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Exploring New Digital Addictions: Developing a WhatsApp Addiction Index

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Abstract: In recent decades, computer-mediated communication has become increasingly intense and frequent due to the fast growing, widespread of social media platforms. In particular, WhatsApp could be now considered one of our daily channels of private conversations: we deepen relationships, flirt, make appointments, gossip. Originally created as a channel to replace the traditional paid SMS, it has now become, along with other social networks, an extension of our offline lives. However, many studies (Ko, et al., 2007; Brand et al., 2016; 2019) show that excessive use of social media can lead to pathological attitudes. Problems arise when face-to-face communication is completely replaced by mediated communication, or when mediated communication gets in the way of other activities in our daily lives. Our contribution discusses the preliminary results of a study aimed at developing and subsequently starting to validate an index to detect WhatsApp addiction. This exploratory study is based on the implementation of an online survey using both a WhatsApp addiction index developed by us and some validated scales: Internet Addiction Assessment (Young, 1998), Smartphone Addiction Scale (Yang, et al., 2013), and Fear of Missing Out (FoMO) Scale (Przybylski, 2013).

Keywords: Behavioral addictions, WhatsApp Addiction, Exploratory Factor Analysis (EFA), Validation

Introduction

In recent years, the study of behavioral addictions has increased dramatically (Sixto-Costoya et al., 2021), also due to the recent Covid-19 pandemics (Sinclair et al., 2020). According to the latest version of the DSM (2023), a behavioral addiction is such when no substances play a central role. In fact, the peculiarity of behavioral addiction is that the person compulsively seeks to implement a rewarding behavior, without involving the intake of a drug or psychoactive substance. The definition of behavioral addiction comes from the continued pursuit of a pattern of behavior over extended periods of time; and it occurs despite the fact that addiction usually causes negative consequences on a relational, social, emotional, and family level (Petry, 2016). In addition, the effects of addiction often spread to the workplace. But also, to the economic sphere and to the person's own health¹. According to Goodman (1990), addiction defines a condition whereby a problematic behavior is characterized by (a) recurrent failure to control the behavior and (b) continuation of the behavior despite significant negative consequences. Mark Griffith (2005) defines a behavioral addiction based on six criteria: prominence (the behavior tends to assume the greatest prominence in the person's life, to the detriment of other thoughts, feelings, and actions), influence on mood (emotional consequences of the addictive behavior), tolerance (intensification of the behavior to induce effects of sufficient intensity), withdrawal symptoms (unpleasant moods or physical consequences resulting from the implementation of the behavior), conflict (interpersonal conflicts resulting from the established addiction or incompatibility with other personal tasks or activities) and relapse (the presence of multiple relapses in the disorder after phases of suspension). According to a study published by Gutiérrez in 2014, these addictions closely resemble, in their characteristics and consequences, drug addiction, the criteria common to both types of addiction are as follows: Ability to fall into an addictive relationship with certain behaviors, from which positive reinforcement is obtained, excessive preoccupation with consumption or a behavior that causes positive reinforcement, temporary tolerance or level of satiety, loss of control, where the frequency of the behavior increases, becoming increasingly automatic, difficulty in controlling or avoiding the behavior in question, even if there are important negative consequences. As Panova and Carbonell pointed out (2018), research on behavioral addictions has grown greatly in the number and variety of topics: from studying (Andreassen, Griffiths & Pallesen, 2016) to tanning (Nolan & Feldman, 2009) to cosmetic surgery (Suissa, 2008) to Argentinean tango (Targhetta, Nalpas & Perney, 2013), Harry Potter (Rudski,

¹ DMS V – *Diagnostic and Statistical Manual of Mental Disorders, 2022*

Segal & Kallen, 2009) and, above all, digital and technological addictions due to the expansion of the Internet and the development of social networks.

Several forms of addictions related to the digital revolution have been studied, such as the addiction to: Internet (Young, 1998), Smartphone (Know et al., 2013), Facebook (Andreassen et al., 2012), FoMO – Fear of Missing Out (Przybylski et al., 2013), Instagram (Sholeh & Rusdi, 2019), Twitter (Kircaburun, 2016), YouTube (De Béral, Guillon & Bungener, 2019) and Whatsapp (Bernal-Ruiz et al. 2019; King et al., 2019). This demonstrates how studies of behavioral addictions associated with the internet and social media have increased in recent years in some academic fields such as sociology or education. With this regard, our study intends to explore and deepen the use of WhatsApp in users' daily life with the aim at developing and subsequently validating an index for the detection of WhatsApp addiction.

