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Title: Validation study of the Core Beliefs about Behavioral Addictions and Internet
Addiction Questionnaire (CBBAIAQ)

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Abstract

The present study involves the construct and validation of the Core Beliefs about Behavioral Addictions and Internet Addiction Questionnaire (CBBAIAQ), on a French non-specific population. Development of the questionnaire was divided into three steps: creation of items based on semi-structured interviews, conduction of an Exploratory Factor Analysis (EFA) to elaborate the structure of the questionnaire on a first sample of 458 participants, and assessment of internal structure by performing a Confirmatory Factor Analysis (CFA) on a second sample of 544 participants. Data was collected through online surveys. Both samples were evaluated for problematic Internet use (PIU) (IAT; Young, 1998) and problematic Facebook use (PFU) (BFAS; Andreassen, Torsheim, Brunborg, & Pallesen, 2012) for testing correlations with CBBAIAQ factors. EFA, performed on the 91 created items, identified a 3-factor solution composed of 41 items. CFA, performed on the 41 remaining items, revealed a more significant 6-factor model of 23 items. Factor 2, 4, and 6 were significantly negatively correlated with PIU ($r=-0.09$, $r=-0.11$, $r=-0.09$). Psychometric properties of the CBBAIAQ ($X^2=406$; $p<.001$; CFI=0.94; TLI=0.93; SRMR=0.05; RMSEA=0.04) and internal coherence (from $\alpha=0.67$ to $\alpha=0.85$) were good. The CBBAIAQ can be exploited in future research to explore relations between core beliefs and other variables.

Key words: Behavioral addiction, Internet addiction, Problematic Internet use, Core beliefs, Social representations, Social Media addiction.

1. Introduction

These past decades, problematic Internet use (PIU), its consequences, and possible psychotherapeutic treatments received increasing attention (Zajac, Ginley, Chang, & Petry, 2017), and excessive Internet use was recognized as a global public health concern (Ioannidis et al., 2019). PIU (also called Internet Addiction) was understood to be a behavioral addiction despite controversial results in literature (Petry & O'brian, 2013; Starcevic, 2013), which are classified among impulse control disorders in the *ICD-11* (World Health Organization, 2018). PIU is an umbrella term referring to numerous activities on the Internet (e.g. online gaming, online sexual activities, information collection activities, social media, online dating, online shopping) (Király & Demetrovics, 2021; Zhang, Zhang, & Xu, 2019; Ramón-Barrada, Ruiz-Gómez, Belén Correa, & Castro, 2019; Bonilla-Zorita, Griffiths, & Kuss, 2020; Kuss & Griffiths, 2017), and it was suggested that the definition of PIU still being vague makes it less likely to be stigmatized and perceived as a mental health issue (Kim et al., 2018). Nevertheless, serious negative health consequences may occur with PIU (e.g. headaches, blurred vision, tearing eyes, hearing problems, sleeping problems) (Bener et al., 2019), as well as psycho-social problems (e.g. isolation, difficulties making new friends) and comorbidities (e.g. depression, anxiety disorders, social media burn-out, stress) (Carli et al., 2013; Han, 2018; Kim et al., 2019; Király & Demetrovics, 2021; Niedorys, Kocka, Ślusarska, & Chrzan-Rodak, 2018; Liu & Ma, 2018).

Cognitive and Behavioral Treatment (CBT) interventions were identified as efficient treatment for PIU (Young, 2011; 2013; Kim et al., 2018; Zhang et al., 2019; Zajac et al., 2017), and main focuses of preventative and curative CBT interventions are raising awareness about addictive mechanisms, rebuilding meaning around Internet use, learning alternative behaviors, improving self-regulation skills, and reorganizing lifestyle (Kim et al., 2018; Zhang et al., 2019). It was emphasized that what is important in CBT is the individual's understanding and evaluation of the situation (Zhang et al., 2019). Likewise, the health belief

model, used in preventative care applied to problematic health behaviors, chronic illnesses, and psychological disorders (Green, Murphy, & Gryboski, 2020; Goyal, Sudhir, & Sharma, 2020), determined the importance of beliefs in regards to health since they modulate health-related behaviors, and it was shown that health promotion messages are likely to be more efficient if an individual is ready for change and feels concerned by their health (Green et al., 2020). Therefore, it is crucial to investigate beliefs about PIU.

Numerous studies on PIU measured the relation of PIU with beliefs (Balıkçı, Aydın, Sönmez, Kalo, & Ünal-Aydın, 2020; Marci, Marino, Sacchi, Lan, & Spada, 2021; Fioravanti, Flett, Hewitt, Rugai, & Casale, 2020), and maladaptive cognitions about individual's personal Internet use (Sebre, Miltuze, & Limonovs, 2020; Wegmann, Oberst, Stodt, & Brand, 2017). Behavioral and normative beliefs about Instagram use were investigated through a qualitative study (Ting, Ming, de Run, & Choo, 2015), and positive beliefs about Internet use, leading to positive Internet expectancy, were also multiple times shown to be linked to PIU (Liu, Fang, Wang, & Zhou, 2016; Taymur et al., 2016; Brand, Young, Laier, Wölfling, & Potenza, 2016). However, to our knowledge, there are no psychometric tools allowing to measure core beliefs about PIU, and acknowledging the importance of individual's beliefs in regards to PIU for engaging in positive health-behaviors, the aim of this present study was to gain understanding about beliefs about PIU and to create a tool which could be used in a prevention context, individual treatments, and further research.

1.1. Defining PIU

Although there is still no precise definition of PIU, several clinical signs have been established over the past decades, associated with pathological gambling criteria defined in the *DSM-5* (APA, 2013), impulse control disorder defined in the *DSM-IV* (APA, 1994), and neurobiological and psychosocial mechanisms observed in substance abuse (Goldberg, 1996). Griffith's (2005) six-component addiction model which includes salience, tolerance, mood modification, relapse, withdrawal, and conflict was often used to assess facets of PIU (e.g.

problematic social media use, problematic social networking, problematic Tinder use) (Paakkari, Tynjälä, Lahti, Ojala, & Lyyra, 2021; Orosz, Tóth-Király, Bőthe, & Melher, 2016; Andreassen et al., 2016). Overall, Internet Gaming Disorder is one of the many facets of PIU that has been standardized and integrated to the *DSM-5* which included signs as preoccupation, withdrawal, tolerance, problems with reducing, giving up other activities, continuance despite the problems, covering up, use to escape from negative moods, risk of loss regarding relationships and opportunities (APA, 2013).

