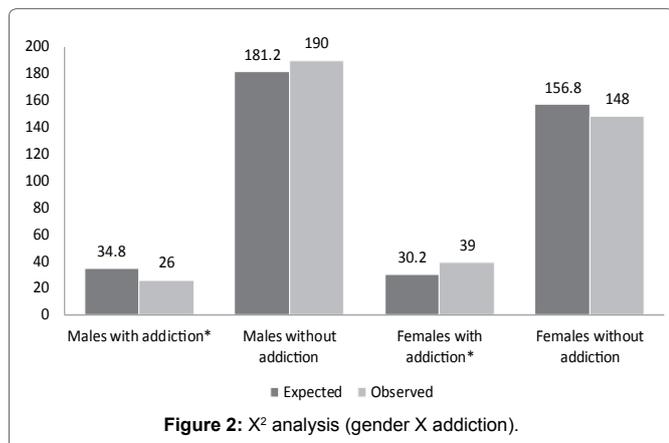
Figure 2: X^2 analysis (gender X addiction).

males (coded 1) in the first (t = -2.597, p = 0.010, η^2 = 0.010) and third (t = -1.925, p = 0.055, η^2 = 0.006) sub-factors respectively (Table 5).

The multivariate gender comparison was significant with respect to physical activity and depression (Λ = 0.898, F = 36.956, p < 0.0001, η^2 = 0.102). The univariate comparisons were significant for both engagement to PA (F = 43.481, p < 0.0001, η^2 = 0.063) and depressive symptoms (F = 44.585, p < 0.0001, η^2 = 0.064). The t parameter estimates indicated that the male group had significantly higher scores in PA (t = 6.594, p < 0.0001, η^2 = 0.063) and lower in depressive symptoms (t = -6.677, p < 0.0001, η^2 = 0.064) compared to the female group.

Age differences (junior vs senior high school students) were not significant for the total CIAS score (t= 1.703, p= 0.089) (M^{junior} = 46.73 $\pm$ 13.07, M^{senior} = 45.00 $\pm$ 12.74). The multivariate age differences with respect to the five sub-factors were significant (Λ = 0.968, F = 4.306, p = 0.001, η^2 = 0.032). The univariate comparisons were significant for the fourth sub-factor ('Interpersonal and Health Problems') (F = 11.924, p = 0.001, η^2 = 0.018). The t parameter estimate (t = 3.453, p = 0.001, η^2 = 0.018) revealed that the younger (juniors: M = 11.30 $\pm$ 3.59) students scored significantly higher compared to the older (seniors: M = 10.35 $\pm$ 3.38) students. The univariate age comparisons were not significant with respect to 'Compulsive Symptoms' (F = 2.693, p = 0.101, η^2 = 0.004), 'Withdrawal Symptoms' (F = 1.207, p = 0.272, η^2 = 0.002), 'Tolerance Symptoms' (F = .175, p = 0.676, η^2 = 0.000) and 'Time Management Problems' (F = 0.000, p = 0.991, η^2 = 0.000).

Multivariate age differences (junior vs senior high school students) were significant for engagement to PA and depressive symptoms (Λ = 0.980, F = 6.649, p = 0.001, η^2 = 0.020). Univariate

differences were significant for PA (F = 11.286, p = 0.001, η^2 = 0.017) but not significant for depressive symptoms (F = 0.309, p = 0.578, η^2 = 0.000). The t parameter estimates (t = 3.359, p = 0.001, η^2 = 0.017) revealed that the junior high school (M = 2.88 $\pm$ 0.75) students had significantly higher PA scores compared to senior high school students (M = 2.67 $\pm$ 0.77).

Discussion

For the purposes of the study, the validity and reliability evidence from the responses of 654 Greek students in the CIAS were examined. Specifically, the: a) construct, concurrent and face validity, and b) the internal consistency and stability across time were examined.

With respect to the construct validity evidence, our research hypothesis was confirmed. The involvement in PA and depressive scores for the group with the tendency for addiction was different compared to the group without. Specifically, the group with the tendency to experience IA was less involved with PA and exhibited wider symptoms of depression, compared to the group without. This finding is in agreement with the literature, since individuals with IA have exhibited higher depressive scores [5-6] and lower engagement to PA and health promoting behaviors [18-19] compared to those without IA.

Concerning concurrent validity, a positive association was found between the CIAS and the depression questionnaire. This result is supported by previous researchers who claimed that depression is associated with IA [6,29,41-43]. In addition, Huang et al. [21] found that the percentage of people with depression who had IA problems was significantly higher than those with addiction but not depression [21]. Similarly, Caplan [44] established the existence of significant correlation between depression and problematic internet use [44]. However, there is not a clear cause - effect relationship between these variables, leaving the area open for future research.

A positive association was found between the hours of daily use and IA, a result which is in agreement with Chen et al [23]. Moreover, Katliala- Heino et al [15] found statistically significant difference in the hours of Internet use among groups with and without IA. Specifically, it was found that as the hours of engagement with the internet increased, the scores in the respective IA questionnaire increased as well. Therefore, the positive correlation between the hours of daily use and IA score may be considered as another evidence of concurrent validity of the CIAS.