2. Literature review

Due to the widespread use of the World Wide Web, studies investigating Internet addiction first emerged in the 1990s (Young, 1996). From a neurological perspective, Internet addiction can be compared to substance addiction and is defined as a behavioral addiction (Grant et al., 2010). In behavioral addictions, addiction is not caused by the substance itself but by repetitive behaviors providing short-term pleasure that may turn harmful in the long run and negatively affects other areas of people's daily life. Among behavioral addictions, we can include addiction to the Internet, gambling, video games, social networks, emails, smartphones, shopping, sex, porn, TV series, emotion, job, and workout (Grant et al., 2010; Robbins et al., 2015). In 2016, a team of researchers elaborated a theoretical model for development and maintenance of Internet addiction (Brand et al., 2016). The model, known as Interaction of Person-Affect-Cognition-Execution (I-PACE), underwent revision in 2019 (Brand et al., 2019). Its authors sought to describe how addiction is acquired and developed. The analysis took into account predisposing factors, including genetic and biological aspects of human behavior, which, according to previous research, could statistically impact Internet use disorders in the future. For instance, negative early childhood experiences can have lifelong consequences on individuals and make them more vulnerable than others to developing Internet addiction, particularly if they experienced early traumas, emotional or physical abuses, episodes of social isolation, and even if they were massively exposed to parental use of the Internet and social media (Dalbudak et al., 2014). Beyond these predisposing factors, three psychopathologies have been found that can be responsible for Internet use disorders. These factors are depression, social anxiety, and Attention-deficit/hyperactivity disorder (ADHD) (Brand et al., 2019). In addition, other factors,

such as impulsiveness, low self-esteem, conscientiousness, shyness, neuroticism, tendency to procrastinate, and low self-determination, have been found to be related to Internet addiction. Through the use of smartphones, individuals can gain unlimited access to the Internet and, consequently, potentially connect to the web at any time and any place. As a result, behavioral addictions have increased. This is primarily because people can more easily get access to websites or applications that might play a crucial role in fostering the aforementioned behavioral addictions (e.g., addiction to porno, video games, TV series, etc.). Among the various drawbacks of access to digital platforms, the overuse of social media has also been proven to have adverse effects on people's well-being (e.g., Kross et al., 2021) and can worsen interpersonal and romantic relationships (e.g., Krasnova et al., 2016; Muise et al., 2009; Utz & Beukeboom, 2011).

The pervasiveness of smartphones is such that the mere presence of these objects, even if switched off, can negatively affect the quality of relationships between people, as proved by a study conducted in 2012 by a team of psychologists (Przybylski et al., 2012). Through smartphones, it is also possible to connect to the applications of social networks, among which the most popular in Italy are Facebook, Instagram, YouTube, TikTok, and WhatsApp. Governed by the principles of captology (Fogg, 2003), these applications are designed to capture users' attention through internal and external triggers that work to keep them as long as possible on the platforms. With regard to this last point, it is not surprising that the amount of time spent on digital media has been seen to significantly correlate with addiction (Khang et al., 2013).

Among the predictors of addiction to the Internet and social media is neuroticism (Kayaş et al., 2016), one of the traits of the Five-Factor Model of Personality (McCrae & Costa, 1987). Furthermore, as multiple studies show, people with low self-esteem, lower overall self-efficacy, and greater introversion are more likely to become addicted to social media (e.g., Milosevic-Dordevic et al., 2014). In particular, through self-produced images of themselves on social media, individuals try to minimize the possibility of receiving negative evaluations, which favors an increase in self-esteem levels (Andreassen et al., 2017). This might help individuals develop an addiction to social media as it reflects their need to feed their ego or the narcissistic traits of their personality.

Other research demonstrated that individuals experiencing anxiety, avoidant personality disorder (i.e., a disorder which is characterised by the belief that they are worth little), and Fear of Missing Out (FoMO), or those classified as 'shy extroverts' are also at increased risk of developing addiction (Blackwell et al., 2020). Further predictors can be young age, being a woman, not being in a relationship, being a student, having a poor edu-

tion, living on a low income, and narcissism (Andreassen et al., 2017). The motivation itself that leads individuals to use social media could also serve as a predictor of addiction to social media (Khang et al., 2013). For instance, it has been proven that those who use the Internet to play video games or their smartphones to engage in pastimes are significantly exposed to the risk of developing a behavioral addiction (Khang et al., 2013).

Over the years, there have been multiple attempts to measure Internet, smartphone, and social media addictions. Soon after the introduction and large-scale spread of new technological advances such as the Internet, researchers have been committed to creating analytical tools to study the phenomena related to the effects that new hardware and software placed on the marketplace have on people. In 1998, Young (1998) developed the first *Internet Addiction Assessment*, an eight items scale has gradually become a point of reference for research in the field and is still widely used by researchers. In 2017, the scale was adapted to the Italian context, revised, and expanded to include additional 12 valuable items (Servidio, 2017). About smartphone addiction, the first scale to measure it was proposed by Know et al. in 2013, a scale on which the present study has been partially based. What has to be remarked is that the aforementioned scale has also been adapted to the Italian context (De Pasquale et al., 2017). Other attempts have also been made to measure smartphone addiction, including the *Smartphone Application-Based Addiction Scale* (Csibi et al., 2018), which uses a one-factor construct. Among social media, Facebook has undoubtedly been the most investigated one. A Facebook addiction scale, called the *Bergen Facebook Addiction Scale* (Andreassen et al., 2012), was developed in 2012 and eventually evolved into the Bergen Social Media Addiction Scale in 2016 (Andreassen et al., 2016). The latter can be used to analyse any addiction to social media. Both scales are composed of six items based on the six fundamental aspects of addiction: salience, abstinence, conflict, relapse, tolerance, and mood modification. Both the *Bergen Facebook Addiction Scale* and the *Bergen Social Media Addiction Scale* have been translated from English into Italian (Monacis et al., 2017; Soraci et al., 2020) and into other languages (Lin et al., 2017; Mahmood et al., 2020; Pontes et al., 2016; Phanasathit et al., 2015; Veiga et al., 2019), and validated in various national contexts, among which Italy.

