# The TikTok Addiction Scale: Development and validation

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# Abstract

**Introduction:** There is an absence of valid and specific psychometric tools to assess TikTok addiction. Considering that the use of TikTok is increasing very rapidly, and the fact that TikTok addiction may be a different form of social media addiction, there is an urge for a valid tool to measure TikTok addiction.

**Aim:** To develop and validate a tool to measure TikTok addiction among users.

**Methods:** First, we performed an extensive literature review to create a pool of items to measure TikTok addiction. Then, we employed a panel of experts from different backgrounds to examine the content validity of the initial set of items. We examined the face validity of the scale by performing cognitive interviews with TikTok users and calculating the item-level face validity index. We employed exploratory and confirmatory factor analysis to examine the construct validity of the "TikTok Addiction Scale" (TTAS). We examined the concurrent validity of the TTAS by using the "Bergen Social Media Addiction Scale" (BSMAS), the Patient Health Questionnaire-4 (PHQ-4), and the Big Five Inventory-10 (BFI-10). We used Cronbach's alpha, McDonald's Omega, Cohen's kappa, and intraclass correlation coefficient to examine the reliability of the TTAS.

**Results:** Initially, we developed a pool of 28 items and, after expert panel review and item analysis, we deleted 13 items. Then, we conducted exploratory and confirmatory factor analysis including 15 items to examine the factorial structure of the TTAS. Both analyses confirmed that the final version of the TTAS includes 15 items. Moreover, we found six factors including 15 items; salience (two items), mood modification (two items), tolerance (three items), withdrawal symptoms (two items), conflict (four items), and relapse (two items). Concurrent validity of the TTAS was excellent since we found statistically significant correlations between the TTAS and the BSMAS, the PHQ-4, and the BFI-10. Cronbach's alpha and McDonald's Omega for the TTAS was 0.911 and 0.914, respectively. Cohen's kappa for the 15 items ranged from 0.760 to 0.954 ($p < 0.001$ in all cases). Intraclass correlation coefficient for the TTAS was 0.994 ($p < 0.001$). Thus, the reliability of the TTAS was excellent.

**Conclusions:** The TTAS is a six-factor 15-item scale with robust psychometric properties. The TTAS is a short and easy-to-use tool that measures levels of TikTok addiction among users in a valid way. Considering the limitations of our study, we recommend the translation and validation of the TTAS in other languages and populations to further examine the reliability and the validity of the scale.

# Introduction

Social media platforms have gained immense popularity worldwide, with an estimated five billion people use these platforms for connection, communication, and information seeking. Number of social media users has increased worldwide from 2.7 billion in 2017 to 5.2 billion in 2023, a number projected to approach six billion in 2028. Moreover, today the average daily social media usage is 151 minutes, while in 2012 was 90 minutes [1]. In the past year alone, there has been a significant increase in the number of social media users, with approximately 300 million new users joining the social media platforms. On average, a typical social media user interacts with or visits six different platforms each month. Facebook has the greatest number of monthly active users (3.1 billion) following by YouTube (2.5 billion users), Instagram (2 billion users), WhatsApp (2 billion users) and TikTok (1.6 billion users). One out of five people aged 18 and above around the world use TikTok. TikTok was downloaded more than 2 billion times in 2021, and most users are adolescents and young adults (16–35 years old) [2].

TikTok has become one of the world's most widely used applications for short-form videos. Launched internationally in 2017, TikTok is a free social media platform that enables users to create, edit, and share brief video clips that are enhanced with filters and feature the latest music trends. Users can download the application to their smartphones and

record videos that are less than three minutes in length. TikTok offers a variety of features, including adding audio and images, live broadcasting, and earning income based on the number of followers. Unlike other social media platforms (e.g. Facebook, Twitter, Instagram, and Snapchat), which focus primarily on images and text, TikTok emphasizes on brief videos [3]. TikTok's focus on short videos and interactive content has made it a popular choice for users seeking quick, engaging entertainment. Users can earn income and attract followers by producing content, making the application even more appealing. TikTok users prefer the application for various reasons, including social acceptance, comfort, and satisfaction [4].

High levels of digital addiction raise concerns about the appropriate internet use. In particular, a meta-analysis including data from 64 countries found that the global pooled prevalence for social media addiction is 17.4%, for internet addiction is 14.2%, for smartphone addiction is 27%, for cybersex addiction is 8.2%, and for game addiction is 6% [5]. Also, prevalence of digital addiction was higher among low/lower-middle income countries and countries in Eastern Mediterranean region. The growing trend of digital addiction over the past two decades has been exacerbated by the COVID-19 pandemic. Another meta-analysis included 63 studies from 32 nations, and found that the pooled prevalence of social media addiction is 24% worldwide, 31% in collectivist nations and 14% in individualist nations [6]. This finding is supported by another recent meta-analysis included mainly studies that have been conducted during the COVID-19 pandemic [7]. In particular, this meta-analysis showed that the prevalence of problematic social media use is significantly higher in low-income countries, and this difference is probably attributed to different socio-cultural conditions between countries. Evidence regarding the impact of age on problematic social media use is controversial since Cheng et al. [6] found higher prevalence among adolescents rather than both university students and community adult samples, while Meng et al. [5] did not find differences related to age.

There is an ongoing debate over the negative consequences of social media usage. The excessive use of social media is becoming a significant public health issue due to its association with various problems, such as depression, low self-esteem, impulsivity, suicide risk, work impairments, and poor sleep quality [8–13]. A meta-analysis found a negative correlation between problematic social media use and well-being, and a positive correlation between problematic social media use and psychological distress [14]. Also, another recent meta-analysis showed a positive correlation between problematic social media use and stress, anxiety, and depression among adolescents and young adults [15]. Additionally, internet-based addictive behaviors were increased during the COVID-19 pandemic mostly due to mental health issues, problematic substance use, isolation, and financial issues [16].

TikTok empowers users to capture cherished memories and produce concise videos to document their lives, providing ample entertainment. However, it is also emerging as a novel form of social media addiction [17]. Social media addiction refers to the recurrence of addiction-like symptoms or a lack of self-restraint in relation to social media [18, 19]. Although research on social media addiction has concentrated predominantly on Facebook, Instagram, and other well-established social media platforms, it has overlooked TikTok's influence and the associated maladaptive behaviors [17]. Examining the behavior of TikTok addiction is essential for several reasons. Firstly, TikTok has rapidly grown to become one of the most popular applications, surpassing other social media platforms in terms of user numbers and usage intensity [3]. Secondly, TikTok boasts an advanced algorithm system, particularly in terms of participation, content, and types of interaction, which makes TikTok addiction more severe than other social media platforms [17, 20, 21]. While the underlying negative effects of addiction are similar across different platforms, the intensity and driving factors of TikTok addiction are unique [17]. Thirdly, TikTok's target audience is adolescents and young adults with short attention spans. This has raised serious concerns as TikTok addiction is affecting young people seriously.

In this context, valid measurement of social media addiction/disorder/problematic use is crucial to identify high-risk individuals. A recent scoping review found that there are 37 instruments that measure negative social networking site use [22]. The Bergen Facebook Addiction Scale (BFAS) is the most widely instrument for measuring negative use of

social media [23]. Several adaptations from the BFAS has been developed, such as the Bergen Social Media Addiction Scale [24]. Other popular instruments include the Social Media Disorder Scale [25], the Facebook Intrusion Questionnaire [26], the Generalized Problematic Internet Use Scale [27] and the Internet Addiction Test [28]. Lack of consensus among scales makes it difficult to compare results among studies and ascertain the genuine extent of the issue. Furthermore, the diverse range of instruments employed and the scarcity of a consensus concerning the cut-off points for evaluating negative social media use underscore the obstacles and difficulties associated with measuring this problem. Several scales do not even provide cut-off points, thus precluding the clear demarcation between regular and negative usage. Additionally, several scales, such as the BFAS lack explicit cut-off points, opting instead to offer suggestions; in such cases, individual scholars establish different cut-off points.