Regarding the relationship of IA to PA, a statistically significant negative correlation was found. This finding may be considered in accordance to Liao's (2011) proposal of exercise as a means of prevention and/ or part of intervention for the treatment of IA [22]. Specifically, Liao [22] claimed that exercise may reduce depression and improve mood through amines secretion. This assumption is confirmed in the study of Huang et al [21] who found that exercise and good health were associated negatively with the development of IA. Respectively, in the studies of Kim et al., Kim et al. and Yen et al. [18-20] the promotion of healthy lifestyle for people with addiction was proposed, as it was found that these individuals had very limited participation in daily activities that promoted health. The above findings seem important for adolescents, since low levels of PA and long hours of internet use (sedentary behavior) may lead to increased BMI [20], problems in sleep, dietary behavior and health consciousness [18,19] impaired development [19], and interference with the social roles that an individual should adopt from adolescence to adulthood [18].

Table 5: Descriptive statistics and gender comparisons.

Variables		M	SD	N	p
Age					0.174
	Males	14.86	1.44	346	
	Females	15.02	1.53	308	
				3	
F1: Compulsive symptoms					0.001
	Males	9.21	3.08	346	
	Females	9.84	3.21	308	
F2: Withdrawal symptoms					0.342
	Males	9.18	3.30	346	
	Females	9.43	3.48	308	
F3: Tolerance Symptoms					0.055
	Males	7.84	2.60	346	
	Females	8.23	2.60	308	
F4: Interpersonal & Health Problems					0.286
	Males	10.73	3.12	346	
	Females	11.03	3.92	308	
F5: Time Management Problems					0.279
	Males	8.13	2.84	346	
	Females	8.39	3.27	308	
Internet Addition Core Symptoms					0.043
	Males	26.22	7.84	346	
	Females	27.50	8.31	308	
Internet Addition Related Problems					0.233
	Males	18.86	5.24	346	
	Females	19.42	6.61	308	
CIAS total score					0.070
	Males	45.08	12.06	346	
	Females	46.92	13.82	308	
Hours of daily use					0.065
	Males	3.45	2.53	346	
	Females	3.85	3.01	308	
CES-D total score					0.001
	Males	12.58	7.55	346	
	Females	17.60	11.46	308	
PAQ-A total score					0.001
		2.97	74		
	Males	2.58	74	346	
	Females			308	

In addition, the three variables named hours of daily use, engagement in PA and depressive symptoms were significant predictors of IA. This result is in agreement with Huang et al. [21] and Tsitsika et al [13] who found that longer hours of internet use were associated with IA symptoms and reduced activities of daily life. Specifically, in the study of Huang et al [21] internet use was one of the predictors of IA. In the study of Akin and Iskender [41], depression could be predicted by IA and in the study of Huang et al [21], 25.3% of the participants with depression were addicted to the internet. So, the experts who are dealing with IA must take seriously under consideration the three variables that emerged from the discriminant analysis.

The face validity hypothesis argued that females would engage more often in social networks while males would engage more often in games on the web. This claim was verified in the present study, since the majority of females (247/388: 63.66%) dealt mainly with social networks. This hypothesis was based mainly on the study of Tsitsika et al. [13], who found that the use rate of social networks and the percentage of physical problems caused because of the excessive use was significantly higher for European females compared to males [7]. The present study's findings are in agreement with Tsitsika et al. [13] and support the face validity of the CIAS. Males on the other hand were engaged primarily to both internet games (116/346: 33.53%) and social networks (169/346: 48.84%). This finding is partially in

agreement with previous researchers who claimed that males engage mainly to internet games [10,12], gambling [11-12] and pornography [12]. In an attempt to explain the high rate of male involvement with social networks, we consulted a recent study concerning the social networks' use in Europe [13]. No comparable figures to the 48.84% of males' engagement to social networks were found, as the percentage of social networks' use was mentioned combined for the total sample and not separately for each gender. In general, international literature claims females to report higher positive use of social networks and higher positive collective self-esteem, while males report higher negative use and collective self-esteem [7,45].

As to the use of social networks for both genders, recent research findings suggested that 92% of adolescents were members of social networks and 70% uses them every day in Europe [13]. Furthermore, 38% of the adolescents spent at least two hours daily using social networks, while the respective percentage in Greece was 61% [13]. The above figures, combined with the prolonged hours of daily internet use recorded in the present study, could be considered hazardous. Heavy internet use, seems to displace other daily activities (such as studying, communication and going out with friends, doing sports etc.), which are vital for the adolescents' character development [13,18] and linked to negative collective self-esteem [45].

On the other hand, correct and moderate internet use could end up to very positive outcomes. As internet is a great information

resource nowadays, adolescents should be encouraged and taught how to use it in order to search information and further learning opportunities [13]. Another useful dimension is the providing outlet for people who live in remote areas or have mobility restrictions limiting their opportunities for social interaction and/ or working [46].

