Digital literacy, phubbing, and mental well-being in the digital age: a study on young university athletes

Tolga Tek [1]* and Arif Özsari [2]

[1]Faculty of Sport Sciences, Selcuk University, Konya, Türkiye, [2]Faculty of Sport Sciences, Mersin University, Mersin, Türkiye

Digital literacy has now emerged as a pivotal determinant of individuals' social, psychological, and mental responses in contemporary society. This study examined the relationships between digital literacy, phubbing behaviors, and mental well-being among young university athletes. The sample consisted of 224 students (mean age = 20.91; SD = 1.98) from the sports sciences faculty of a state university, including 109 females (48.7%) and 115 males (51.3%), who participated voluntarily. Three validated measurement instruments were employed, with confirmatory factor analysis conducted to establish scale reliability and validity. Statistical analyses included descriptive statistics, correlation analysis, and regression analysis to explore variable relationships within the research model. Correlation analysis detected a significant positive moderate relationship between digital literacy and mental well-being (r = .363), alongside a significant negative weak correlation between digital literacy and self-isolation, a phubbing sub-dimension (r = -.133). Regression analyses demonstrated that digital literacy significantly predicts both mental well-being (β = .363) and phubbing-related self-isolation (β = -.133). The findings imply that enhanced digital literacy may mitigate phubbing behaviors while simultaneously promoting mental well-being among young athletes. The implications for digital citizenship education and athlete development programs should be discussed.

1 Introduction

The pervasive integration of digital technologies-including computers, smartphones, and mobile devices-has fundamentally transformed contemporary social interaction patterns. These technologies now serve as primary conduits for communication, work, learning, and entertainment across diverse populations (1). The rapid acceleration of technological advancement, coupled with its profound influence on daily social life, has generated significant social (2, 3) and psychological implications (4–6) for individuals, thus

the construct of digital literacy has gained prominence as a critical competency for navigating the modern digital landscape.

Digital literacy encompasses the multifaceted ability to effectively utilize digital technologies in our increasingly connected world (7). More specifically, it refers to individuals' capacity to optimally employ digital devices for accessing, identifying, managing, creating, and communicating information (8). This competency extends beyond mere technical proficiency to include critical understanding of appropriate and conscious technology use (9), encompassing knowledge of when, why, and for what duration technological devices should be employed (10). Contemporary conceptualizations of digital literacy emphasize its role in evaluating and organizing digital activities that are embedded within daily life experiences (11), particularly as mobile technologies enable increasingly complex digital interactions (12). A defining characteristic of digital literacy is its inherent adaptability (13), which has resulted in the progressive expansion of its conceptual boundaries and practical applications.

The technological evolution and extensive digitalization of society have established digital competency as essential for full participation in modern civic and economic life (14). Recognition that digital literacy skills are fundamental for successful adaptation to digital societies has positioned these competencies as crucial 21st-century skills for individual development and societal contribution (15). Consequently, digital literacy has become a cornerstone of educational policy in numerous countries, recognized as both a fundamental attribute of engaged citizenship and a prerequisite for workforce competitiveness (16). This recognition has prompted many national governments to prioritize digital literacy acquisition in their policy frameworks, driven by both civic engagement and economic development imperatives (17).

Over recent years, on the other hand, the inappropriate utilization of digital technologies has given rise to problematic behaviors, most importantly "phubbing"- a portmanteau of "phone" and "snubbing" (18). Phubbing is characterized by individuals' tendency to ignore their immediate social environment and avoid meaningful interpersonal communication by focusing attention on their smartphones during social interactions (19–21). Research alludes to the fact that Fear of Missing Out (FoMO) may serve as a psychological trigger for phubbing behaviors, compelling individuals to prioritize smartphone engagement over face-to-face social interaction (22). On the other hand, it has been highlighted that the inappropriate use of digital technologies and applications can lead to various psychosocial problems (23–27). Research findings point to their particularly concerning implications for mental health outcomes (28–32).