Until now, most studies have used simple variables to measure TikTok usage, such as time spent on TikTok, number of accounts that participants follow, and number of friends, close friends, "likes" and "followers" [29–31]. Recently, two studies used an adopted version of the BFAS to measure participants' addiction on TikTok [32, 33]. In particular, these studies just replaced the term "Facebook" with "TikTok" in the six items of the BFAS. Moreover, these studies did not examine the validity of the scale refers to the TikTok items and, thus, use of the BFAS as a proxy for the TikTok addiction is precarious. Additionally, Pontes et al. developed the Gaming Disorder Test (GDT) after the recognition of gaming disorder as an official behavioral addiction and mental health disorder by the World Health Organization (WHO) [34]. Authors developed four items to assess gaming activity both online and/or offline during the last 12 months. Montag and Markett introduced the TikTok Use DisorderQuestionnaire (TTUDQ) by adapting the four GDT items [35]. In particular, they replaced the term "gaming" with "TikTok use" in the four GDT items, but they did not examine the validity of the TTUDQ. Moreover, Montag and Markett pointed out that their study suffers by serious selection bias since they recruited their sample after an advertisement for a study on cognitive failure. Thus, they obtained a non-typical sample for TikTok users with a mean age of 41 years and a maximum age of 85 years.

Although there are a plenty of tools to measure social media, social network, internet, Facebook, and Instagram addiction/disorder/problematic use, there is an absence of valid and specific psychometric tools to assess TikTok addiction/disorder/problematic use. Considering that the use of TikTok is increasing very rapidly, and the fact that TikTok addiction may be a different form of social media addiction, there is an urge for a valid tool to measure TikTok addiction. Given the diversity in platform design among social media platforms, it is crucial to examine the impact of TikTok usage on individuals' mental health. Different platforms may have varying effects on users, potentially leading to distinct outcomes for their mental well-being. Additionally, previous research has disproportionately focused on Facebook, while neglecting the popularity of TikTok and the associated concerns of maladaptive behaviors. Given the limited literature on TikTok use compared to studies on other social media platforms, our study specifically focuses on TikTok overuse. Therefore, the aim of our study was to develop and validate a tool to measure TikTok addiction.

# Methods

# Development of the scale

Figure 1 shows the development and validation of the TikTok Addiction Scale (TTAS). We followed several steps to develop the items of the TTAS [36]. First, we performed a complete and thorough literature review to identify instruments, scales ant tools that measure social media, social network, internet, Facebook, and Instagram addiction/disorder/problematic use [22–28, 37–39]. Literature suggests that addiction involves six core components: (1) salience (preoccupation with social media), (2) mood modification (social media use improves mood), (3) tolerance (increasing amounts of social media use are required to satisfy users), (4) withdrawal (users experience negative feelings when social media use is discontinued or suddenly reduced), (5) conflict (social media use causes problems and conflicts in work/education, relationships, sleep, and other activities), and (6) relapse (users revert to previous

patterns of social media use after abstinence or control) [40–42]. In a similar way, the WHO has recently defined in the 11th Revision of the International Classification of Diseases (ICD-11) gaming disorder as a pattern of gaming behavior or otherwise digital-gaming behavior [43]. It is the first time that any type of social media addiction is defined as a disorder in the ICD. In this context, gaming disorder is characterized by loss of control, increasing priority given to gaming over essential daily activities, functional impairments, and continuation of gaming despite negative consequences. Emphasis is given on that symptoms of social media disorder/addiction should last for at least 12 months. Therefore, WHO definition for the gaming disorder is in accordance with the core components of addiction that we mention above. For instance, increasing priority given to gaming over essential daily activities refers to the component "conflict". After all, we developed 28 items to measure TikTok addiction based on the six core components of addiction, i.e. salience (four items), mood modification (five items), tolerance (five items), withdrawal (two items), conflict (ten items) and relapse (two items).

Afterwards, we employed a panel of 10 experts from different backgrounds (e.g., psychologists, mental healthcare professionals, physicians, sociologists, and nurses) to examine the content validity of the initial set of 28 items. We asked experts to rate how well each of the 28 items corresponds to TikTok addiction among users. We offered experts three options to evaluate each item; "not essential", "useful but not essential" or "essential". After experts' evaluation we calculated the content validity ratio for each item as follows:

$$\text{Content validity ratio} = \frac{n - \frac{N}{2}}{\frac{N}{2}}$$

In the formula above, "n" was the number of experts who rate an item as "essential", while N was the total number of experts (= 10). We retained items with content validity ratio greater than 0.80 as literature suggests [44]. In this step, we removed eight items and, thus, 20 items were remained in our scale; four items refers to salience, four items refers to mood modification, four items refers to tolerance, two items refers to withdrawal, four items refers to conflict, and two items refers to relapse.

Then, we examined the face validity of the TTAS by performing cognitive interviews with five TikTok users [45]. All users interpreted the 20 items as we intended. Furthermore, we conducted a pilot study with 15 TikTok users (eight males and seven females, mean age; 22.7 years) to examine the clarity of the 20 items by calculating the item-level face validity index. We asked TikTok users to rate the clarity of the 20 items. Answers were on a four-point Likert scale: 1 = item is not clear; 2 = item is somewhat clear; 3 = item is quite clear and; 4 = item is highly clear). Then, we calculated the item-level face validity index, and we kept items with values greater than 0.80 as literature suggests [46]. Face validity index ranged from 0.866 to 1.000 and, thus, we kept all 20 items in our scale.

Twenty items (e.g., "During the last 12 months, I feel good when I upload videos on TikTok", "During the last 12 months, I think about how I could reduce my work/study to spend more time on TikTok", "During the last 12 months, I feel sad when I cannot use TikTok for some time") were rated on a five-point Likert scale as follows: very rarely (1), rarely (2), sometimes (3), often (4), very often (5). Higher scores indicate greater TikTok addiction. Supplementary Table 1 shows the 20 items that were produced after the initial development phase of the TTAS.

# Participants and procedure

We developed the TTAS in Greek. Our study population included adults aged 18 years or older that were being able to read and understand Greek. Moreover, our participants must be TikTok users for at least the last 12 months. We created an anonymous online version of the study questionnaire through Google forms. We collected our data through

several ways; dissemination through social media (i.e., TikTok, Facebook, Instagram, Viber, and WhatsApp), face-to-face interviews, and e-mail campaigns. We collected our data during July 2024.

Final overall sample included 429 TikTok users. Among our participants, 81.8% were females (n = 351) and 18.2% were males (n = 78). Mean age of our sample was 26.5 years (standard deviation; 8.5), with a median value of 22 years (minimum age; 18, maximum age; 54). Participants reported a mean time of TikTok use of 2.2 hours daily (standard deviation; 1.6 hours, median; 2 hours; minimum value; 15 minutes, maximum value; 8 hours).

# Item analysis

We employed an item analysis for the 20 items that were produced after the initial development phase of the TTAS. We used the overall sample to check inter-item correlations, corrected item-total correlations, floor and ceiling effects, skewness, kurtosis, and Cronbach's alpha (when a single item was deleted) for our 20 items [47]. Literature suggests that acceptable values for inter-item correlation range from 0.15 to 0.75 [48], and for item-total correlation are higher than 0.30 [49]. Floor or ceiling effects are considered when more than 85% of participants achieve the lowest or highest possible score, respectively [50]. Items follow the normal distribution when skewness is between − 2 to + 2, and kurtosis is between − 7 to + 7 [51].

# Construct validity

We employed exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) to examine the construct validity of the TTAS. Literature suggests a minimum sample size for the EFA of 50 observations [52] of five observations per item [47]. Also, minimum sample size for the CFA is 200 observations [53]. Our sample covered these requirements. In particular, we split randomly our participants into two groups to perform EFA and CFA with different samples. Then, we used 169 TikTok users to conduct the EFA, and 260 TikTok users to conduct the CFA. Therefore, we used two different samples to perform EFA and CFA to improve validity of our analyses. Our samples in both cases covered the sample requirements for EFA and CFA.

First, we performed EFA to explore the underlying factor structure of the TTAS, and then we employed CFA to verify the results of EFA. In this step, we included the 15 items that emerged after the initial development of the TTAS and the item analysis.

We calculated the Kaiser-Meyer-Olkin index and p-value for Bartlett sphericity test to examine suitability of our data to perform EFA. Acceptable values for the Kaiser-Meyer-Olkin index and Bartlett sphericity test are > 0.80 and < 0.05, respectively [51]. We used oblique rotation (promax method in SPSS) to perform EFA since we expected significant correlations between potential factors that were developed from the analysis. Acceptable values for the EFA are the following: eigenvalues > 1, factor loadings > 0.60, communalities > 0.40, and the total variance explained by the factors > 65% [51]. Additionally, we calculated Cronbach's alpha for the factors that were produced by the EFA with values > 0.7 considered to be acceptable [54].