In recent years, the scales that have been proven to work have increasingly been adapted to new emerging social media. To name an example, an adapted version of the *Bergen Social Media Addiction Scale* (Andreassen et al., 2016), titled the Bergen Instagram Addiction Scale, was developed in 2021 by scholars from the University of Roma “La Sapienza” (Ballarotto et al., 2021). Similarly, an Instagram addiction scale (Kircaburun & Griffiths, 2018) was adapted from Young’s (1998) *Internet addiction scale* (Young, 1998). Its

battery of questions comprises fifteen items, eight of which are related to the social effects of the overuse of Instagram and seven to compulsive behaviors.

2.1 WhatsApp as a social network

According to the Pew Research Center (2021) and the latest research (Menon, 2022; Abdelhamid et al., 2022; Chakravarti, 2021), WhatsApp can be considered one of the top social media in the world together with YouTube, Facebook, Instagram, Twitter, Instagram, and TikTok. As described by Rusni and Lubis (2017: 8-9), some of the affordances in common between WhatsApp and other social networks are: a) sending text messages; b) receiving and sending photos and videos from live cameras or albums; d) exchange documents in the form of files or others; e) make phone calls and video calls or send voice recordings directly; f) share location by utilizing GPS; g) Sending a contact card; h) exchanging emoticons and stickers through personal or group chat; i) can change profiles, status posts, back up messages, change numbers and maintain account security. In addition, in 2018 WhatsApp, together with Facebook, started providing the feature of 'Story' to its platform. Based on the existence of these features, using the WhatsApp platform, like other social networks, allows users to socialize, build bonds with individuals or in groups, strengthen relationships (as highlighted by Arruda Filho & Ferreira, 2021), exchange information (Islam et al., 2020), build self-representation, and more.

Although WhatsApp is among the most popular smartphone applications globally, few attempts have been made to develop an addiction rating scale. For instance, a team of Spanish researchers has advanced a scale called the 'WhatsApp Negative Impact Scale' (Bernal-Ruiz et al. 2019), which focuses on the damaging effects of WhatsApp rather than addiction. With regard to addiction, one of the first experiments was conducted in Brazil. The study used a *WhatsApp Dependence Scale* (King et al., 2019), a battery of 16 items aiming to measure three levels of addiction: mild, moderate, and vigorous. Furthermore, an attempt to standardize and validate a *WhatsApp Addiction Test* has been made in India (Vadivu et al., 2021). The test consists of 28 statements, to which it is possible to attribute the frequency out of four possibilities: never, rarely, often, and always. However, all these attempts seem to investigate a concept (negative impact) that is only partially overlapping with the definition of behavioral addiction, or to be too closely tied to the sociocultural context in which the research took place. no attempt has been made to validate a WhatsApp Addiction Scale in the Italian context. Our study aims to fill these gaps in the literature by developing and starting to validate a WhatsApp Addiction Index (WAI).

3. Method

3.1 Research design

The research design aims at addressing the following research questions:

RQ1) Develop an index to measure WhatsApp Addiction;

RQ2) Test and initial validation procedures of the WhatsApp Addiction Index by exploring its relationships with some relevant variables from the literature on behavioral addiction to digital technology.

Our research adopted an exploratory approach through a quantitative method, an online survey among Italian digital users.

The literature review has suggested some conceptual dimensions to explore in order to analyze the users' propensity to develop a strict bond with a digital platform like WhatsApp. Our reflection starts from the assumption that WhatsApp addiction can be understood from the study of other addictions that exist in the digital context, such as Internet addiction, Smartphone addiction, and the negative feeling known as Fear of Missing Out (FoMO). The bond between the addictions considered here not only has already been highlighted in the literature (which in this regard, could be defined as technology addiction as stated by Turel et al., 2011), but it is justified by the fact that WhatsApp users are strongly involved in smartphone and Internet use. Therefore, the use of one could imply the use of the other and vice versa, creating a close connection between the different addictions. This is not to say that those who are addicted to Internet, are also addicted to smartphones and vice versa; in fact, the phenomena could be liked by attitudes that bind the individual to more devices, or more apps, more chats, and so on.