Research has shown that individuals have a “first-choice-use” when it comes to Internet use, and people might be addicted more to the content or application rather than the Internet itself (Brand, Young, Laier, Wolfing, & Potenza, 2016; Starcevic, 2013; Griffiths & Szabo, 2013). PIU was considered multidimensional and refers to any kind of activity, application or medium involving Internet use (Király & Demetrovics, 2021; Montag et al., 2015; Pawlikowski, Nader, Burger, Stieger, & Brand, 2014; Davis, 2001; Brand, Young, & Laier, 2014; Caplan, 2010).

In this context, this present study explored relations of beliefs about Internet use with both PIU in general and Facebook use, since this is still one of the most widely used social media around the world (Pornsakulvanich, 2018; Ryan, Chester, Reece, & Wenos, 2014). There is no consensus about how to consider PSM (Paakkari et al., 2021), which was either defined by the addiction model (Griffiths, 2005), adaptations of the criteria for Internet Gaming Disorder (APA, 2013), and literature on Social Media addiction suggests that it is a legitimate disorder by its own, and more rigorous studies could allow a reconsideration of its definition in the *DSM-5* (Pantic, 2014; Ryan et al., 2014; Van de Eijnden, Lemmens, & Valkenburg, 2016). It is important to remind that several social media activities overlap and terms may be used interchangeably in literature (Kuss & Griffiths, 2017). As such, social media is an umbrella term for online media applications, such as collaborative projects, weblogs, content communities, social networking sites (e.g. online dating sites), virtual game

worlds and virtual social worlds (Aydın, Güçlü, Ünal-Aydın, & Spada, 2020; Strubel & Petrie, 2017; Kaplan & Haenlein, 2010).

1.2. Cognitive and behavioral approach on PIU

A consistent part of literature is dedicated to studying behavioral and cognitive models of PIU (Caplan, 2002; 2005; 2010; Davis, 2001), and individual and group interventions of CBT dedicated to treatment of PIU (Young, 2011, 2013; Kim et al., 2018; Zhang et al., 2019). The cognitive and behavioral model of PIU differentiated specific PIU (use of Internet for a specific purpose that also exists outside of Internet use) from generalized PIU (multidimensional overuse of the Internet), and determined the role of maladaptive cognitions about the self and the world in development and maintenance of PIU (Davis, 2001). This model suggests that PIU itself is the consequence of preexisting psycho-social problems, and literature identified other cognitive and behavioral factors that might stress occurrence of PIU (e.g. preference of online social interactions, mood alteration, cognitive preoccupation, deficient self-regulation) (Caplan, 2010, p. 1090). In addition, the I-PACE model (Interaction of Person-Affect-Cognition-Execution) showed that cognitive biases play a role in the learning process and facilitates associations between thoughts and Internet use (Brand, Young, Laier, Wolfing, & Potenza, 2016), and suggested that addictive behaviors (e.g. online gaming, gambling, shopping, pornography, social networking) develop as a consequence of interaction of predisposing variables, affective and cognitive responses, and executive functions (Brand et al., 2019).

As mentioned previously, Internet-related cognitions correlated with PIU (Balıkçı et al., 2020; Marci et al., 2021; Fioravanti et al., 2020), and beliefs linked to Internet use might encourage PIU by creating Internet-expectations and by normalizing it (Taymur et al., 2016; Brand et al, 2016; Lee, Ko, & Chou, 2014; Sebre et al., 2020; Wegmann et al, 2017; Ting et al., 2015; Liu et al., 2016). In this direction, neuropsychological research and CBT programs suggest that patients can enhance control over Internet use by modifying cognitions and

expectancies linked to their Internet use (Brand, Young, & Laier, 2014). In fact, beliefs and representations about ourselves and our surroundings have an impact on our thoughts, emotions, and daily life habits (Wenzel, 2012). Several CBT programs were introduced these past decades and focused on learning new skills for management of PIU rather than neutralizing it. For instance, CBT-IA used a three-phase approach designed for PIU specifically (behavior modification to gradually decrease Internet use, cognitive therapy used to address denial, and identification of coexisting issues) and showed promising results as it helped ameliorate symptoms of PIU (Young, 2011, 2013). Likewise, the PROTECT+ program was designed for treating PIU in adolescents and included psychoeducation, cognitive restructuring, and development of life skills interventions, which targeted boredom and motivational problems, procrastination and performance anxiety, social anxiety, and functional emotional regulation skills (Szász-Janocha, Vonderlin, & Lindenberg, 2021). The CBT approach highlights the importance of beliefs in treating PIU, in preventative and curative contexts.

1.3. This present study

The aim of this present study was the construction and conceptual validation of the Core Beliefs about Behavioral Addiction and Internet Addiction Questionnaire (CBBAIAQ). Assessing core beliefs about PIU will allow healthcare professionals to better understand the social narratives and beliefs associated to Internet addiction. This is important, as former studies have underlined the implication of cognitive mechanisms in the upkeep of addictive behaviors to products and behaviors (Tison & Hautekeete, 1998; Chabrol, Massot, Chouicha, Montovany, & Rogé, 2001; Hautekeete, Cousin, & Graziani, 1999; Beck, Wright, Newman, & Liese, 1993), and in PIU (Davis, 2001; Caplan, 2010; Brand et al., 2019 ; Young, 2013 ; Szász-Janocha et al., 2021). The term Internet addiction (IA) was used as much as PIU because IA is a commonly used term in the general population. The underlying matter is to build up awareness around the existence of core beliefs and social narratives linked to PIU.