After EFA, we performed CFA to confirm the validity of the TTAS factor structure. The TTAS followed normal distribution and, thus, we used the maximum likelihood estimator. We checked the goodness of fit indices in CFA by calculating two indices of absolute fit (i.e., root mean square error of approximation [RMSEA] and goodness of fit index [GFI]), two indices of relative fit (i.e., normed fit index [NFI] and comparative fit index [CFI]), and one index of parsimonious fit (i.e., chi-square/degree of freedom [$x^2$/df]). Acceptable values for fit indices in CFA are the following: RMSEA < 0.10, GFI > 0.90, NFI > 0.90, CFI > 0.90, and $x^2$/df < 5 [50, 55−57]. Additionally, we calculated standardized regression weights between items and factors, and correlation coefficients between factors.

# Concurrent validity

Concurrent validity of the TTAS was investigated using the Bergen Social Media Addiction Scale (BSMAS) [24], the Patient Health Questionnaire-4 (PHQ-4) [58], and the Big Five Inventory-10 (BFI-10) [59]. We checked the concurrent validity of the TTAS on the overall sample (N = 429).

The BSMAS includes six items (e.g., During the last 12 months, do you spent a lot of time thinking about social media or planned use of social media?). Answers are on a five-point Likert scale from 1 (very rarely) to 5 (very often). Total score ranges from 6 to 30, and higher scores on the BSMAS indicate greater social media addiction. We used the valid Greek version of the BSMAS [60]. In our study, Cronbach's alpha for the BSMAS was 0.829, and McDonald's Omega was 0.830.

Two recent systematic reviews suggested a correlation between social media overuse and depression and anxiety symptoms [61, 62]. Thus, we used the PHQ-4 to further examine the concurrent validity of the TTAS. The PHQ-4 comprises four items (e.g., Over the last two weeks, how often have you been bothered by feeling nervous, anxious or on edge?), and assess anxiety and depression. Answers are on a four-point Likert scale from 0 (not at all) to 3 (nearly every day). Total score ranges from 0 to 12, and higher scores on the PHQ-4 indicate greater anxiety and depression. We used the valid Greek version of the PHQ-4 [63]. In our study, Cronbach's alpha for the PHQ-4 was 0.818, and McDonald's Omega was 0.825.

Several studies support the positive correlation between social media addiction and neuroticism [64–66]. Moreover, literature found a negative correlation between social media addiction and conscientiousness [66]. Therefore, we used the BFI-10 to examine the concurrent validity of the TTAS. The BFI-10 is a 10-item scale that measures the domains of the five-factor model of personality: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Each factor includes two items. A sample item is the following: "I see myself as someone who is reserved". Answers are on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Total score for each factor ranges from 2 to 10. Higher scores on the BFI-10 indicate greater neuroticism, extraversion, openness, agreeableness, and conscientiousness. We used the valid Greek version of the BFI-10 [67]. In our study, Cronbach's alpha for the BFI-10 was 0.712, and McDonald's Omega was 0.714.

We measured the overall score for the scale and the six factors that emerged from the factor analysis. Specifically, we summed the responses for all items and divided the total by the number of items to determine the total score for the scale. Likewise, scores for each factor were calculated. All the scores ranged from one to five, with higher scores indicating greater levels of TikTok addiction.

Afterwards, we expected a positive correlation between the TTAS and the BSMAS, the PHQ-4, and neuroticism. Moreover, we expected a negative correlation between the TTAS and extraversion, openness and conscientiousness.

# Reliability

First, we used the overall sample (N = 429) to assess the reliability of the TTAS. In particular, we calculated Cronbach's alpha and McDonald's Omega for the TTAS and the factors. Acceptable values for Cronbach's alpha and McDonald's Omega are > 0.6 [54].

Additionally, we measured corrected item-total correlations and Cronbach's alpha when a single item was deleted for the 15 items of the TTAS. Acceptable values for corrected item-total correlations were ≥ 0.30 [49].

Moreover, we performed a test-retest study with 30 TikTok users. In that case, participants completed the TTAS twice in one week. We measured Cohen's kappa for the 15 items of the TTAS since the answers were in an ordinal scale. Also, we measured the two-way mixed intraclass correlation coefficient (absolute agreement) for the total score of TTAS, and for scores on six factors.

# Ethical considerations

We collected our data in an anonymous and voluntary basis. We informed participants about the aim and the design of our study and they gave their informed consent. The Ethics Committee of the Faculty of Nursing, National and Kapodistrian University of Athens approved our study protocol (approval number; 451, June 2023). Moreover, we conducted our study in accordance with the Declaration of Helsinki [68].

# Statistical analysis

We use absolute numbers and percentages to present categorical variables. Also, we use mean, standard deviation, median, minimum value and maximum value to present continuous variables. We employed the Kolmogorov-Smirnov test and Q-Q plots to examine the distribution of scores on our scales. Scores on TTAS, BSMAS, PHQ-4 and BFI-10 followed normal distribution. Thus, we calculated Pearson's correlation coefficient to examine correlation between scales. P-values less than 0.05 were considered as statistically significant. We performed CFA with AMOS version 21 (Amos Development Corporation, 2018). All other analyses were conducted with IBM SPSS 21.0 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.).

# Results

# Item analysis

We present results from the item analysis in the Table 1; descriptive statistics, corrected item-total correlations, floor and ceiling effects, skewness, kurtosis, and Cronbach's alpha when a single item was deleted. Moreover, we present inter-item correlations between the 20 items that were produced after the initial development phase of the TikTok Addiction Scale in the Supplementary Table 2.

We deleted items #1, #4, #5, #6 and #12 due to low inter-item correlations with several other items. Moreover, items #1 and #5 had negative inter-item correlations with other items, while item #5 had low corrected item-total correlation (0.268). Cronbach's alpha for the 20 items was 0.896 and was decreased after removal of each single item. Moreover, we examined the meaning of retained and excluded items in a theoretical way to judge the validity of item analysis. All items that were removed after item analysis had items with similar meaning that were retained. For instance, the item #1 had a similar meaning with the item #2, the item #4 with the item #3, the item #5 with the item #7, the item #6 with the item #8, and the item #12 with the item #11.

Therefore, we deleted five items (#1, #4, #5, #6, #12, Table 1), and the remaining 15 items had acceptable corrected item-total correlations, inter-item correlations, floor and ceiling effects, skewness and kurtosis. Cronbach's alpha for the 15 items was 0.916.

Table 1

Descriptive statistics, corrected item-total correlations, floor and ceiling effects, skewness, kurtosis, and Cronbach's alpha (when a single item was deleted) for the 20 items that were produced after the initial development phase of the TikTok Addiction Scale (N = 429).

| Item | Mean (standard deviation) | Corrected item-total correlation | Floor effect (%) | Ceiling effect (%) | Skewness | Kurtosis | Cronbach's alpha if item deleted | Item exclusion or retention |
|---|---|---|---|---|---|---|---|---|
| 1. I spend a lot of time thinking about what videos should upload on TikTok | 1.42 (0.77) | 0.316 | 73.0 | 0.0 | 1.76 | 2.12 | 0.889 | Excluded |
| 2. I think about how I could reduce my work/study to spend more time on TikTok | 1.57 (0.79) | 0.520 | 58.7 | 0.2 | 1.33 | 1.32 | 0.884 | Retained |
| 3. I have TikTok in my mind even when I am not using it | 1.94 (0.98) | 0.628 | 41.3 | 1.9 | 0.87 | 0.24 | 0.881 | Retained |
| 4. I feel compelled to upload videos on TikTok soon after an event | 1.35 (0.66) | 0.350 | 74.8 | 0.0 | 1.93 | 3.08 | 0.888 | Excluded |
| 5. I feel good when I upload videos on TikTok | 1.77 (1.07) | 0.268 | 60.1 | 1.4 | 1.11 | 0.04 | 0.892 | Excluded |
| 6. My mood is improved when I get likes/comments for my videos | 2.02 (1.30) | 0.321 | 54.5 | 5.1 | 0.88 | -0.61 | 0.892 | Excluded |
| 7. I feel calm when I use TikTok | 3.27 (0.96) | 0.333 | 5.8 | 6.3 | -0.53 | 0.04 | 0.889 | Retained |
| 8. I use TikTok as a get away from my problems and my thoughts | 3.43 (1.16) | 0.549 | 6.8 | 20.7 | -0.35 | -0.61 | 0.883 | Retained |
| 9. I have had difficulties controlling the time I spend on TikTok | 3.27 (1.22) | 0.662 | 9.1 | 19.1 | -0.19 | -0.87 | 0.879 | Retained |
| 10. I have had difficulties closing TikTok | 3.00 (1.19) | 0.641 | 12.4 | 12.8 | 0.01 | -0.78 | 0.880 | Retained |