The following conceptual map (Fig.1) represents the model that inspired our research; it includes four main areas:

- Socio-demographic characteristics (age, gender, qualification, area of residence);
- Fear of Missing Out (FoMO) area investigating users' unpleasant feelings related to digital use due to the fear of being left out of events that happen online while doing something else;
- The area of Internet Addiction that delves into the intensity of the link between users and their being on the Internet;
- The dimension of Smartphone addiction that considers the link between users and mobile devices.

The following sections will specify the empirical specification of each sub-dimension considered in the questionnaire and their respective operational definition.

Fig.1 Research Conceptual map (own elaboration)



The research work focuses on the relationship between a sample of Italian users and digital consumption (in terms of devices, social networks and Internet in general) with a specific focus on the use of WhatsApp. The research objectives are combined within a wider project to create and validate a useful tool to detect the propensity to develop a WhatsApp addiction. Therefore, our research objectives are (a) through multivariate analysis, to create an index that detects the propensity to develop a WhatsApp Addiction; (b) to test the index through a comparison with variables already tested in the literature. Specifically, we will test the index of WhatsApp addiction with the variables age (Gui & Büchi, 2019; Rosenfeld et al., 2018; Andreassen et al., 2017; Kumar & Sharma, 2017; Montag et al., 2015); gender (Gui & Büchi, 2019; Nayak, 2018; Kumar & Sharma, 2017; Bernal-Ruiz et al., 2019; Rungta, 2015; Montag et al., 2015; Roberts, 2014; Kwon et al. 2013), and qualification (Andreassen et al., 2017; Van Deursen, 2015; Montag et al., 2015; Kwon et al., 2013).

3.2 Research method, sample and data collection

Through a quantitative approach, we implemented an online survey. The increased use of the quantitative approach and the growth of web surveys during the Covid-19 pandemics (Velotti, Punziano, Addeo, 2022) prompted us to go down this path in order to analyze the phenomenon on a larger scale.

The online survey was based on four different sections: The first investigates the socio-demographic information of the sample; the second deepens the relationship between users and digital devices, social media, and Internet in general; the third explores the propensity to develop FoMO and addictions

to Internet and smartphones; the last dimension aims to investigate the relationship between users and the WhatsApp application. For the second and the third part of the questionnaire, three scales widely used in the literature were included and adapted to the Italian context: The Internet Addiction Assessment (Young, 1998), Smartphone Addiction Scale (Yang, et al., 2013) and Fear of Missing Out (FoMO) Scale (Przybylski, 2013). The last part of the questionnaire was created *ex novo*, including batteries with a frequency scale, with the aim of investigating users' WhatsApp usage habits. In addition, it consists of open-ended and closed-ended questions.

The unit of analysis are people who use WhatsApp in their daily life. The methodological choice to involve Italian users who use WhatsApp addresses a research gap as this topic is still largely underexplored in the Italian context, where WhatsApp users are 36.9 million circa in 2021 (Statista.com)². Respondents were selected through a non-probabilistic sampling procedure among online users of the most popular social networks in Italy, like Facebook, Instagram (Statista, 2021)³. Since the sample is not representative, this survey does not claim to extend the results of the research to the entire Italian population.

The online questionnaire was pre-tested on small sample (30 subjects) in order to detect issues in the structure, tricky questions, and several types of biases. Some amendments were made according to the respondents' feedback.

The data collected through the online questionnaire was managed by the professional hosting service offered by SurveyMonkey. The hyperlink to the survey was shared mainly on social networking platforms (e.g., Facebook and WhatsApp). The average time required to complete the survey was 9 minutes. A total of 265 responses were collected, of which incomplete responses were eliminated, for a net total of 224 complete responses were obtained.

Research sample of 57.1% females and 42.4% males. The age of the respondents falls within a range of 18 to 72 years (as shown in Table 1).

² <https://www.statista.com/forecasts/1145177/whatsapp-users-in-italy>

³ <https://www.statista.com/statistics/787390/main-social-networks-users-italy/>

Table 1. Sample demographics

		Count	%
Gender	F	128	57.1
	M	95	42.4
	Other	1	.4
Age	18-24	44	19.6
	25-39	94	42.0
	40-54	46	20.5
	55+	40	17.8

3.3 Measures

As described in the previous paragraph, the questionnaire has four main sections, each one related to a specific dimension concerning WhatsApp usage. Therefore, in addition to the socio-demographic section (see the previous paragraph), the web survey consisted of three other sections. At first, the section about digital habits consisted of three questions asking how frequently users perform certain actions or use some online platforms/services (as shown in Table 2).