This scale was designed to be used in a research protocol but could also serve healthcare or educational contexts for prevention or to support patients that manifest symptoms of PIU, especially by identifying the link between beliefs related to Internet use and Internet use itself.

The following research question guided this present study: **What are common core beliefs about behavioral addictions and Internet addiction among a non-specific population? and what are the relations between core beliefs and scores of PIU and PFU?**

2. Methodology

2.1. Creation of the CBBAIAQ

For development of the questionnaire, items were created from semi-structured research interviews with 4 male participants and 3 female participants of different ages ($M=30.6$, $SD=11.5$), with an interview grid based on literature on PIU and general questions about interviewee's opinions about it (e.g. "what does the term Internet Addiction mean to you?", "what do you know about behavioral addictions?", "what would characteristics of an Internet addict be?"). Participants did not have significant scores for PIU. Interviews were transcribed and through analysis of the verbatim transcriptions, ten main themes came through. In total, 91 items were created. Formulations of sentences were extracted from the interviews for construction of the items: (1) the definition of addiction "Addiction is being dependent on a product or a way of life", (2) Internet addiction as a behavioral addiction "Internet addiction is a new behavioral addiction", (3) addiction to specific activities on the Internet rather than Internet addiction in general "One can be dependent of one activity in particular on the Internet (social networking, online dating, online gaming, etc.)", (4) the existence of different levels of Internet Addiction, "Internet addiction can be absent, mild, moderate or severe", (5) the generational and cultural aspects in regards to Internet use and addiction "Older people are less dependent on the Internet because they have known a different way of functioning", (6) psycho-social and educational influences on Internet Addiction "Highly educated individuals are less dependent on the Internet because they know how to protect themselves from the

dangers of Internet”, (7) negative consequences of Internet Addiction on daily life “Internet addiction harms creativity and intellectual stimulation”, (8) biological, psychological and sociological risks of Internet Addiction “Being online too much can impact one’s perception of reality”, (9) the impact of availability of the Internet on Internet Addiction “Today, anyone can become addicted to the Internet because almost any activity requires an Internet connection”, (10) social and professional benefits of Internet use and its impact on Internet Addiction “Using the Internet is addictive because it makes relationships with others less complicated”.

2.2. Study samples

Two samples were used for the development of the CBBQIAQ. Sample 1 was used for the exploratory factor analysis (EFA), and sample 2 for the confirmatory factor analysis (CFA). Both studies addressed a non-specific French-speaking population and the only inclusion criteria was Internet use. Sociodemographic characteristics of the two samples are presented in table 1. Sample 1 was composed of 458 participants, composed of 159 male participants (35%) and 299 female participants (65%) aged between 18 and 74 years old ($M=33.5$, $SD=13.34$). Sample 2 was composed of 544 participants aged between 18 and 68 years old ($M=29.9$, $SD=11.3$), with 121 (22%) male participants and 423 (78%) female participants.

Table 1

Sociodemographic characteristics of study sample 1 and 2

	N	%	N	%
	<i>Sample 1 (N=458)</i>		<i>Sample 2 (N=544)</i>	
Sex				
Male	159	35	121	22
Female	299	65	423	78
Professionnal category				
Intermediate professions	66	14	73	13
Student	160	34	237	43
Artisan, trader	68	14	6	2
Company director	-	-	5	1
Liberal professions	23	5	35	6
Unemployed	37	8	21	6

Retired	16	4	3	0.5
Employee	88	19	61	11
Civil servant	-	-	103	19
Professional domain				
Computer science	71	16	99	18
Addictology	-	-	35	6
Health and social	-	-	146	27
Education	-	-	122	22
None of those	-	-	142	26
History of addictions				
Yes	170	37	187	35
No	288	63	357	65
Problematic Internet use				
Yes	142	31	85	15
No	312	68	459	85
Problematic Facebook use				
Yes	305	67	43	8
No	152	33	501	92
I need Internet for work				
Yes	-	-	496	91
No	-	-	48	9
I meet people with Internet addiction at work				
Yes	-	-	351	64
No	-	-	193	36
Age	33.5 (M)	13.4 (SD)	29.9 (M)	11.3 (SD)

Sample 1 was composed of a majority of students, intermediate professions, and employees. A minority worked in computer science professions ($N=71$). On the first sample, 31% of the participants ($N=142$) obtained significant scores for PIU, and 33% ($N=305$) for PFU. Sample 2 was composed of a majority of individuals that worked in intermediate professions, that were students, or worked as civil servants. In addition, 15% ($N=85$) of the sample obtained significant scores for PIU, and 8% ($N=43$) did for PFU. Internet is commonly used for work, more than half of the participants consider that they meet people that have Internet addiction at work. A minority of participants presented past addictions in both samples, however this still represents a significant part of sample 1 (37%) and sample 2 (35%).

2.3. Measures

In the two studies, participants responded to an anamnestic questionnaire. The items were not completely identical, as can be observed in table 1. However, the questionnaires retraced general sociodemographic information (e.g. sex, age, professional category, history of past addiction) and internet-related information. History of addictions was evaluated by the item “I have had addictive behaviors to certain products or behaviors in the past” (Yes/No).

2.3.1. *Core Beliefs about Behavioral Addictions and Internet Addiction Questionnaire*

This questionnaire assessed agreement of the participants with general beliefs about various different dimensions of Internet addiction. It is a self-report questionnaire with a 7-point Likert-type responses (1=I do not agree at all to 7=I completely agree). Sample 1 responded to 91 items that were created after qualitative analysis of the semi-structured interviews. Items were described in the methodology section that describes the creation of the CBBAIAQ. Sample 2 responded to 41 items that remained after Exploratory Factor Analysis. Internal consistencies were developed in the result section, but were convenient for sample 1 ($\alpha=0.86$, $\alpha=0.79$, $\alpha=0.74$) and for sample 2 (ranging from $\alpha=0.67$ to $\alpha=0.85$).