| Item | Mean (standard deviation) | Corrected item-total correlation | Floor effect (%) | Ceiling effect (%) | Skewness | Kurtosis | Cronbach's alpha if item deleted | Item exclusion or retention |
|---|---|---|---|---|---|---|---|---|
| 11. I want to use TikTok more and more | 2.36 (1.08) | 0.593 | 23.8 | 5.1 | 0.57 | -0.12 | 0.881 | Retained |
| 12. I use TikTok even in the bathroom | 3.08 (1.38) | 0.347 | 17.2 | 20.0 | -0.09 | -1.24 | 0.891 | Excluded |
| 13. I feel bad when I cannot use TikTok for some time | 1.34 (0.64) | 0.590 | 73.4 | 0.0 | 2.05 | 4.24 | 0.884 | Retained |
| 14. I feel sad when I cannot use TikTok for some time | 1.30 (0.55) | 0.574 | 75.1 | 0,0 | 1.71 | 1.96 | 0.885 | Retained |
| 15. I don't get enough time to do things I want to do because I spend a lot of time on TikTok | 1.98 (1.06) | 0.603 | 42.4 | 2.8 | 0.90 | 0.14 | 0.881 | Retained |
| 16. I lose sleep due to excessive use of TikTok | 2.47 (1.14) | 0.614 | 23.8 | 5.8 | 0.41 | -0.53 | 0.881 | Retained |
| 17. I am not able to concentrate on my work/study due to TikTok use | 2.20 (1.19) | 0.691 | 35.9 | 5.6 | 0.76 | -0.32 | 0.878 | Retained |
| 18. I use TikTok so much that it has had a negative impact on my work/study | 1.97 (1.16) | 0.627 | 47.6 | 4.4 | 1.04 | 0.16 | 0.880 | Retained |
| 19. I feel depressed when I do not use TikTok, which goes when I use it | 1.63 (0.89) | 0.534 | 59.7 | 0.7 | 1.33 | 1.09 | 0.884 | Retained |
| 20. I feel anxious when I do not use TikTok, which goes when I use it | 1.70 (0.94) | 0.577 | 57.6 | 0.5 | 1.13 | 0.27 | 0.882 | Retained |

# Exploratory factor analysis

The Kaiser-Meyer-Olkin index was 0.895, and p-value for Bartlett sphericity was < 0.001 indicating that our sample was adequate to perform EFA. We employed oblique rotation (promax method) to perform our EFA including the 15 items mentioned above (items #2, #3, #7, #8, #9, #10, #11, #13, #14, #15, #16, #17, #18, #19 and #20 in Table 1).

We found six factors including all items (Table 2). Therefore, our EFA confirmed the six-factor model for the TTAS that we hypothesized in the Introduction. According to the literature, addiction involves salience, mood modification, tolerance, withdrawal, conflict and relapse. Thus, our EFA identified the following factors: salience (two items; #1, #2), mood modification (two items; #3, #4), tolerance (three items; #5, #6, #7), withdrawal symptoms (two items; #8, #9), conflict (four items; #10, #11, #12, #13), and relapse (two items; #14, #15), (Table 2). The total variance explained by the six factors was 80.703%. The variance explained by each single factor was as follows: 47.649% of the total variance explained by the factor "conflict", 9.605% of the total variance explained by the factor "tolerance", 8.559% of the total variance explained by the factor "withdrawal symptoms", 5.823% of the total variance explained by the factor "salience", 4.908% of the total variance explained by the factor "relapse", and 4.159% of the total variance explained by the factor "mood modification". Factor loadings ranged from 0.733 to 0.939, while communalities ranged from 0.707 to 0.894.

Cronbach's alpha for the TTAS was 0.916, while McDonald's Omega was 0.923. Cronbach's alpha and McDonald's Omega for the factors of the TTAS ranged from 0.659 to 0.868 (Supplementary Table 3).

Table 2
Exploratory factor analysis using oblique rotation (promax method) for the TikTok Addiction Scale (n = 169).

| Item | Factors | | | | | | Communalities |
|---|---|---|---|---|---|---|---|
| | Conflict | Tolerance | Withdrawal symptoms | Salience | Relapse | Mood modification | |
| 1. I think about how I could reduce my work/study to spend more time on TikTok | 0.391 | 0.350 | 0.443 | **0.866** | 0.344 | 0.224 | 0.770 |
| 2. I have TikTok in my mind even when I am not using it | 0.599 | 0.528 | 0.555 | **0.796** | 0.358 | 0.220 | 0.707 |
| 3. I feel calm when I use TikTok | 0.196 | 0.288 | 0.191 | 0.075 | 0.370 | **0.903** | 0.845 |
| 4. I use TikTok as a get away from my problems and my thoughts | 0.471 | 0.422 | 0.395 | 0.492 | 0.318 | **0.809** | 0.788 |
| 5. I have had difficulties controlling the time I spend on TikTok | 0.667 | **0.869** | 0.227 | 0.339 | 0.398 | 0.430 | 0.809 |
| 6. I have had difficulties closing TikTok | 0.699 | **0.888** | 0.427 | 0.499 | 0.306 | 0.266 | 0.843 |
| 7. I want to use TikTok more and more | 0.527 | **0.883** | 0.489 | 0.378 | 0.434 | 0.285 | 0.824 |
| 8. I feel bad when I cannot use TikTok for some time | 0.403 | 0.408 | **0.898** | 0.533 | 0.464 | 0.220 | 0.810 |
| 9. I feel sad when I cannot use TikTok for some time | 0.497 | 0.430 | **0.894** | 0.445 | 0.482 | 0.317 | 0.836 |
| 10. I don't get enough time to do things I want to do because I spend a lot of time on TikTok | **0.829** | 0.592 | 0.442 | 0.488 | 0.439 | 0.059 | 0.767 |
| 11. I lose sleep due to excessive use of TikTok | **0.733** | 0.664 | 0.220 | 0.105 | 0.485 | 0.423 | 0.722 |
| 12. I am not able to concentrate on | **0.917** | 0.663 | 0.392 | 0.449 | 0.486 | 0.324 | 0.847 |

| Item | Factors | | | | | | Communalities |
|------|---------|--|--|--|--|--|---------------|
| | Conflict | Tolerance | Withdrawal symptoms | Salience | Relapse | Mood modification | |
| my work/study due to TikTok use | | | | | | | |
| 13. I use TikTok so much that it has had a negative impact on my work/study | **0.876** | 0.528 | 0.474 | 0.487 | 0.355 | 0.307 | 0.804 |
| 14. I feel depressed when I do not use TikTok, which goes when I use it | 0.503 | 0.421 | 0.430 | 0.317 | **0.939** | 0.403 | 0.894 |
| 15. I feel anxious when I do not use TikTok, which goes when I use it | 0.467 | 0.464 | 0.631 | 0.510 | **0.867** | 0.294 | 0.841 |

Values express factors loadings. Bold indicate the highest factor loadings for the items.

## Confirmatory factor analysis

Then, we performed CFA to verify the factors of the TTAS that obtained from the EFA. Thus, we performed CFA of 15 items across six factors. Our CFA suggested that the six-factor model with 15 items of the TTAS had very good fit to data since $x^2$/df was 1.481, RMSEA was 0.043, GFI was 0.953, NFI was 0.953, and CFI was 0.984. Moreover, the correlation coefficients between factors were positive and statistically significant (p < 0.001 in all cases). In particular, correlation coefficients ranged from 0.382 to 0.703. Standardized regression weights between 15 items and six factors ranged from 0.473 to 0.921 (p < 0.001 in all cases). CFA of the TTAS is shown in Fig. 2.

In conclusion, our EFA and CFA identified a six-factor 15-item model for the TTAS; salience (two items; #1, #2), mood modification (two items; #3, #4), tolerance (three items; #5, #6, #7), withdrawal symptoms (two items; #8, #9), conflict (four items; #10, #11, #12, #13), and relapse (two items; #14, #15), (Supplementary Table 4).