Table 2. Operational definition of the digital habits

Question	Items	Modalities	Measure
How much do you use the following devices in your daily life?	Cell phone or smartphone Laptop Tablet Desktop computer Media players (iPod, Mp3 player) Smart Tv (Television connected to the Internet) Console / video games Alexa, Google Home or similar Smartwatch E-book reader	I do not own this device Never or almost never Sometimes Often Very often	Ordinal
How often do you use the internet to...?	Make new friends Looking for a job Practice a new language Use social media Keep in touch with friends Keep in touch with family Buy products and services Gaming Pay bills Stay up to date on the latest events (news news, public events politicians, etc.) Organize trips Work / Business Study Downloading or listening to music, etc. (e.g. iTunes, Spotify) Watching movies (e.g. Netflix, Amazon Prime) Participating in debates political	Never Almost Never Rarely Sometimes Often Almost always	Ordinal
How often do you access the following apps via your smartphone, tablet, or PC?	WhatsApp Facebook Instagram Twitter Tik Tok LinkedIn Pinterest YouTube Snapchat Reddit Clubhouse	Never/Nearly Never Once a month Once a week 2-3 times a week Daily	Ordinal

The sections related to the themes of Internet Addiction, Smartphone Addiction, and FoMO were investigated through a set of 10 items derived from the literature. In particular, we used scales already present in the literature: Internet Addiction Assessment (Young, 1998), Smartphone Addiction Scale (Yang, et al., 2013) and Fear of Missing Out (FoMO) Scale (Przybylski, 2013).

Among them, we selected the most useful items for our empirical work and adapted them to the Italian context. From this selection, a single battery was created covering the main topics of the Scales considered, as shown in Table 3. During the survey phase, we asked respondents to indicate, based on their personal experience, their degree of agreement with the statements (in a range from “Completely disagree” to “Completely agree”).

Table 3. Operational definition of the Technology Addiction

Component	Operational Definition	Modalities	Measures
Internet Addiction (Young, 1998)	It bothers me when someone disturbs me while I'm online; In the past, I have tried to reduce the time I spend online; In a situation where it is possible to perform an action both online and offline, I prefer using the internet.		
Smartphone Addiction (Yang, et al., 2013)	I would never give up the use of my smartphone; People around me tell me that I use my smartphone too much; When I leave the house without my smartphone I feel anxious; I go out of my way to follow an online conversation with my friends in real-time.	Completely disagree Disagree Uncertain Agree Completely agree	Ordinal
Fear of Missing Out (Przybylski, 2013)	I am constantly connected because I am afraid of losing important information; I post my experiences online because I want to share them with my friends; When I go on vacation, I continue to stay daily with my friends.		

Finally, the last section was intended to measure directly the potential addiction to WhatsApp by implementing items chosen from different sets of statements about WhatsApp usage. Two subsets of items were included in the questionnaire, and respondents were asked to indicate how often they performed certain actions on WhatsApp (as shown in Table 4).

Table 4. Operational definition of the “WhatsApp Usage” and “WhatsApp Engagement” subsets

Component	Description	Operational Definition	Modalities	Measure
WhatsApp usage	Stories	I post stories on WhatsApp; I control who watches my stories; I view the stories of my WhatsApp contacts.	Never Several times a year Several times a month Several times a week Several times a day Every hour	Ordinal
	Update social profile	I update my WhatsApp profile photo; I update my WhatsApp status.		
	Sending multimedia messages	I send voice messages; I send photos of my daily life e.g. while eating, cooking, working, studying.		
WhatsApp Engagement	Checking activities	I check the last login time of other WhatsApp users; When “he is writing” appears, I wait for a reply; In the evening, before falling asleep, I check WhatsApp messages one last time; In the morning, when I wake up, I immediately check my WhatsApp messages.	Never Rarely Sometimes Often Nearly always	Ordinal
	Daily use	I use WhatsApp while eating; I use WhatsApp while walking; I use WhatsApp while I am talking live with someone; I use WhatsApp Web while working or studying.		

The operational definition of *WhatsApp Usage* takes into account two different sub-components: the first component is related to the use of all features of the messaging app (uploading or viewing stories, the possibility

to update its own social profile, or sending photos or vocal messages). This component has been operationalized with a set of items to which respondents were asked to answer on a six-point scale from “Never” to “Every hour”.

The second component (*WhatsApp Engagement*) is one linked to the users’ engagement, and involvement in the activity of checking/monitoring their own profile (as to check the last login time of other WhatsApp users, to check the last WhatsApp notification before falling asleep or after waking up), and their daily use of the messaging app (using the app while performing other daily activities). This component has been operationalized with a set of items to which respondents were asked to answer on a five-point scale ranging from “Never” to “Nearly always”.

3.4 Data Analysis

The data analysis, performed with SPSS23®, was performed in three steps. First, we tested data quality through univariate analysis. Among the most interesting results, we found that 97.6% of respondents use WhatsApp every day, 83.2% of them have notifications turned on, and 52.2% spend more than an hour a day on per day on WhatsApp.

The second and third stages of data analysis were aimed at addressing the research questions. The second stage involved Exploratory Factor Analysis (EFA) to create a WhatsApp Addiction Index (WAI). In the third stage, bivariate analysis was performed to test the WAI external validity (by checking the averages across the scales for different socio-demographic groups).

Specifically, we used one-way analysis of variance (ANOVA) to explore the relationships between WhatsApp Addiction Index and gender, and qualification. Finally, we used a correlation analysis to test the interrelation between WhatsApp Addiction Index and age.