2.3.2. *Internet Addiction (or Problematic Internet use)*

The Internet Addiction Test (IAT) was created by Young in 1998, validated by Widianto and Mc Murren (2004), translated and validated into French (Khazaal et al., 2008). This is a 20-item self-report test with 5-point Likert responses (1=rarely, 2=occasionally, 3=sometimes, 4=often, 5=always). A score between 0 and 30 indicates no problematic use of the Internet, a score between 31 and 49 indicates a slight dependence, a score between 50 to 79 a moderate dependence and a score between 80 to 100 means a severe dependence. In the present study, participants scores were divided into two dichotomous categories, 0-49 (no problematic use) and 50-100 (problematic Internet use). The scale has good internal consistency on each of the samples, with Cronbach's alpha of $\alpha=.92$ for both sample 1 and sample 2.

2.3.3. Facebook Addiction (or Problematic Facebook use)

A French translation of the Bergen Facebook Addiction Scale (BFAS, Andreassen, Torsheim, Brunborg, & Pallesen, 2012) was used to measure problematic use of Facebook (PFU). This scale operates from the six-component model of addiction perspective (Griffiths, 2005). It is a 6-item self-report scale on a 5-point Likert scale (1=very rarely, 2=rarely, 3=sometimes, 4=often, 5=very often). The used cut-off score for PFU is 16. The scale has good internal consistency with Cronbach's alpha of $\alpha=.90$ for both sample 1 and sample 2.

2.4. Procedure

For both studies, a declaration of conformity was made at the university's ethics committee, and the study was designed in accordance with ethical guidelines of the Helsinki Declaration. Participants of sample 1 and 2 were recruited online through diverse social network sites, professional networks, chat rooms and were addressed to several university secretaries. Indeed, these present studies were interested in assessing core beliefs about behavioral addiction and Internet addiction in a general non-specific population, the only inclusion criteria were the use of Internet, having an account on Facebook and being at least 18 years old. Participants could access the online survey by clicking on a link. Before participation could take place, participants received the informed consent which they needed to agree with in order to continue. A brief research summary of the study was presented, which contained aims of the study, instructions necessary to complete the survey and an e-mail address was displayed so the participants could reach out for questions or give feedback about the study.

2.5. Statistics

Exploratory factor analysis (EFA) was performed with Statistica® Software on sample 1. After analysis, items were selected to obtain a satisfying model. Internal coherence was evaluated with Cronbach's Alphas, and Pearson correlations were performed on factors of the CBBAIAQ, PIU scores and PFU scores. Confirmatory factor analysis (CFA) and reliability

analysis were performed with SPSS® and Jamovi® software on sample 2. Pearson correlations were performed on factors of the CBBAlAQ, PIU scores and PFU scores.

3. Results

3.1. Exploratory factor analysis on sample 1

Exploratory factor analysis was carried out on the 91 items of the questionnaire using a maximum likelihood extraction method which was used in combination with Varimax. Several solutions were tested and are presented in table 2.

Table 2

Results of Exploratory factor analysis

	Model fit measures						Bartlett's Test		
	X ²	dl	p	BIC	TLI	RMSEA	X ²	dl	p
Two factors	8206	3826	<.001	-15236	0.603	0.0499	15612	4005	<.001
Tree factors	7096	3738	<.001	-15806	0.688	0.0442	15612	4005	<.001
Four factors	6617	3651	<.001	-15752	0.717	0.0405	15612	4005	<.001

For selection of the items, correlations that were equal or above 0.40 are retained and items without any saturation or with saturation on two factors are excluded. The most satisfactory model is a three-factor solution including 41 items. Distribution of the 41 items in accordance to the factors, and internal consistence are presented in table 3.

Table 3

Item distribution and internal consistencies

Items	Factors		
	1	2	3
2	0.46	-0.04	0.29
5	0.49	-0.06	0.18
11	0.47	-0.01	0.31
14	0.47	-0.01	0.24
17	0.46	0.02	0.22
21	0.57	-0.12	-0.01
24	0.57	0.01	-0.04
27	0.56	-0.19	0.04
28	0.54	0.02	0.09
30	0.47	0.15	0.04
32	0.53	0.07	0.15
33	0.50	0.26	0.16
35	0.65	0.11	0.21

36	0.64	0.09	0.16
38	0.44	0.11	0.21
40	0.47	0.14	0.01
62	0.51	-0.02	0.12
69	0.69	0.07	0.16
85	0.59	0.16	0.16
9	0.05	0.49	-0.03
12	-0.32	0.64	-0.01
29	0.09	0.63	-0.01
31	0.05	0.48	-0.02
41	-0.30	0.56	0.31
45	0.06	0.55	0.23
46	-0.12	0.55	0.23
60	0.25	0.49	-0.02
75	0.16	0.41	0.32
76	0.12	0.54	0.11
78	0.05	0.63	-0.01
15	0.04	0.27	0.46
19	0.18	-0.18	0.51
39	0.05	0.23	0.61
44	-0.15	0.28	0.44
49	-0.06	0.34	0.48
51	0.36	0.13	0.48
52	-0.08	0.05	0.71
54	0.26	0.02	0.56
58	0.17	0.11	0.54
63	0.18	-0.11	0.64
86	-0.09	0.28	0.45
<i>Cronbach's Alpha</i>	0.86	0.79	0.74
<i>Explained variance</i>	8.56	5.33	6.09

The first factor is called “Knowledge about addiction and Internet Addiction” and is composed of 19 items that concern core beliefs about behavioral addictions in general and Internet addiction in particular (“Addiction is being dependent on a product or a way of life”). Internal consistency $\alpha=.86$ is satisfactory. The second factor is composed of core beliefs that suggest Internet addiction does not exist and tends to minimize its existence which was called “The myth of Internet addiction” (“activities in which one gives oneself entirely is more a hobby than an addiction”). This factor includes 11 items and internal consistency $\alpha=.79$ is satisfactory. The third factor is called “Vulnerability and consequences” and concerns core beliefs about vulnerability and risk factors as well as negative consequences of Internet

addiction (“Being addicted to the Internet is to confuse reality with virtual reality”). This factor includes 11 items and internal consistency is satisfactory with Cronbach’s alpha $\alpha=.74$.