## Concurrent validity

We found a positive correlation between the TTAS and the BSMAS, suggesting that participants with higher levels of social media addiction have also higher levels of TikTok addiction. In particular, correlation coefficients between the TTAS and the BSMAS ranged from 0.475 to 0.744 (p < 0.01 in all cases).

Moreover, we found a positive correlation between the TTAS and the PHQ-4, suggesting that participants with higher levels of anxiety and depression may have higher levels of TikTok addiction. In particular, correlation coefficients between the TTAS and the PHQ-4 ranged from 0.163 to 0.371 (p < 0.01 in all cases).

Additionally, the six factors of the TTAS and the total score were correlated negatively with conscientiousness; correlation coefficients ranged from − 0.406 to -0.210, p < 0.01 in all cases). Similarly, we found a negative correlation between the extraversion and salience (r = -0.123, p < 0.05), mood modification (r = -0.226, p < 0.01), tolerance (r =

-0.110, p < 0.05), conflict (r = -0.165, p < 0.05), relapse (r = -0.144, p < 0.01), and total score of the TTAS (r = -0.184, p < 0.01).

Also, we found a negative correlation between openness and withdrawal symptoms (r = -0.145, p < 0.01), and a positive correlation between neuroticism and mood modification (r = 0.116, p < 0.05), and tolerance (r = 0.169, p < 0.01).

Therefore, the concurrent validity of the TTAS was excellent. Table 3 shows the correlations between the TTAS and the BSMAS, the PHQ-4, and the BFI-10.

Table 3
Pearson's correlation coefficients between the TikTok Addiction Scale (TTAS) and the Bergen Social Media Addiction Scale (BSMAS), the Patient Health Questionnaire-4 (PHQ-4), and the Big Five Inventory-10 (BFI-10) (n = 429).

| TTAS | BSMAS | PHQ-4 | BFI-10 | | | |
|---|---|---|---|---|---|---|
| | | | Neuroticism | Openness | Extraversion | Conscientiousness |
| Salience | 0.509** | 0.163** | -0.014 | -0.079 | -0.123* | -0.264** |
| Mood modification | 0.475** | 0.363** | 0.116* | -0.059 | -0.226** | -0.210** |
| Tolerance | 0.601** | 0.317** | 0.169** | -0.004 | -0.110* | -0.312** |
| Withdrawal symptoms | 0.509** | 0.181** | -0.047 | -0.145** | -0.037 | -0.270** |
| Conflict | 0.649** | 0.358** | 0.063 | -0.073 | -0.165* | -0.420** |
| Relapse | 0.547** | 0.266** | 0.001 | -0.091 | -0.144** | -0.248** |
| Total score | 0.744** | 0.371** | 0.089 | -0.083 | -0.184** | -0.406** |
| * p < 0.05 | | | | | | |
| ** p < 0.01 | | | | | | |

# Reliability

We present Cronbach's alpha and McDonald's Omega for the six-factor model with 15 items for the TTAS in Table 4. Cronbach's alpha and McDonald's Omega for the TTAS was 0.911 and 0.914, respectively. Moreover, Cronbach's alpha for the six factors ranged from 0.624 to 0.860, while McDonald's Omega ranged from 0.862 to 0.879. Thus, the internal consistency of the TTAS was very good.

Additionally, corrected item-total correlations had values between 0.333 and 0.756, while removal of each single item did not increase Cronbach's alpha (Supplementary Table 5).

Cohen's kappa for the 15 items ranged from 0.760 to 0.954 (p < 0.001 in all cases), (Supplementary Table 6). Additionally, intraclass correlation coefficient for the total score was 0.994 (95% confidence interval; 0.984 to 0.998, p < 0.001), while for the six factors ranged from 0.930 to 0.992 (p < 0.001 in all cases), (Supplementary Table 7). Thus, the reliability of the TTAS was excellent.

Table 4
Cronbach's alpha and McDonald's Omega for the six-factor model
with 15 items for the TikTok Addiction Scale (n = 429).

| Factor | Cronbach's alpha | McDonald's Omega |
|---|---|---|
| Salience | 0.642 | NC |
| Mood modification | 0.624 | NC |
| Tolerance | 0.850 | 0.862 |
| Withdrawal symptoms | 0.847 | NC |
| Conflict | 0.873 | 0.879 |
| Relapse | 0.860 | NC |
| TikTok Addiction Scale | 0.911 | 0.914 |
| NC: non computable due to limited items | | |

# Discussion

Only seven years after its initial release, TikTok has become one of the world's most widely used applications for short-form videos since more than 20% of adults around the world use it [2]. Although research on social media addiction has primarily focused on well-established platforms like Facebook, Instagram, and others, it has overlooked the influence of TikTok and the related maladaptive behaviors [17]. Therefore, employing valid tools to assess TikTok addiction is essential to identify high-risk individuals. A recent review revealed that there are 37 instruments that measure negative social networking site usage, such as the Bergen Facebook Addiction Scale, the Social Media Disorder Scale, the Facebook Intrusion Questionnaire, the Generalized Problematic Internet Use Scale, and the Internet Addiction Test [22]. However, no valid and specific psychometric tools exist to assess TikTok addiction/disorder/problematic use. Given the rapid increase in TikTok usage and the fact that TikTok addiction may be a distinct form of social media addiction, there is a need for a valid tool to measure TikTok addiction. Given the differences in platform design among social media platforms, it is crucial to investigate the impact of TikTok usage on individuals' mental health. To the best of our knowledge, no valid and specific tool exists to assess TikTok addiction.

In this context, we developed and validated a specific tool to measure TikTok addiction among users, i.e. the TikTok addiction scale. Since the literature suggests that addiction involves six core components, namely salience, mood modification, tolerance, withdrawal, conflict and relapse, we developed items for the TTAS according to this theoretical framework [40–43]. After a thorough literature review [22–28, 37–39] we identified 28 items, and we deleted eight items after examination of content validity and face validity. Then, we performed an item analysis for the 20 items that were produced after the initial development phase of the TTAS, and we deleted five items due to low inter-item correlations, negative inter-item correlations and low corrected item-total correlations.

Afterwards, we performed exploratory and confirmatory factor analysis to examine the construct validity of the TTAS. Factor analysis identified six factors which explain 80.703% of the total variance of TikTok addiction. In particular, the factors were the following: salience (two items), mood modification (two items), tolerance (three items), withdrawal symptoms (two items), conflict (four items), and relapse (two items). The factor "conflict" explained the greatest amount of the variance, and then the factors "tolerance" and "withdrawal symptoms". In CFA, the RMSEA was 0.043, the GFI was 0.953, the NFI was 0.953, and the CFI was 0.984, which indicate very good fit to our data [50, 55–57]. Additionally, the correlation coefficients between the six factors ranged from 0.382 to 0.703 and were statistically significant (p < 0.001 in all cases). Thus, our factor analysis identified a six-factor 15-item model for the TTAS, and

confirmed our hypothesis that TikTok addiction involves six components (i.e., salience, mood modification, tolerance, withdrawal, conflict and relapse) as other addictions involve.

Additionally, we examined the concurrent validity of the TTAS by estimating the correlation between the TTAS and the BSMAS [24], the PHQ-4 [58], and the BFI-10 [59]. In particular, we expected a positive correlation between the TTAS and the BSMAS, the PHQ-4, and neuroticism. On the opposite, we expected a negative correlation between the TTAS and extraversion, openness and conscientiousness. The concurrent validity of the TTAS was excellent since we found moderate to high correlation coefficients between the TTAS and the BSMAS. As it was expected, the scores for the TTAS are correlated with a specific social media measure of addiction, such as the Bergen Social Media Addiction Scale. Moreover, we found positive and statistically significant correlations between the TTAS and the PHQ-4. Literature confirms this finding since two recent systematic reviews found a positive correlation between social media overuse and depression and anxiety symptoms [61, 62]. Also, we found that the higher the score on the TTAS, the higher the score on neuroticism. Several studies showed the positive correlation between social media addiction and neuroticism [64–66]. On the other hand, we found a negative correlation between the TTAS and conscientiousness. This finding is in accordance with the literature since individuals with high levels of conscientiousness give less priority to social media in order to accomplish their work [66].