4. Results

RQ1) Develop an index to measure WhatsApp Addiction;

The first research question was addressed through an EFA applied to the “WhatsApp Usage” and “WhatsApp Engagement” subsets to evaluate how many factors could be extracted for each set of questions (Jena, Pradhan, 2018). The EFA was carried out through a principal component procedure using the Varimax rotation method. Kaiser’s criteria (1960) were implemented to select the numbers of factors to consider (those with an eigenvalue higher than 1) and which variables to choose in order to represent each extracted factor (factor loading cut-off point was ± 0.6 , as suggested by Comrey, Lee, 1992). The KMO test and the Bartlett test were conducted to evaluate the

goodness of the data to be put under EFA. Finally, Cronbach's α was calculated to test the reliability of the subsets of items.

First EFA involved all the items included in the "WhatsApp Usage" and "WhatsApp Engagement" subsets. In the Table 5, we show the first factor extracted named "*Phubbing*" (a neologism created from the combination of two words "phone" and "snubbing"), because the variables having the higher factor loadings are: I use WhatsApp while eating (.705), I use WhatsApp while walking (.767), I use WhatsApp while I am talking live with someone (.820), I use WhatsApp Web while working or studying (.580). The second factor extracted is represented by variables covering some aspects related to the feature of *Stories* (i.e. photos or videos available for 24 hours that users generally publish to tell what they do during the day), I post stories on WhatsApp (.805), I check who watches my stories (.833), I view the "stories" of my WhatsApp contacts (.777). This is why it was labeled as "*Stories Addiction*". The third factor extracted was named "*Recidivist Behavior*" as it is represented by variables such as: When "he is writing" appears, I wait for a reply (.745), In the evening, before falling asleep, I check WhatsApp messages one last time (.763), In the morning, when I wake up, I immediately check my WhatsApp messages (.693), I check the last login time of other WhatsApp users (.553). The fourth factor extracted is named "*Multimedia usage*" is related to sending of multimedia material (so that does not include text messages), such as photos, videos, or images: I prefer sending a voice message instead of calling (.843), I send voice messages (.838), I send photos of my daily life e.g. while eating, cooking, working, studying (.648). The variables related to the attention to take care of one's social image have been included under the third factor named "*Self-representation*": I update my WhatsApp profile photo (.691), I update my WhatsApp status (.906).

Table 5. Factor loadings of the variables included in the “WhatsApp features usage” and “WhatsApp engagement” subsets

Items	<i>Factor loadings</i>				
	Phubbing	Stories Addiction	Recidivist Behavior	Multimedia usage	Self-representation
I check the last login time of other WhatsApp users			.553		
I prefer sending a voice message instead of calling				.843	
When “he is writing” appears, I wait for a reply			.745		
In the evening, before falling asleep, I check WhatsApp messages one last time			.763		
In the morning, when I wake up, I immediately check my WhatsApp messages			.693		
I use WhatsApp while eating	.705				
I use WhatsApp while walking	.767				
I use WhatsApp while I am talking live with someone	.820				
I use WhatsApp Web while working or studying	.580				
I post stories on WhatsApp		.805			
I check who watches my stories		.833			
I view the “stories” of my WhatsApp contacts		.777			
I update my WhatsApp profile photo					.691
I update my WhatsApp status					.906
I send voice messages				.838	
I send photos of my daily life e.g. while eating, cooking, working, studying				.648	

Variance explained = 65.1%; Kaiser–Meyer–Olkin (KMO) test = .792; Bartlett’s test, $p < .000$;
Overall Cronbach’s alpha = .824. Cronbach’s alpha for each one: Factor 1=0.743; Factor 2= 0.778;
Factor 3 = 0.743; Factor 4 = 0.747; Factor 5=0,634

The five resulting factors together accounted for 65.1% of the total variance. KMO test value was over 0.7, and Bartlett's test was lower than 0.05, these results mean that all the EFA conditions were satisfied, moreover the Cronbach's α higher than .700 (with a score of .824) assures a good reliability.

The next step of the analysis was to save the factor scores using the regression method, so that five variables were created and named respectively Stories Addiction, Self-Representation, Multimedia usage, Recidivist Behavior, and Phubbing. Finally, these new variables were combined into the WhatsApp Addiction Index by applying a single factor analysis and extracting a single factor (as shown in Table 6).

Table 6. Factor loadings of the variables used for the WhatsApp Addiction Index

Items	<i>Factor loadings</i>
Phubbing	.751
Stories Addiction	.658
Recidivist behaviour	.672
Multimedia Usage	.631
Self-representation	.568

Kaiser-Meyer-Olkin (KMO) test = .700; Bartlett's test, $p < .000$

This further analysis shows that each component has a certain weight in the composition of the WhatsApp Addiction Index. The WhatsApp Addiction Index (WAI) was created by saving the factor scores. The final step in defining the WhatsApp Addiction Index was to convert the index values into a range from 0 to 100 to simplify its interpretation.