Pearson’s correlations were conducted on the three factors of the CBBAIAQ with PIU scores, PFU scores, and age. Results are presented in table 4.

Table 4

Pearson’s correlations of CBBAIAQ factors, PIU and PFU

	1	2	3	4	5
1. Factor 1	-				
2. Factor 2	0.11*	-	-		
3. Factor 3	0.33***	0.36***			
4. PIU	-0.07	0.31***	-0.00	-	
5. PFU	-0.15***	0.35***	0.13**	0.63***	-
6. Age	-0.28***	0.06	0.13**	-0.03	0.04

Note. * $p<.05$, ** $p<.01$, *** $p<.001$. Factor 1: Knowledge about addiction and Internet Addiction, Factor 2: The myth of Internet addiction, Factor 3: Vulnerability and consequences.

Results indicate strong negative correlations of factor 1 with PFU scores and with age. Factor 2 presents a strong and positive correlation with PIU scores and PFU scores. Factor 3 presented a small positive correlation with PFU and age.

3.2. Confirmatory Factor Analysis on sample 2

A confirmatory factor analysis (CFA) was conducted on the 41 items of the questionnaire. Table 3 below describes the indices of fit on two different solutions that were tested. Indices of fit that were taken in account were X^2 , CFI (comparative fit index), TLI (Tucker-Lewis index), SRMR (Standardized Root Mean Residual) and RMSEA (root mean square of approximation).

Table 5

Summary of fit indices for CFA on the original 3-factor model and 6-factor model (N=544)

Model fit measures	X ²	df	p	CFI	TLI	SRMR	RMSEA
Original three-factor solution	317	776	<.001	0.60	0.58	0.09	0.07
Six-factor solution	406	215	<.001	0.94	0.93	0.05	0.04

Note. X² = chi square, df = degree of freedom, *p* = probability value, CFI = comparative fit index, TLI = Tucker-Lewis index, SRMR = Standardized root mean residual, RMSEA = Root mean square of approximation

The original three-factor model that was obtained after EFA was tested but did not show satisfying model fit measures. A six-factor solution was tested and reported satisfying model fit measures.

After conduction of the CFA, 23 items correlated on 6 different factors that showed convenient internal consistency (Cronbach's alpha from 0.67 to 0.85). The item loading between item and factors are all above 0.44. Table 6 gives a full description of the factors (ranked by factor loading) that are named after analysis of the meaning of the items, internal consistency, and factor loads. The six factors are called 1) Risks and consequences of IA, 2) Minimization of IA because of social and professional benefits, 3) Criteria for behavioral addiction and IA, 4) Technology expertise and generational impact on IA, 5) Healthy relationships protect from IA, and 6) Reasons for developing IA.

Figure 1 shows results of the CFA that was conducted on the six-factor solution and explains the new distribution of items on the factors. The six-factor solution remains similar to the original structure, only more precise. The evolution of the factor structure and the item distribution depending on the factors is addressed in the discussion.

Table 6

Factors, internal consistency (Cronbach's alpha), loads and items with English translation

Factors	Cronbach's Alpha	Load	Questions
Risks and consequences of IA	0.79	0.73	Utiliser Internet en permanence empêche de vivre dans l'instant présent et de profiter de la vie Constantly using the Internet prevents you from living in the moment and enjoying life
		0.71	Dans la dépendance à Internet, les relations sont plus superficielles parce que la communication est virtuelle Because of Internet addiction, relationships are more superficial because communication is virtual
		0.72	La dépendance à Internet provoque un repli sur soi-même Internet addiction causes self-containment
		0.64	La dépendance à Internet nuit à la créativité et à la stimulation intellectuelle Internet addiction harms creativity and intellectual stimulation
		0.52	Les personnes qui dépendent d'Internet recherchent la facilité, on n'a pas réellement besoin d'Internet People who depend on the Internet are looking for the easy way, we do not really need the Internet
		0.51	Être addict à Internet c'est confondre la réalité avec un monde virtuel Being addicted to the internet means confusing reality with a virtual world
Minimization of IA explained by its social and professional purposes	0.68	0.70	On peut être exclu(e) socialement si on n'utilise pas Internet, donc la plupart des personnes deviennent dépendantes People can be socially excluded if they do not use the Internet, so most people become dependent
		0.46	Les personnes extraverties sont plus dépendantes d'Internet, parce que les réseaux sociaux permettent de communiquer davantage Extroverted people are more dependent on the Internet because social networks make it possible to communicate more
		0.59	Les personnes qui utilisent de beaucoup Internet, même si elles sont dépendantes, optimisent leur chance de réussir professionnellement People who use the Internet a lot, even if they are addicted, increase their chance of succeeding professionally
		0.56	On devient dépendant(e) à Internet par peur de ne pas être au courant des mêmes informations que les autres We become dependent on the Internet fear of not being aware of the same information as others
		0.44	Consulter Internet permet d'optimiser ses chances d'établir des relations (amicales, amoureuses, professionnelles) Consulting the Internet can optimize your chances of establishing relationships (friendly, romantic, professional)
Criteria for behavioral addiction and IA	0.67	0.68	On est addict a Internet lorsque l'usage récréatif devient une obsession One is addicted to the Internet when recreational use becomes an obsession
		0.53	Quelqu'un de dépendant a un comportement trouve du réconfort dans la réalisation de ce comportement When someone is addicted to a behavior, they find comfort in realizing this behavior
		0.57	L'addiction à Internet c'est une addiction comportementale nouvelle Internet addiction is a new behavioral addiction
		0.46	L'addiction, c'est être dépendant d'un produit ou d'une manière de vivre Being addicted is being dependent on a product or a way of living
		0.50	On est addict à Internet lorsque cela devient la seule source d'information, de moyen de communication, de plaisir One is addicted to the internet when it becomes their only source of information, means of communication, pleasure