Mental well-being, as defined by the World Health Organization (33) represents a state of mental wellness that enables individuals to cope effectively with life stressors, realize their potential, engage in productive learning and work, and contribute meaningfully to their communities. This construct encompasses the capacity to utilize one's skills for societal benefit, establish positive relationships, and maintain inner equilibrium alongside personal responsibility (34). Mental well-being fundamentally concerns an individual's psychological state, including their emotional experiences, beliefs, motivations, and behavioral patterns (35). It reflects both the quality and nature of mental experiences individuals acquire throughout their lives (36). Research indicates that individuals with elevated mental well-being demonstrate superior positive psychological skills in self-relationships and interpersonal interactions, exhibiting greater effectiveness in stress management (37).

The sporting domain has not remained immune to digital and technological advancement, with these developments permeating all aspects of athletic life. Young university athletes naturally engage with technological tools and digital media to follow developments across social, sporting, and scientific domains. The literature mentions that digital literacy awareness enables more effective utilization of cognitive processes including productivity enhancement, sound decision-making, problem-solving, and solution-oriented thinking (38, 39). On top of that, digital literacy has been associated with numerous individual and social benefits (40–44).

Despite growing interest in digital literacy research, previous studies have predominantly employed summative assessment approaches, with limited attention to formative evaluation of students' digital skill mastery (45). Emerging research indicates that phubbing behaviors may negatively impact individual development and impede the formation and maintenance of close relationships (46, 47). However, our understanding of mental well-being in the digital context remains limited (48). Given this research gap, we hypothesize that digital literacy awareness among young athlete-students may facilitate healthy social relationship formation and support optimal mental well-being levels, promoting healthier developmental processes in both athletic and social domains. This study, therefore, aimed to examine the relationships between digital literacy levels and both phubbing behaviors and mental well-being among university student-athletes. Given the scarcity of research simultaneously addressing digital literacy, phubbing, and mental well-being variables, the findings are expected to contribute meaningfully to the existing literature and inform future research directions. Based on the framework and empirical evidence reviewed above, the following hypotheses were formulated:

Hypothesis 1: Digital literacy significantly predicts mental well-being.

Hypothesis 2: Digital literacy significantly predicts nomophobia (a sub-dimension of phubbing).

Hypothesis 3: Digital literacy significantly predicts interpersonal conflict (a sub-dimension of phubbing).

Hypothesis 4: Digital literacy significantly predicts self-isolation (a sub-dimension of phubbing).

Hypothesis 5: Digital literacy significantly predicts problem awareness (a sub-dimension of phubbing).

2 Materials and methods

2.1 Data collection instruments

2.1.1 Three validated measurement instruments were utilized to assess the study variables, each described below

2.1.1.1 Digital literacy scale

Digital literacy was assessed through the scale originally developed by Ng (49) and subsequently adapted to Turkish by Ustundag et al. (50). This unidimensional instrument comprises 10 items rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Higher scores indicate greater digital literacy competence, and the Turkish language adaptation demonstrated satisfactory psychometric properties in previous research.

2.1.1.2 Generic scale of phubbing

Phubbing behaviors were measured via the scale developed by Chotpitayasunondh and Douglas (51) and adapted to Turkish by Orhan-Goksun (52). This multidimensional instrument consists of 15 items rated on a 7-point Likert scale (1 = never to 7 = always) across four distinct sub-dimensions: nomophobia (fear of being without mobile phone contact), interpersonal conflict (conflicts arising from phone use), self-isolation (withdrawal from social interactions due to phone use), and problem awareness (recognition of problematic phone use patterns). Higher scores on each sub-dimension indicate greater levels of the respective phubbing behavior.

2.1.1.3 Warwick-Edinburgh mental well-being scale short form

Mental well-being was assessed through the short form developed by Tennant et al. (53) and adapted to Turkish by Demirtas and Baytemir (34). This unidimensional scale comprises 7 items rated on a 5-point Likert scale (1 = none of the time to 5 = all of the time). The scale measures positive aspects of mental health, including positive feelings and functioning. Higher scores indicate superior mental well-being.