4.1 Initial Validation procedures of the WAI

RQ2) Test and initial validation procedures of the WhatsApp Addiction Index by exploring its relationships with some relevant variables from the literature on behavioral addiction to digital technology.

The construct validity of the WAI has been tested by carrying out a bivariate analysis with a set of variables that, according to literature, are strictly related to an attitude to develop a technology addiction (Internet, social media, gaming, and so on).

First, we tested the relationship between the WAI and gender. Generally speaking, the results seem to be in line with the literature (Gui & Büchi,

2019; Nayak, 2018; Kumar & Sharma, 2017; Bernal-Ruiz et al., 2019; Rungta, 2015, Montag et al., 2015; Roberts, 2014; Kwon et al. 2013), as there is a higher propensity for women (+6.1) in our sample to develop a WhatsApp addiction compared to men emerged from the T-test for gender (see Table 7). Moreover, the T-test shows that this difference is statistically significant, this could be considered an interesting outcome, considering the non-probability sampling procedure adopted. Nevertheless, this result is surely interesting from a theoretical point of view, and it deserves deep investigation with further research.

Table 7. Relationship between WAI and Gender

Gender	Mean	Std. Dev.
Men	33.2	17.9
Women	39.3	17.2

Levene's test for equality of variances			T-test for equality of means				
	F	Sign.	t	df	Sig. (two-tailed)	Mean difference	Std. error difference
Equal variances assumed	.000	.992	-2.594	221	.01	-6.16	2.38
Equal variances not assumed			-2.577	197.7	.01	-6.16	2.39

According to the literature (Andreassen et al., 2017; Van Deursen, 2015; Montag et al., 2015; Kwon et al., 2013), there is a negative relationship between technological addictions and the educational level, which means that those with lower educational qualifications have a higher inclination to develop an addiction to digital tools. As shown in Table 8, this seems supported by our results in which respondents with a lower grade are more likely to have higher WAI score (Middle school +6.7 compared to Postgraduate). In this case the results must be taken with due caution and cannot be generalized, given the statistical significance and eta square values. However, from a substantive point of view, there is a difference between the variables that deserves further investigation in a subsequent phase of the research and that gives a positive indication of the validity of the WAI.

Table 8. Relationship between WAI and Educational Level

Educational Level		Mean		Std. dev.		
Middle school		40.6		16.9		
High school		36.6		17.5		
University degree (Bachelor's or Master's)		35.8		17.2		
Post-graduate		33.9		19.9		
		Sum of Squares	df	Mean Square	F	Sig.
Be-tween Groups	(Com-bined)	1824.771	4	456.19	1.460	.216
Within Groups		68449.703	219	312.55		
Total		70274.474	223			

Focusing on the variables that mainly characterize the studies in the technological addiction literature (Gui & Büchi, 2019; Rosenfeld et al., 2018; Andreassen et al., 2017; Kumar & Sharma, 2017; Montag et al., 2015), these studies show a close link between age and WAI: younger people are more likely to overuse of digital devices, social networks, gaming platforms and so on. As shown in the following in Table 9, the correlation coefficient between the WAI and age shows a statistically significant negative relationship (-.471, $p < .01$). This statistical analysis confirms that age may be a determining factor in the creation of behaviors that link subjects (in particular, young people) to more intensive WhatsApp use.

Table 9. Correlation analysis between age and WAI

	WAI
Age	-.471**

** correlation is significant at the .01 level (two-tailed).

The last step of the construct validation process was to analyze the relationship among the WAI and the variables measuring respectively the Fear of Missing Out (Przybylski, 2013), the Smartphone Addiction (Yang, et al., 2013), and the Internet Addiction (Young, 1998), because, as said in the previous section of this paper, literature (Gentile, Coyne & Bricolo, 2013; Sigerson, 2017) highlighted a link among the several technological addictions.

Table 10. Correlation analysis between FoMO, Smartphone Addiction, Internet Addiction, and WAI

	WAI
FoMO	.594**
Smartphone Addiction	.426**
Internet Addiction	.280**

** correlation is significant at the .01 level (two-tailed).

As shown in the previous table, Correlation analysis among these variables shows a high, positive and statistically significant correlation coefficient among WAI and the FoMO, Smartphone Addiction, Internet Addiction, meaning that the higher are the technological behavioral addictions the higher is the propensity to have a WhatsApp addiction.

Summing up, the statistical analysis has supported the process of construct validation of the WAI, even if with all the cautions due to the non-probabilistic sampling procedure used to build the database.

5. Discussion

The main objective of this study was the use of social networks by a sample of Italian users, with specific reference to WhatsApp. The results show that the large majority of those who have access to social media use WhatsApp on a daily basis. Overall, the use of the app has various facets, ranging from a purely social use (e.g., sending text or multimedia messages to cultivate social relationships) to a use aimed at the representation of one's image (e.g., talking about oneself through Stories, updating one's image and status).