Expertise in technology and generational impact on IA	0.74	0.70	Les générations nées avec les nouvelles technologies sont plus dépendantes d'internet que les générations d'avant Generations born with new technologies are more dependent on the Internet than generations before
		0.70	Les personnes âgées sont moins dépendantes d'Internet parce qu'elles ont connu une autre façon de fonctionner Seniors are less dependent on the Internet because they have known another way of functioning
		0.66	Les personnes qui ne sont pas habiles avec Internet et les supports qui permettent de l'utiliser deviennent moins facilement dépendantes d'Internet People who are not internet-savvy (and the media that allows them to use it) become less easily dependent on the Internet
Healthy relationships protect from internet addiction	0.85	0.85	Les personnes ayant de bonnes relations familiales sont moins dépendantes d'Internet People with good family relationships are less dependent on the Internet
		0.87	Les personnes ayant un bon réseau social sont moins dépendantes d'Internet People with a good social network are less dependent on the Internet
Reasons for developing internet addiction	0.74	0.91	Il est facile de devenir dépendant aux activités sur Internet à cause de son accès facile et quasi-illimité It is easy to become dependent on Internet activities because of its easy (and almost unlimited) access
		0.66	Il est facile de devenir dépendant d'Internet parce que c'est un outil qui permet de satisfaire ses besoins plus rapidement It's easy to become internet-dependent because it's a tool that helps you meet your needs faster

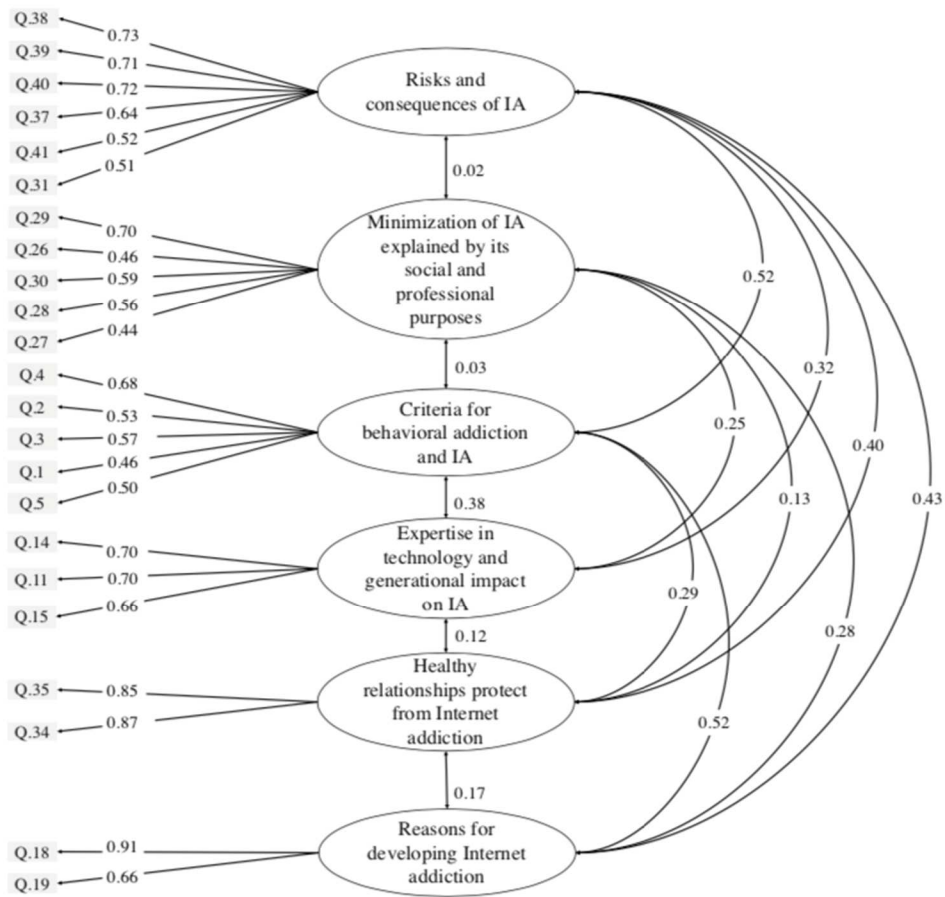


Figure 1. CBBIAIQ Confirmatory Factor Analysis

Pearson's correlations were conducted on the six factors of the CBBIAIQ with PIU scores, PFU scores, and age. Results are presented in table 7.

Table 7

Pearson's correlations of CBBIAIQ factors, PIU and PFU

	1	2	3	4	5	6	7	8
1. Factor 1	-							
2. Factor 2	0.26***	-						
3. Factor 3	0.42***	0.28***	-					
4. Factor 4	0.09*	0.17***	0.07	-				
5. Factor 5	0.34***	0.10*	0.23***	0.13**	-			
6. Factor 6	0.31***	0.24***	0.39***	0.23***	0.13**	-		
7. PIU	0.02	-0.09*	0.00	-0.11**	0.07	-0.09*	-	
8. PFU	0.07	0.06	0.03	0.02	0.04	0.00	0.48***	-
9. Age	-0.01	-0.12**	-0.00	-0.16***	0.04	-0.05	0.05	-0.26***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$. Factor 1: Risks and consequences of IA, Factor 2:

Minimization of IA explained by its social and professional purposes, Factor 3: criteria for

behavioral addiction and IA, Factor 4: Expertise in technology and generational impact on IA, Factor 5: Healthy relationships protect from IA, Factor 6: Reasons for developing IA.

Results indicated no correlations of factor 1, factor 3, factor 5 with PIU, and none of the CBBAIAQ factors correlated with PFU. However, factor 2, factor 4, and factor 6 are negatively correlated to PIU. Factor 2, factor 4, and PFU are also negatively correlated to age. There is a strong positive correlation between PIU and PFU.

4. Discussion

4.1. Consistency of descriptive results with previous literature

First of all, descriptive results revealed that Internet use is highly work-related even in non-IT occupations, which illustrates its universalization in the work and educational contexts (Barrère, 2015; Guyonvarch, 2017). This does illustrate why abstinence recovery models were suggested to be impractical for PIU given that online activities are well integrated in daily life (Young, 2013, p. 210).