2.2 Research design

The study employed a correlational survey design, which belongs to the category of relational screening models aimed at determining the existence and degree of covariation between two or more variables (54). This non-experimental design was selected as appropriate for examining the relationships between digital literacy, phubbing behaviors, and mental well-being without manipulating the variables of interest.

2.3 Participants

The study sample consisted of 224 university students enrolled in sports sciences programs at a state university in Turkey.

Participants ranged in age from 18 to 26 years (M = 20.89, SD = 1.90), with 109 females (48.7%) and 115 males (51.3%) represented. All participants were recruited through convenience sampling and provided informed consent prior to participation. Inclusion criteria required participants to be currently enrolled undergraduate students in sports sciences programs and to possess regular smartphone usage patterns.

2.4 Data collection procedure

Data collection was conducted during the 2024 academic year following institutional review board approval. Participants completed the survey instruments during regularly scheduled class periods, with data collection supervised by trained research assistants. The survey battery required approximately 30 minutes to complete. Participants were informed of their right to withdraw from the study at any time without penalty, and confidentiality was assured through anonymous data collection procedures.

2.5 Statistical analysis

Data analysis proceeded through several stages to ensure data quality and appropriate statistical modeling. Initially, missing data patterns were examined, and cases with excessive missing values (>10%) were excluded from analysis. Normality of the data distribution was evaluated through examination of skewness and kurtosis statistics. The psychometric properties of the scales were evaluated in greater detail through reliability analyses (Cronbach's alpha coefficients) and confirmatory factor analysis (CFA) was conducted to validate the factor structure of each measurement instrument using maximum likelihood estimation. Statistical analyses included descriptive statistics (means, standard deviations, frequencies), Pearson product-moment correlations, and regression analyses. Mean scores were calculated for each scale and used in subsequent analyses. Regression analyses were conducted to test the study hypotheses, with digital literacy as the predictor variable and mental well-being and phubbing sub-dimensions as criterion variables. Statistical significance was set at $p < .05$.

3 Results

3.1 Measurement model validation

Confirmatory factor analysis (CFA) was conducted to evaluate the congruence between the hypothesized factor structure of each measurement instrument and the empirical data (55). The results demonstrated acceptable model fit across all three scales (Table 1).

For the Digital Literacy Scale, fit indices indicated adequate model fit: χ^2/df = 2.084, CFI = .946, GFI = .948, IFI = .947, AGFI = .904, TLI = .919, and RMSEA = .070. The Warwick-Edinburgh Mental Well-being Scale similarly demonstrated satisfactory fit: χ^2/df = 2.096, CFI = .966,

TABLE 1 Confirmatory factor analysis results for scales.

Scales	CMIN/DF	CFI	GFI	IFI	AGFI	TLI	RMSEA
Digital Literacy (DLS)	2.084	.946	.948	.947	.904	.919	.070
Mental Well-being (WEMWBS-SF)	2.096	.966	.968	.967	.926	.940	.070
Phubbing (GSP)	2.029	.945	.915	.946	.873	.929	.068

GFI = .968, IFI = .967, AGFI = .926, TLI = .940, and RMSEA = .070. The Generic Scale of Phubbing exhibited acceptable fit indices: χ^2/df = 2.029, CFI = .945, GFI = .915, IFI = .946, AGFI = .873, TLI = .929, and RMSEA = .068. These values satisfy established criteria for acceptable model fit (56, 57), with CFI and TLI values approaching or exceeding.95, RMSEA values below.08, and χ^2/df ratios below 3.0 (58–61).

3.2 Data distribution and reliability assessment

Examination of data distribution characteristics showed that skewness and kurtosis values for all study variables fell within acceptable ranges (± 1.0), supporting the assumption of normal distribution necessary for parametric statistical analyses (62, 63). Internal consistency reliability, assessed through Cronbach's alpha coefficients, demonstrated satisfactory reliability across all measures (Table 2). Reliability coefficients ranged from α = .724 to α = .858, all exceeding the minimum threshold of.70 recommended for research purposes (64).

3.3 Descriptive statistics and correlational analysis

Pearson product-moment correlations were computed to examine the bivariate relationships among study variables (54). Correlation coefficients are typically interpreted as follows: 0 < r < 0.30 indicates a weak relationship, 0.30 < r < 0.70 a moderate relationship, and 0.70 < r < +1 a strong relationship (65).