Finally, we found that the reliability of the TTAS was excellent since Cronbach's alpha and McDonald's Omega for the scale was 0.911 and 0.914, respectively. Moreover, Cronbach's alpha for the six factors ranged from 0.624 to 0.860, while McDonald's Omega ranged from 0.862 to 0.879. Additionally, in the test-retest study we found that the intraclass correlation coefficient for the TTAS was 0.994, while for the six factors ranged from 0.930 to 0.992.

# Limitations

Our study had several limitations. First, we conducted our study in a particular country by employing a convenience sample. For instance, compared with the general population, a relatively low percentage of males participated in our study. Thus, our sample cannot be generalized and further studies with more representative samples and in different setting (e.g. students, adolescents) should be conducted to further examine the validity of the TTAS. However, our psychometric analysis is powerful since our sample size met all the requirements. Second, we did not perform our study under clinical settings, and, thus, our findings should be used with concern in clinical practice for diagnosis. Studies with well-controlled clinical settings would add significant information. For instance, identification of TikTok addicted users through clinical examination by psychologists may help us to identify cut-off points for the TTAS, and examine the predictive validity of the scale. Third, we used self-report scales to measure concurrent validity of the TTAS, and, thus, information bias is probable. Fourth, we examined the concurrent validity of the TTAS by calculating the correlation coefficients between the TTAS and three other scales, i.e. BSMAS, PHQ-4 and BFI-10. Future studies may also use other scales to further validate the TTAS. Finally, we employed a cross-sectional design to examine the validity of the TTAS. Since TikTok users' attitudes may change throughout the time, longitudinal studies should investigate how TikTok addiction levels change over time.

# Conclusions

As far as we are aware, the TTAS is the first tool that specific measures levels of TikTok addiction among users. After a thorough reliability and validity analysis we found that the TTAS is a short and easy-to-use tool with robust psychometric properties. Our findings suggest that the TTAS is a six-factor 15-item scale that measures the six core components of addiction (i.e., salience, mood modification, tolerance, withdrawal, conflict and relapse). Thus, the TTAS may be used as a timely tool to measure levels of TikTok addiction and identify high-risk users, both in the community and educational fields. Considering the limitations of our study, we recommend the translation and validation of the

TTAS in other languages and populations to further examine the reliability and the validity of the scale. The TTAS could be an effective means to measure the TikTok addiction, and may help policy makers, health educators, clinicians and scholars to recognize high-risk groups for TikTok addiction.

## Declarations

## References

1. Statista Social Media & User-Generated Content. Available online: https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/

2. Datareportal Global Social Media Statistics. Available online: https://datareportal.com/social-media-users

3. Montag C, Yang H, Elhai JD (2021) On the Psychology of TikTok Use: A First Glimpse From Empirical Findings. Front Public Health 9:641673. 10.3389/fpubh.2021.641673

4. Lodice R, Papapicco C (2021) To Be a TikToker in COVID-19 Era: An Experience of Social Influence. ONLINE J COMMUN MEDI 11:e202103. 10.30935/ojcmt/9615

5. Meng S-Q, Cheng J-L, Li Y-Y, Yang X-Q, Zheng J-W, Chang X-W, Shi Y, Chen Y, Lu L, Sun Y et al (2022) Global Prevalence of Digital Addiction in General Population: A Systematic Review and Meta-Analysis. Clin Psychol Rev 92:102128. 10.1016/j.cpr.2022.102128

6. Cheng C, Lau Y, Chan L, Luk JW (2021) Prevalence of Social Media Addiction across 32 Nations: Meta-Analysis with Subgroup Analysis of Classification Schemes and Cultural Values. Addict Behav 117:106845. 10.1016/j.addbeh.2021.106845

7. Casale S, Akbari M, Seydavi M, Bocci Benucci S, Fioravanti G (2023) Has the Prevalence of Problematic Social Media Use Increased over the Past Seven Years and since the Start of the COVID-19 Pandemic? A Meta-Analysis of the Studies Published since the Development of the Bergen Social Media Addiction Scale. Addict Behav 147. 10.1016/j.addbeh.2023.107838

8. Arrivillaga C, Rey L, Extremera NA (2022) Mediated Path from Emotional Intelligence to Problematic Social Media Use in Adolescents: The Serial Mediation of Perceived Stress and Depressive Symptoms. Addict Behav 124:107095. 10.1016/j.addbeh.2021.107095

9. Bányai F, Zsila Á, Király O, Maraz A, Elekes Z, Griffiths MD, Andreassen CS, Demetrovics Z (2017) Problematic Social Media Use: Results from a Large-Scale Nationally Representative Adolescent Sample. PLoS ONE 12:e0169839. 10.1371/journal.pone.0169839

10. Sindermann C, Elhai JD, Montag C (2020) Predicting Tendencies towards the Disordered Use of Facebook's Social Media Platforms: On the Role of Personality, Impulsivity, and Social Anxiety. Psychiatry Res 285:112793. 10.1016/j.psychres.2020.112793

11. Keles B, McCrae N, Grealish AA, Systematic Review (2020) The Influence of Social Media on Depression, Anxiety and Psychological Distress in Adolescents. Int J Adolescence Youth 25:79–93. 10.1080/02673843.2019.1590851

12. Kuss D, Griffiths M, Karila L, Billieux J (2014) Internet Addiction: A Systematic Review of Epidemiological Research for the Last Decade. *CPD 20*, 4026–4052, 10.2174/13816128113199990617

13. Xanidis N, Brignell CM (2016) The Association between the Use of Social Network Sites, Sleep Quality and Cognitive Function during the Day. Comput Hum Behav 55:121–126. 10.1016/j.chb.2015.09.004

14. Huang C (2022) A Meta-Analysis of the Problematic Social Media Use and Mental Health. Int J Soc Psychiatry 68:12–33. 10.1177/0020764020978434

15. Shannon H, Bush K, Villeneuve PJ, Hellemans KG, Guimond S (2022) Problematic Social Media Use in Adolescents and Young Adults: Systematic Review and Meta-Analysis. JMIR Ment Health 9:e33450. 10.2196/33450

16. Masaeli N, Farhadi H (2021) Prevalence of Internet-Based Addictive Behaviors during COVID-19 Pandemic: A Systematic Review. J Addict Dis 39:468–488. 10.1080/10550887.2021.1895962

17. Smith T, Short A (2022) Needs Affordance as a Key Factor in Likelihood of Problematic Social Media Use: Validation, Latent Profile Analysis and Comparison of TikTok and Facebook Problematic Use Measures. Addict Behav 129:107259. 10.1016/j.addbeh.2022.107259

18. Casale S, Rugai L, Fioravanti G (2018) Exploring the Role of Positive Metacognitions in Explaining the Association between the Fear of Missing out and Social Media Addiction. Addict Behav 85:83–87. 10.1016/j.addbeh.2018.05.020

19. Tarafdar M, Maier C, Laumer S, Weitzel T (2020) Explaining the Link between Technostress and Technology Addiction for Social Networking Sites: A Study of Distraction as a Coping Behavior. Inform Syst J 30:96–124. 10.1111/isj.12253

20. Iram; Aggarwal H (2020) Time Series Analysis of Pubg and Tiktok Applications Using Sentiments Obtained from Social Media-Twitter. Adv Math Sci J 9:4047–4057. 10.37418/amsj.9.6.86

21. Zhang X, Wu Y, Liu S (2019) Exploring Short-Form Video Application Addiction: Socio-Technical and Attachment Perspectives. Telematics Inform 42:101243. 10.1016/j.tele.2019.101243

22. Varona MN, Muela A, Machimbarrena JM (2022) Problematic Use or Addiction? A Scoping Review on Conceptual and Operational Definitions of Negative Social Networking Sites Use in Adolescents. Addict Behav 134:107400. 10.1016/j.addbeh.2022.107400

23. Andreassen CS, Torsheim T, Brunborg GS, Pallesen S (2012) Development of a Facebook Addiction Scale. Psychol Rep 110:501–517. 10.2466/02.09.18.PR0.110.2.501-517

24. Andreassen CS, Billieux J, Griffiths MD, Kuss DJ, Demetrovics Z, Mazzoni E, Pallesen S (2016) The Relationship between Addictive Use of Social Media and Video Games and Symptoms of Psychiatric Disorders: A Large-Scale Cross-Sectional Study. Psychol Addict Behav 30:252–262. 10.1037/adb0000160

25. Van Den Eijnden RJJM, Lemmens JS, Valkenburg PM (2016) The Social Media Disorder Scale. Comput Hum Behav 61:478–487. 10.1016/j.chb.2016.03.038