In this study, results indicated that none of the core belief factors were associated to PFU, and only the factors (2) Minimization of IA explained by its social and professional purposes, (4) Expertise in technology and generational impact on IA, and (6) Reasons for developing IA were negatively associated to PIU. The difference in results between PIU and PFU might be related to the differences that were pointed out between PIU and problematic social media use and the importance of studying subtypes of PIU individually (Kuss & Griffiths, 2017; Paakkari et al., 2021; Montag et al., 2015; Pantic, 2014). Low activation of minimization beliefs about PIU, low activation of beliefs about the impact of technology and generation on PIU, and low activation about reasons as to why people might easily develop PIU would be associated to higher scores of PIU. It would have been expected to have higher levels of minimization in case of PIU, as this is often the case in addictive behaviors (Menecier, Rotheval, Plattier, Fernandez, & Ploton, 2016). Results should be relativized and

replicated in further studies on individuals with confirmed PIU since on our samples, only a minority obtained significant scores for PIU. However, while most healthcare professionals and research identified risks of excessive Internet use, some authors also claim that excessive Internet use tends to be “over-pathologized” and that Internet use can also be perceived as a social evolution and integrated to daily life (Griffiths, 2000; Hinic, 2011; Billieux, Schimmenti, Khazaal, Maurage, & Heeren, 2015; Kardefelt-Winther, 2014). It is important to remember that individuals without high scores for PIU, will also have beliefs about PIU without this being necessarily harmful.

Moreover, we might hypothesize that there is a dissonance between perceived PIU and real PIU which may bias our PIU results. Research on PIU in adolescents suggested that PIU isn't always perceived as problematic even when this is present (Wang, Wu, & Lau, 2016). These authors suggest that screening “perceived barriers” (e.g. social benefits) to reduce the Internet and finding strategies to remove these would be a more effective prevention strategy than prevention programs that emphasize threat. Indeed, the outcomes of excessive Internet use can be very negative (Young, 1998; Tao et al., 2010; Griffiths, 1999; Griffiths, Kuss, Billieux, & Pontes, 2016; Masi, 2017; Sim et al., 2012; Billieux, 2012; Starcevic, 2013), but for some people PIU is perceived as beneficial more than harmful despite the negative outcomes (Wang, Wu, & Lau, 2016). Thereby, the need of a formal definition and specific training of professionals is imperative in order to draw the limit between a healthy and problematic use and offer worthy support and prevention, since standard interventions won't necessarily be as effective on the constantly evolving utilization of Internet. Using a tool such as the CBBAIAQ will allow to rapidly identify perceptions of Internet users on PIU and therefore help to point out more easily the barriers to the reduction of Internet. Further studies could investigate the hypothesis of the relationship of core beliefs about IA with perceived PIU.

4.2. Discussion of the structural evolution of the questionnaire after CFA

After performing a CFA, six domains of core beliefs were highlighted and selected. Overall, the six-factor solution that was conserved is interesting and is a more precise model than the previous 3-factor solution that was found in result of the EFA (see figure 2). The first factor of the three-factor model was called “Knowledge about behavioral addiction and Internet addiction” and was originally composed of item 1 to 19. In the new six-factor model, this previous factor is divided into three new factors: new factor 3 that is called “Criteria for behavioral addiction and Internet addiction” (items 1, 2, 3, 4, and 5), new factor 6 that was named “Reasons for developing Internet addiction” (items 18 and 19) and new factor 4 that was called “Technology expertise and generational impact on IA” (items 11, 14, and 15). Moreover, the second original factor that was called “myth of Internet addiction” remained the same but has been renamed “Minimization of IA because of social and professional benefits” (items 26, 27, 28, 29, and 30) and some of the items were removed. After analysis of the items of this factor it became clear that the mechanism of minimization was at stake. Finally, the third original factor composed of item 31 to 41 was named “Vulnerability and consequences” and was divided into two factors. The first factor (new factor 1) kept the same name and meaning and was called “risks and consequences” and the second one (new factor 5) was called “healthy relationships protect from Internet addiction” (items 34 and 35).

4.3. Discussion of the meaning of the Core Beliefs dimensions

This present study was conducted to validate a questionnaire about core beliefs about behavioral addiction and Internet addiction. Here below, the meaning of dimensions was addressed with elements of literature.

4.3.1. Risks and consequences of Internet Addiction

The first dimension conveys beliefs about risks and consequences of IA that have been formerly addressed in literature. For instance, the threat of IA on wellbeing and enjoyment of

life that was formerly examined through the interference of PIU with subjective wellbeing and Fear of missing out (FOMO) (Stead & Bibby, 2017). Also, the harmful effect that IA can have on the consistency and authenticity of relationships, addressed in studies that outlined the negative consequences on family and interpersonal relationships (Bajwa, Batool, & Tahira, 2018; Tsai & Lin, 2003; Milani, Osualdella, & Di Blasio, 2009). Then, the “numbing” effect of IA that would harm creativity and intellectual stimulation and the confusion of the real world with a virtual world, explained by Davis’s definition of healthy Internet users (Davis, 2001). Studies underlined the necessity of clearing up boundaries between real life and virtual life right from the start of Internet-consumption, which would also help to avoid FOMO (Suman, 2018; Chou & Edge, 2012). The idea of PIU being associated with less creativity and intellectual stimulation may also be related to the fact that Internet related disorders were associated to concepts such as boredom (Wolniewicz, Rozgonjuk, & Elhai, 2020), social conflicts and behavioral problems such as aggressiveness (Piko, Prievara, & Mellor, 2017), that might seem antagonist to creativity and stimulation that vehicle a sense of openness.