As shown in Table 3, the correlational analysis unveiled several significant relationships. Digital literacy demonstrated a significant positive moderate correlation with mental well-being (r = .363, p <.01), indicating that individuals with higher digital literacy levels tend to report greater mental well-being. Additionally, a significant negative weak correlation emerged between digital literacy and self-isolation, a sub-dimension of phubbing (r = -.133, p <.05), meaning that higher digital literacy could be associated with reduced tendencies toward social isolation in digital contexts.

3.4 Regression analysis results

A series of simple linear regression analyses were conducted to test the study hypotheses, examining the predictive utility of digital literacy for mental well-being and each phubbing sub-dimension (Table 4).

3.4.1 Hypothesis 1: digital literacy predicting mental well-being

The regression model examining digital literacy as a predictor of mental well-being was statistically significant, ($F_{(df=1.222)}$ = 33.726, p <.001). Digital literacy accounted for 13.2% of the variance in mental well-being scores (R^2 =.132),. The standardized regression coefficient indicated that digital literacy was a significant positive predictor (β = .363, t = 5.807, p=.000), supporting Hypothesis 1. This finding denotes that each unit increase in digital literacy is associated with a corresponding increase in mental well-being.

TABLE 2 Skewness, Kurtosis, and Cronbach's Alpha (α) Values for Scale Domains.

Variables	Skewness	Kurtosis	Cronbach's alpha (α)
Digital Literacy	-.108	-.396	.819
Mental Well-being	-.460	-.168	.786
Nomophobia	-.128	-.879	.774
Interpersonal Conflict	.822	-.302	.828
Self-isolation	.455	-.602	.858
Problem Awareness	.243	-.803	.724

TABLE 3 Correlation analysis results of the research variables.

N = 224	1	2	3	4	5	6
Digital Literacy	–					
Mental Well-being	.363**	–				
Nomophobia	.117	.119	–			
Interpersonal Conflict	-.066	.012	.390**	–		
Self-isolation	-.133*	.015	.261**	.624**	–	
Problem Awareness	-.123	-.051	.386**	.632**	.534**	–

**p<.01; *p<.05. 1: Digital Literacy, 2: Mental Well-being, 3: Nomophobia, 4: Interpersonal Conflict, 5: Self-isolation, 6: Problem Awareness.

TABLE 4 Regression analysis results of the research variables.

Part 1								
Model	**B**	**Std. Error**	**Beta (β)**	**t**	**p**	**VIF**	p=.000*** F(1-222)= 33.726 D-W=1.842	R=.363 R²=.132 Adj. R²= .128
(Constant)	2.428	.251	–	9.681	.000	–		
Digital Literacy	.396	.068	.363	5.807	.000***	1.000		
Dependent Variable: Mental Well-being								
Part 2								
(Constant)	3.780	.540	–	7.000	.000	–	p=.080 F(1-222)=3.083 D-W=1.685	R=.117 R²=.014 Adj. R²= .009
Digital Literacy	.258	.147	.117	1.756	.080	1.000		
Dependent Variable: Nomophobia								
Part 3								
(Constant)	3.095	.543	–	5.702	.000	–	p=.328 F(1-222)=.959 D-W=1.748	R=.066 R²=.004 Adj. R²= .000
Digital Literacy	-.145	.148	-.066	-.979	.328	1.000		
Dependent Variable: Interpersonal Conflict								
Part 4								
(Constant)	4.133	.575	-	7.188	.000	–	p=.047* F(1-222)=4.002 D-W=2.043	R=.133 R²=.018 Adj. R²= .013
Digital Literacy	-.313	.156	-.133	-2.001	.047*	1.000		
Dependent Variable: Self-isolation								
Part 5								
(Constant)	4.650	.588	–	7.902	.000	–	p=.066 F(1-222)= 3.414 D-W=1.828	R=.123 R²=.015 Adj. R²= .011
Digital Literacy	-.296	.160	-.123	-1.848	.066	1.000		
Dependent Variable: Problem Awareness								

***p<.001; *p<.05; Beta (β), Standardized coefficients; D-W, Durbin Watson; VIF, Variance Inflation Factor.

3.4.2 Hypothesis 2: digital literacy predicting nomophobia

The regression analysis for nomophobia as the criterion variable did not achieve statistical significance ($F_{(df=1.222)}$ = 3.083; p >.05). Digital literacy did not significantly predict nomophobia levels among participants, failing to support Hypothesis 2.