26. Elphinston RA, Noller P (2011) Time to Face It! Facebook Intrusion and the Implications for Romantic Jealousy and Relationship Satisfaction. Cyberpsychology Behav Social Netw 14:631–635. 10.1089/cyber.2010.0318

27. Caplan SE (2010) Theory and Measurement of Generalized Problematic Internet Use: A Two-Step Approach. Comput Hum Behav 26:1089–1097. 10.1016/j.chb.2010.03.012

28. Young KS (1998) Internet Addiction: The Emergence of a New Clinical Disorder. CyberPsychology Behav 1:237–244. 10.1089/cpb.1998.1.237

29. Zhu J (Jason);, Ma Y, Xia G, Salle SM, Huang H, Sannusi SN Self-Perception Evolution among University Student TikTok Users (eds) (2024) : Evidence from China. *Front. Psychol. 14*, 1217014, 10.3389/fpsyg.2023.1217014

30. Alhabash S, Smischney TM, Suneja A, Nimmagadda A, White LR, So Similar (2024) Yet So Different: How Motivations to Use Facebook, Instagram, Twitter, and TikTok Predict Problematic Use and Use Continuance

Intentions. Sage Open 14. 10.1177/21582440241255426

31. Hendrikse C, Limniou M (2024) The Use of Instagram and TikTok in Relation to Problematic Use and Well-Being. J technol behav sci. 10.1007/s41347-024-00399-6

32. Yang Y, Adnan H, Sarmiti N (2023) The Relationship Between Anxiety and TikTok Addiction Among University Students in China: Mediated by Escapism and Use Intensity. Int J Media Inform Lit 8. 10.13187/ijmil.2023.2.458

33. Rogowska AM, Cincio A (2024) Procrastination Mediates the Relationship between Problematic TikTok Use and Depression among Young Adults. JCM 13:1247. 10.3390/jcm13051247

34. Pontes HM, Schivinski B, Sindermann C, Li M, Becker B, Zhou M, Montag C (2021) Measurement and Conceptualization of Gaming Disorder According to the World Health Organization Framework: The Development of the Gaming Disorder Test. Int J Ment Health Addict 19:508–528. 10.1007/s11469-019-00088-z

35. Montag C, Markett S (2024) Depressive Inclinations Mediate the Association between Personality (Neuroticism/Conscientiousness) and TikTok Use Disorder Tendencies. BMC Psychol 12:81. 10.1186/s40359-024-01541-y

36. McCoach D, Gable R, Madura J (2013) Review of the Steps for Designing an Instrument. In *Instrument development in the affective domain*; New York, Springer: New York, ; pp. 277–284

37. Bekalu MA, Sato T, Viswanath K (2023) Conceptualizing and Measuring Social Media Use in Health and Well-Being Studies: Systematic Review. J Med Internet Res 25:e43191. 10.2196/43191

38. Darvesh N, Radhakrishnan A, Lachance CC, Nincic V, Sharpe JP, Ghassemi M, Straus SE, Tricco AC (2020) Exploring the Prevalence of Gaming Disorder and Internet Gaming Disorder: A Rapid Scoping Review. Syst Rev 9:68. 10.1186/s13643-020-01329-2

39. Pan Y-C, Chiu Y-C, Lin Y-H (2020) Systematic Review and Meta-Analysis of Epidemiology of Internet Addiction. Neurosci Biobehav Rev 118:612–622. 10.1016/j.neubiorev.2020.08.013

40. Brown R (1993) Some Contributions of the Study of Gambling to the Study of Other Addictions. Gambling Behaviour and Problem Gambling. University of Nevada, Reno, pp 241–272

41. Griffiths M, Nicotine (1996) Tobacco and Addiction. Nature 384:18. 10.1038/384018a0

42. Griffiths MA (2005) Components Model of Addiction within a Biopsychosocial Framework. J Subst Use 10:191–197. 10.1080/14659890500114359

43. WHO International Classification of Diseases 11th Revision. Available online: https://icd.who.int/en

44. Ayre C, Scally AJ (2014) Critical Values for Lawshe's Content Validity Ratio: Revisiting the Original Methods of Calculation. Meas Evaluation Couns Dev 47:79–86. 10.1177/0748175613513808

45. Meadows K (2021) Cognitive Interviewing Methodologies. Clin Nurs Res 30:375–379. 10.1177/10547738211014099

46. Yusoff MSB (2019) ABC of Response Process Validation and Face Validity Index Calculation. *EIMJ 11*, 55–61, 10.21315/eimj2019.11.3.6

47. Costello AB, Osborne J (2005) Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis. *10*, 1–9, 10.7275/JYJ1-4868

48. DeVon HA, Block ME, Moyle-Wright P, Ernst DM, Hayden SJ, Lazzara DJ, Savoy SM, Kostas-Polston E (2007) A Psychometric Toolbox for Testing Validity and Reliability. J Nurs Scholarsh 39:155–164. 10.1111/j.1547-5069.2007.00161.x

49. De Vaus D (2004) Surveys in Social Research, 5th edn. Routledge, London

50. Yusoff MSB, Arifin WN, Hadie SNH (2021) ABC of Questionnaire Development and Validation for Survey Research. *EIMJ 13*, 97–108, 10.21315/eimj2021.13.1.10

51. Hair J, Black W, Babin B, Anderson R (2017) Multivariate Data Analysis, 7th edn. Prentice Hall, New Jersey

52. De Winter JCF, Dodou D, Wieringa PA (2009) Exploratory Factor Analysis With Small Sample Sizes. Multivar Behav Res 44:147–181. 10.1080/00273170902794206

53. Klein R (2016) Principles and Practice of Structural Equation Modelling, 4th edn. Guilford Press, New York

54. Bland JM, Altman DG (1997) Statistics Notes: Cronbach's Alpha. BMJ 314:572–572. 10.1136/bmj.314.7080.572

55. Brown T (2015) Confirmatory Factor Analysis for Applied Research, 2nd edn. The Guilford Press, New York

56. Hu L, Bentler PM (1998) Fit Indices in Covariance Structure Modeling: Sensitivity to Underparameterized Model Misspecification. Psychol Methods 3:424–453. 10.1037/1082-989X.3.4.424

57. Baumgartner H, Homburg C (1996) Applications of Structural Equation Modeling in Marketing and Consumer Research: A Review. Int J Res Mark 13:139–161. 10.1016/0167-8116(95)00038-0

58. Kroenke K, Spitzer RL, Williams JBW, Lowe B (2009) An Ultra-Brief Screening Scale for Anxiety and Depression: The PHQ-4. Psychosomatics 50:613–621. 10.1176/appi.psy.50.6.613

59. Rammstedt B, John OP (2007) Measuring Personality in One Minute or Less: A 10-Item Short Version of the Big Five Inventory in English and German. J Res Pers 41:203–212. 10.1016/j.jrp.2006.02.001

60. Dadiotis A, Bacopoulou F, Kokka I, Vlachakis D, Chrousos GP, Darviri C, Roussos P (2021) Validation of the Greek Version of the Bergen Social Media Addiction Scale in Undergraduate Students. EMBnet j 26:e975. 10.14806/ej.26.1.975

61. Cunningham S, Hudson CC, Harkness K (2021) Social Media and Depression Symptoms: A Meta-Analysis. Res Child Adolesc Psychopathol 49:241–253. 10.1007/s10802-020-00715-7

62. Hussain Z, Wegmann E, Yang H, Montag C (2020) Social Networks Use Disorder and Associations With Depression and Anxiety Symptoms: A Systematic Review of Recent Research in China. Front Psychol 11:211. 10.3389/fpsyg.2020.00211

63. Karekla M, Pilipenko N, Feldman J (2012) Patient Health Questionnaire: Greek Language Validation and Subscale Factor Structure. Compr Psychiatr 53:1217–1226. 10.1016/j.comppsych.2012.05.008

64. Correa T, Hinsley AW, De Zúñiga HG (2010) Who Interacts on the Web? The Intersection of Users' Personality and Social Media Use. Comput Hum Behav 26:247–253. 10.1016/j.chb.2009.09.003

65. Kuss DJ, Griffiths MD (2011) Online Social Networking and Addiction—A Review of the Psychological Literature. *IJERPH 8*, 3528–3552, 10.3390/ijerph8093528

66. Wilson K, Fornasier S, White KM (2010) Psychological Predictors of Young Adults' Use of Social Networking Sites. Cyberpsychol Behav Soc Netw 13:173–177. 10.1089/cyber.2009.0094