4.3.2. Minimization of Internet Addiction because of social and professional benefits

The second dimension gathers beliefs that minimize IA by valuing its professional and social benefits. This relates to former studies that showed that beliefs and Internet-expectations might be used to normalize excessive use (Taymur et al, 2016; Brand et al, 2016; Lee, Ko, & Chou, 2014; Sebre et al, 2020; Wegmann et al, 2017; Ting et al, 2015; Liu et al, 2016). Minimization often interferes with other addictive thought processes and addictive behaviors (Menecier et al., 2016; Beck et al., 1993; Tison & Hautekeete, 1998). Moreover, these beliefs point out the perceived barriers for Internet use reduction, such as the risk of social exclusion and missing out that can result out of not using the Internet (Wang, Wu, & Lau, 2016; Prybylski, Murayama, DeHaan, & Gladwell, 2013; Beyens, Frison, & Eggermont,

2016). In fact, these core beliefs are consistent with the changes that have occurred these past decades in social media such as the suppression of anonymity, which encourages the permanent interaction with others, pursuing social recognition and sensation seeking (Correa, Hinsley & Zuniga, 2010; Hoffner & Lee, 2015). However, even if Internet use can have positive outcomes, excessive use can result in social media burnout, which is an extreme fatigue and exhaustion related to the use of social media, encouraging anxiety and depression (Han, 2018; Dhir, Yossatorn, Kaur & Chen, 2018; Charoensukmongkol, 2016; Ma & Liu, 2019). Minimization might also be related to denial which was addressed by CBT-IA programs by cognitive therapy methods (Young, 2011; 2013). Further studies should investigate this dimension of core beliefs and denial in PIU.

4.3.3. Criteria for Behavioral addiction and Internet Addiction

The third dimension is composed of core beliefs that highlight the obsessive and excessive characteristics of PIU, consistent with the definition of impulsion control diagnosis which PIU was often related to (Besser et al., 2017; Shapira et al. 2003; APA, 2013;), and criteria for addictions (Starcevic, 2013; Griffiths, 2005; Young, 1996; Goldberg, 1996). For instance, the comfort obtained in carrying out the behavior of using the Internet and the abandonment of other sources of information, communication and pleasure.

4.3.4. Technology expertise and generational impact on Internet Addiction

Dimension four referred to beliefs about the impact of the level of expertise in technology and generation in which one grew up in, on developing PIU. Age is, in fact, an important factor in the relationship that one will have with Internet and social media, as shows a recent study carried out on five European countries (Fortunati, Taipale, & Luca, 2019). Indeed, although older generations have known a life without the Internet, this is not the case for millennials, and as Internet is constantly used for both leisure activities and in academic fields, younger populations are more at risk for developing Internet-related disorders (Grau,

S., Kleiser, S., & Bright, L. (2019). New generations were mentioned as “smart generations” in reference to exposure to smart devices (e.g. Ipad, smartphones, computers), this was presented as a cause for concern because of the socio-professional pressure they may encounter to be “technologically intelligent” (Gupta, 2019).

4.3.5. Healthy relationships protect from Internet Addiction

The fifth dimension of core beliefs is more focused on protecting beliefs, and assumes that one is protected from IA if one has healthy relationships such as having a family you can depend on. Recent literature has established once again that adolescents are more vulnerable to PIU, and that various parenting styles and teacher support can help reduce the development of IA (Zhang, Bai, Jiang, Yang, & Zhou, 2019). Further studies might want to investigate whether believing that healthy relationships could protect from developing PIU, actually makes individuals more prone to establish healthy interpersonal relationships, or whether individuals are aware of this but don't act on it.

4.3.6. Reasons for developing Internet Addiction

Finally, dimension six gives two explanations for the development of IA, which are the easy and almost unlimited-access, and the fact that it helps you meet your needs faster. Internet does have benefits when it is used in a healthy context (Davis, 2001), and is omnipresent in almost all domains of today's society (Grau et al., 2019; Gupta, 2019). Some authors have described Internet use as “facilitated laziness” (Price-Mitchell, 2014 in Stead & Bibby, 2017), and was considered by some as a social evolution rather than a pathology (Griffiths, 2000; Hinic, 2011; Bilieux et al., 2015; Kardefelt-Winther, 2014). Internet can be utilized in ways individuals see fit, which may help needs to be met faster. This factor was also strongly associated to factor 4, that is related to minimization and denial in regards to PIU.

4.4. Limitations

This study has some limitations. In fact, on both samples, there was a minority of male participants, and a majority of students. On the other hand, the samples were diversified in age, since participants were aged between 18 and 74 years old. It would have been interesting to survey underaged participants, since results showed that younger participants had higher scores of PFU and it is well known that new generations are a high-risk population. Only a minority of participants showed scores above the cut-off scores of PIU and PFU, maybe PIU and PFU would have been higher on a younger population and would have allowed to compare better the link between core beliefs and Internet use. Further studies in this matter will allow us to confirm our new emerging hypothesis.

4.5. Perspectives and clinical implications

This study highlights the importance of studying beliefs related to behavioral addiction and Internet addiction. This scale provides a better understanding of the beliefs that underlie this type of addiction could offer interesting therapeutic leverage. Yet, it has become clear that cognitions vary according to the type of Internet use and activity that is displayed. Further studies should investigate the relations of core beliefs in regards to specific activities on the Internet (e.g. social media, online dating, online shopping). This would allow to identify cognitions linked to a specific activity that are likely to trigger negative emotions, feelings, or beliefs. The CBBAIAQ may be used for prevention purposes, as existing CBT programs already integrate psycho-education about PIU and cognitive therapy methods to address maladaptive cognitions and denial (Young, 2011; 2013 (Szász-Janocha et al., 2021).

5. Conclusion

The aim of this study was to validate the Core Beliefs about Behavioral Addictions and Internet Addictions Questionnaire (CBBAIAQ). This present study details the full evolution of the questionnaire from its creation, exploratory factor analysis, to the confirmatory factor analysis that revealed a six-factor model that shows satisfactory internal

consistency. The final version of this questionnaire is composed of 23 items, divided into six factors: 1) risks and consequences of IA, 2) minimization of IA because of social and professional benefits, 3) criteria for behavioral addiction and IA, 4) technology expertise and generational impact on IA, 5) healthy relationships protect from IA, and 6) reasons for developing IA. It can be concluded that the CBBAIAQ can be exploited in future research and for psychoeducational purposes.

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