With the goal of creating an index that can detect the propensity to develop a WhatsApp Addiction, we used EFA to identify the main components of the index. *Multimedia Usage*, *Stories Addiction*, *Recidivist Behavior*, *Phubbing* and *Self-representation* are the five components included in the WAI, which detect different attitudes and actions related to the use of the messaging app. *Multimedia Usage*, *Stories Addiction* and *Recidivist Behavior* refer to different types of use of the chat: the first aimed at a multimedia use of the app, which is often secondary or interconnected to a purely textual use of the same; the second relates to a practice commonly used not only on WhatsApp but on all other social networks, that is to publish *stories* lasting 24 hours with the aim of talk about themselves and tell particular moments of their day; finally, the third factor relates instead to a more unconscious attitude that binds users to

a constant and intrusive use of the app in their daily lives. From the second factor analysis, the factors *Phubbing* and *Self-representation* emerged. Both emerge from the canvas woven by social networks that keep us entangled in their nets, often causing damage to the quality of our lives (and in particular, of our attention to work, study, social relations, and affections). All of the factors listed relate to common practices that might emerge, to a greater or lesser degree, in those who overuse WhatsApp.

The last phase of analysis focused on validating the WAI through bivariate analyses with some socio-demographic variables, age, gender, and educational level, and the technological addiction variables (FoMO, Smartphone Addiction, Internet Addiction). Despite the non-representative sampling procedure, the results are encouraging as they are in line with the relevant literature. First, we carried out a bivariate analysis between WAI and gender variables, from which an association emerged between women and the propensity to develop WhatsApp addiction. This shows that women make a more intense use of WhatsApp (and social in general), and this could have a more negative effect on them than men to whom lower values were found instead.

Finally, we tested the WhatsApp Addiction index with the educational level. In this case, through an ANOVA analysis, a negative association emerged between the two variables: as the sample's educational qualification increases, their propensity to develop a WhatsApp Addiction decreases. This would lead us to hypothesize that more educated people would be more averse to falling into the trap of social networks. This result could be linked to the existence of a different orientation in the use of the internet: those who come from upper middle classes (in terms of education and income), demonstrate a more focused use of the internet to pursue and improve themselves; on the contrary, those who belong to lower social classes demonstrate a more focused use of the Internet on social networks (Micheli, 2015). This topic would broaden the discourse on the need to educate people on a more conscious use of technology, especially on social networks (such as WhatsApp).

Furthermore, through a Correlation Analysis we tested the WAI with the age of the sample. This analysis revealed a strong negative relationship between the variables involved: this means that as the age of users increases, their propensity to develop an addiction to WhatsApp should decrease. In other words, younger age groups are the ones most at risk of falling into the abuse of addictions generated by Internet use. This is a not encouraging result for young people who are classified with any other social network as the group most at risk of developing a propensity for digital addiction (Fitria, 2018; Haug et al., 2015; Kwon, Yang & Kim, 2013).

In addition, there is a strong link between FoMO, Smartphone Addiction, Internet Addiction and WAI, as reported by the Correlation Analysis. This leads us to hypothesize that those who demonstrate excessive attitudes towards the digital world in some way (in terms of overuse of smartphones, Internet, chatting, and so on), could develop equally morbid links with the WhatsApp messaging app. The interconnections between technology addictions could be tighter than expected (Gentile, Coyne & Bricolo, 2013; Siger-son, 2017).

Finally, although the main limitation of our study, i.e., collecting data on a non-representative sample, undermines the possibility of generalizing the results, the statistical analysis has supported the process of construct validation of the WAI. Indeed, the results show consistent with previous research showing that overuse or misuse of certain technologies or social media is often related to socio-demographic, socio-economic, or cultural factors.

6. Conclusion

As technology advances as an essential component of our daily lives, it becomes critical to develop an awareness of how it is used and the possible dangers of misusing new technologies and new media. The scientific literature points out, for at least a decade now, that the use of these platforms can cause discomfort diseases and addictions (Youg, 1998; Kwon, Yang & Kim, 2013).

In the latest version of the Diagnostic and Statistical Manual of mental disorders (DSM), the reference manual with respect to mental disorders for both clinical and research contexts, the only addiction not related to substances to be included in the list of mental disorders is currently gambling. Addictions to the internet and new media, such as social networking, are not yet on this list but are noted as proposed in the third section of the manual (Yau, 2015).

The work presented in this article began as exploratory research into what may be new an addiction conveyed by the WhatsApp messaging app.

This research is not free from limitations. First, regarding the sample on which the study was conducted. In this case, we have been working on a non-representative sample. Second, this is an exploratory work, that's why a follow-up and advancement phase of the research is planned for the future. This is because in the next phase we will try to adapt the questionnaire to the Italian context based on the results obtained in this phase, to do this the revised questionnaire will be submitted to a representative sample of the Italian population. The third limitation concerns instead the internal coherence of the questionnaire because there are some semantically redundant questions that need to be further refined.

However, our work represents a first attempt to operationalize and measure the concept of WhatsApp addiction in the Italian territory, a context still little studied in the literature. This could lay the groundwork for studies that develop more sophisticated analyses applicable in other contexts.

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