67. Soto CJ, John OP (2017) The next Big Five Inventory (BFI-2): Developing and Assessing a Hierarchical Model with 15 Facets to Enhance Bandwidth, Fidelity, and Predictive Power. J Pers Soc Psychol 113:117–143. 10.1037/pspp0000096

68. World Medical Association World Medical Association Declaration of Helsinki (2013) Ethical Principles for Medical Research Involving Human Subjects. JAMA 310. 10.1001/jama.2013.281053
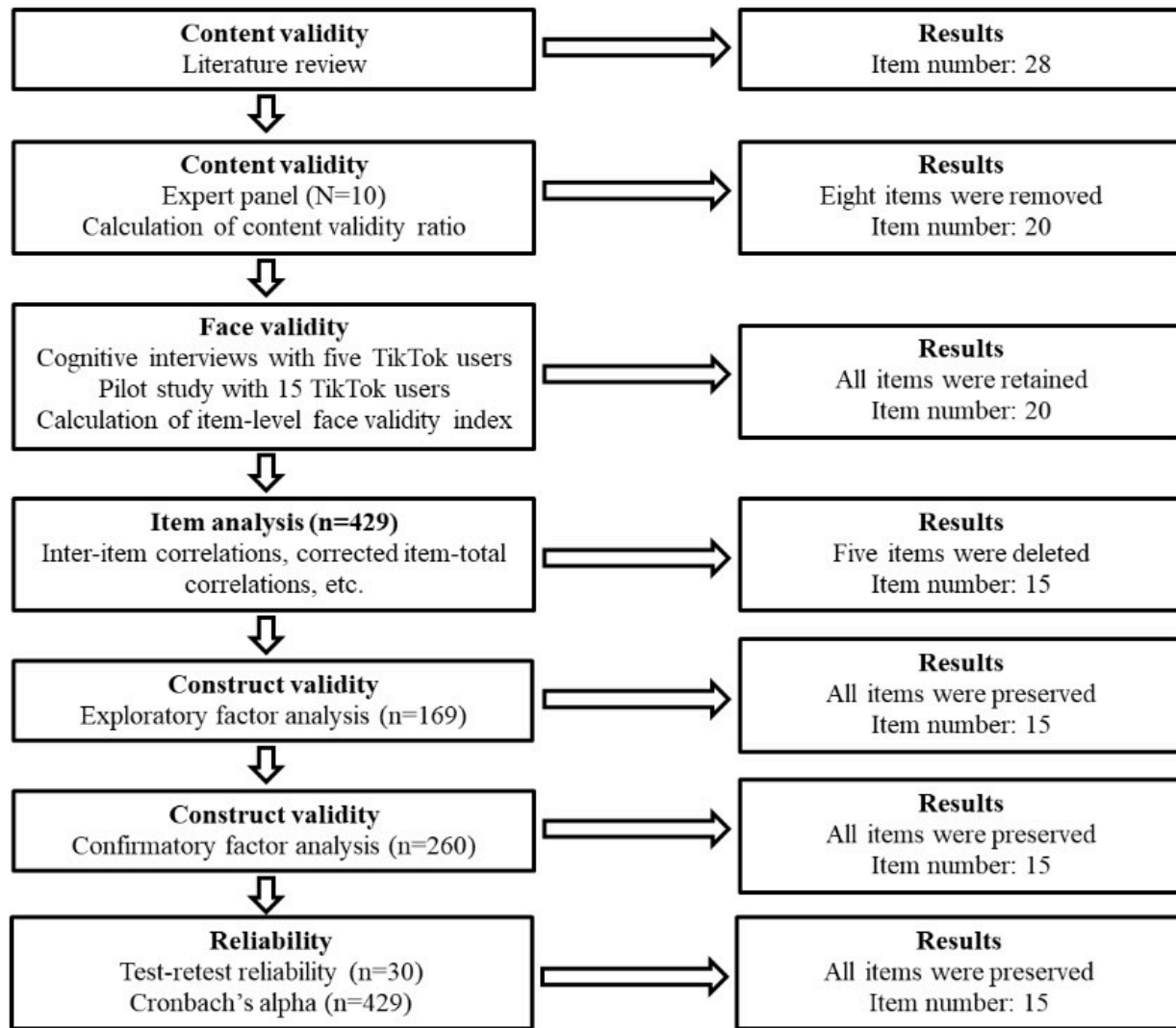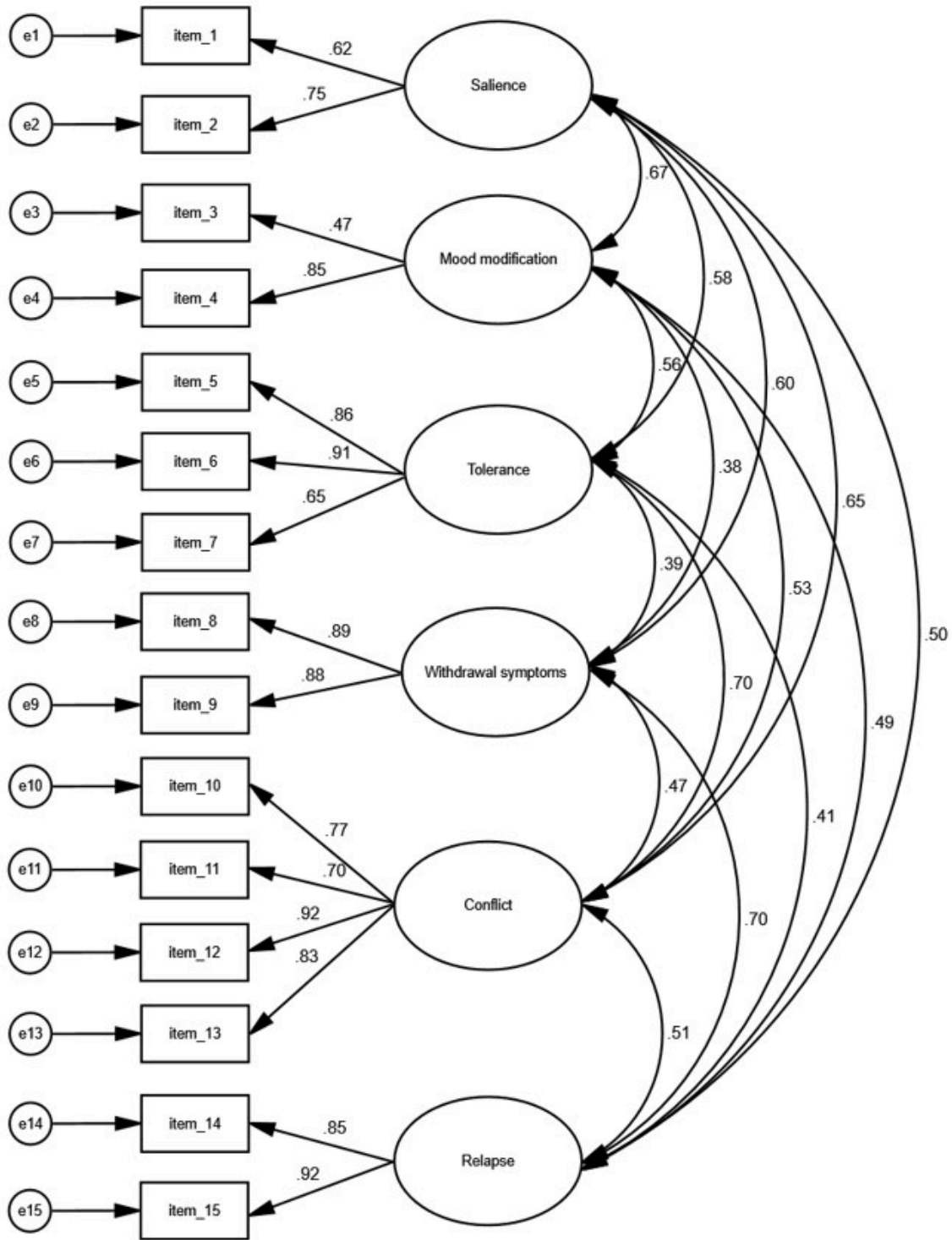
# Figures

**Figure 1**

Development of the TikTok Addiction Scale.

**Figure 2**

Confirmatory factor analysis of the TikTok Addiction Scale.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryTables.docx