Concerning the reliability of CIAS sub-factors and the total score, the internal consistency and stability across time were acceptable and in accordance to the standards [33] and the respective CIAS literature [16,23,47-49]. Specifically, the Cronbach alpha's of the CIAS total score reported in literature were 0.90 [47], 0.94 [23], 0.95 [48] and 0.97 [16], well above the research standards (> .70) [33] for reliability coefficients.

With respect to gender and age differences, no research hypotheses were formulated. Females scored higher in compulsive and tolerance symptoms. No gender differences were reported for withdrawal, interpersonal and health problems and time management problems. In accordance to the above findings, Kuss, Griffiths and Binder [30] found that females with addiction were more than males, but the difference was not statistically significant. Similarly, in the study of Katliala- Heino et al [15] in Finland, the percentage for females at risk of addiction was higher compared to males, while in the study of Gamez- Guadix, Villa- George and Calvete [31] in Mexico, no gender difference was found. In contrast, several researchers have found more males with the tendency to experience IA compared to females [7,9-10,12,17,19]. Overall, the conflicting findings may be attributed to the different samples examined, instruments used, type of internet engagement etc.

Further, females had higher predisposition to exhibit depressive symptoms and less involvement in PA than males. These findings are in agreement with Kim et al. [36] who claimed that females exhibited higher scores in depression and suicidal ideation compared to males. Further, previous researchers supported that females are less involved in daily PA compared to males [36,49,50]. In the past, less involvement in PA has been associated with higher depressive symptoms [51-52], feelings of isolation [53] and loneliness [54]. These variables seem to interact with each other, since PA may suppress the tendency to experience depressive symptoms, increase the chances to communicate with others, ameliorate the effect of loneliness and overall the amount of time spent alone in the web.

The age differences (junior high school vs senior high school), with respect to the addiction and depression questionnaires, were not significant. This finding is in conflict with Kim et al. [17] and Stavropoulos et al. [19] who claimed that younger participants had higher IA scores. In the present study, significant age differences were found only in PA, where junior high school students reported higher engagement scores compared to senior students. This is probably due to more hours of teaching physical education in junior high school, but also to more free time available to younger students. In detail, senior high school students are preparing themselves for undergraduate studies, have long hours of studying and attending classes and subsequently, not enough time for engagement in PA.

In conclusion, the adapted in Greek CIAS appears as valid and reliable and may be used to assess IA in Greek adolescents. Furthermore, the PA of adolescents with problematic internet use is reduced, while their predisposition to depression is higher than their peers who are not at risk of addiction. So, PA may have an inhibitory effect and may be proposed as part of the respective treatment. This

hypothesis, however, must be confirmed in experimental studies before permanent conclusions are drawn.

Certain limitations do not allow generalization of the present findings without caution. First, the sample was limited to adolescents, 13 to 19 years old, living in Athens. Second, it was not feasible to observe the actual behavior of adolescents, regarding their daily involvement with internet use, physical activity and depressive symptoms. To overcome this limitation, self-reported questionnaires were used instead. The assessment of PA however, was based on the guidelines presented by Kowalski, Crocker and Donen [55] for adolescents approximately 14 to 20 years old. In the present study, the younger group of junior high school students was 13 years old, a little bit under the guidelines of Kowalski et al [55]. We decided, however, to proceed and administer the PAQ-A to 13 year adolescents despite the above discrepancy which may stem from the differences between the Canadian and the Greek educational systems. Further, the PAQ-A has been used in the past with Greek adolescents [56], providing support to our decision. Third, no clinical samples (such as individuals diagnosed with internet addiction or depression) were available in the present study, in order to contrast their responses to those of adolescent high school students with no addiction/ depression. Fourth, we may not exclude the tendency of certain adolescents to give socially desirable responses to the questionnaires administered. An attempt was made to overcome that limitation using the SDS scale and reduce the bias of socially desirable responses. As the percentage of participants who answered desirably was quite high (16.33%), it is proposed that future researchers should examine this tendency during their respective assessments. Finally, although the effect sizes were moderate to high for the intercorrelations, they were mainly low for the comparisons between: a) those with and without the tendency for IA and b) across gender and age groups. It appears therefore that the emerged differences were mainly attributed to the wide number of adolescents examined.

Future studies may attempt to overcome the above limitations and examine the validity and reliability of CIAS, in other districts within Greece, with different age groups, etc. Furthermore, due to the possible inhibitory effect of PA on the appearance of both depression and addiction, the effects of an organized PA program for the treatment of patients with IA may be examined. Finally, the low effect sizes may be indicative that gender and age differences, although significant, may not be so wide to consider in the future. Adolescents may be treated as a unified group, according to gender and age, while group differences may be examined for other independent variables such as engagement to PA, sedentary daily habits, type of engagement in the web, socioeconomic status, etc.

As to the benefits of the present study, the attempt to associate PA to IA may be innovative, as it may prove helpful in the future for both clinicians and researchers alike. Possibly, the promotion of a healthy lifestyle may be the safe future path to avoid symptoms of IA in adolescents.

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