3.4.3 Hypothesis 3: digital literacy predicting interpersonal conflict

The regression model with interpersonal conflict as the dependent variable was not statistically significant ($F_{(df=1.222)}$ = .959; p >.05). Digital literacy did not emerge as a significant predictor of interpersonal conflict related to phubbing behaviors, so Hypothesis 3 was not supported.

3.4.4 Hypothesis 4: digital literacy predicting self-isolation

The regression analysis revealed a statistically significant model ($F_{(df=1.222)}$ =4.002; p = .047). Digital literacy explained approximately 2% of the variance in self-isolation scores (R^2 = .018). The standardized regression coefficient indicated that digital literacy was a significant negative predictor of self-isolation (β = -.133, t = -2.001, p = .047), supporting Hypothesis 4. This result

suggests that higher levels of digital literacy are associated with reduced self-isolation behaviors.

3.4.5 Hypothesis 5: digital literacy predicting problem awareness

The regression model examining problem awareness as the outcome variable approached but did not achieve statistical significance ($F_{(df=1.222)}$ = 3.414; p >.05). Digital literacy did not significantly predict problem awareness levels, failing to support Hypothesis 5.

Overall, the regression analyses provided support for only two of the five study hypotheses. Digital literacy emerged as a significant positive predictor of mental well-being and a significant negative predictor of self-isolation, whereas it failed to predict nomophobia, interpersonal conflict, or problem awareness dimensions of phubbing behavior.

4 Discussion

This investigation examined the interrelationships among digital literacy, phubbing behaviors, and mental well-being within a sample of young university athletes. The findings contribute to

our understanding of how digital competencies may influence both positive psychological outcomes and problematic technology-related behaviors in this unique population.

The primary finding confirmed a significant positive association between digital literacy and mental well-being, with digital literacy accounting for 13.2% of the variance in mental well-being scores. This relationship provides empirical support for Hypothesis 1 and aligns with emerging frameworks that position digital literacy as a protective factor in the digital age. Although direct comparative research within athlete populations remains rather limited, our findings are consistent with Meng et al. (66), who demonstrated comparable positive effects of digital literacy on mental well-being among preschool children, which could mean this relationship may be robust across developmental stages. The observed association between digital literacy and mental well-being can be understood through several mechanisms. Enhanced digital literacy may facilitate more purposeful and mindful technology engagement, reducing the cognitive load associated with navigating digital environments (67). Additionally, digitally literate individuals may possess superior skills for accessing mental health resources, maintaining social connections through digital platforms, and avoiding potentially harmful online content (68). This finding extends previous research demonstrating positive associations between digital literacy and related psychological constructs, including creativity and innovation (69), individual creative traits (70), psychological capital (71), communication competence (72), and self-efficacy beliefs (73). Besides, community-based digital literacy interventions have demonstrated efficacy in enhancing cognitive functioning (74), thus indicating that the benefits of digital competency extend beyond mere technical proficiency to encompass broader mental health outcomes. For university athletes, who must navigate both academic and athletic demands in the process of maintaining social relationships, enhanced digital literacy may provide crucial skills for managing multiple digital identities and communication channels effectively.

A second key finding was the significant negative association between digital literacy and self-isolation (a phubbing sub-dimension), with digital literacy negatively predicting this behavior, thus providing support for Hypothesis 4, which implies that digital literacy may serve as a protective factor against certain aspects of problematic smartphone use. This finding aligns with models proposing that digital literacy encompasses not merely technical skills but also critical awareness of technology's social and psychological impacts (75). Digitally literate individuals may possess enhanced metacognitive awareness of their technology use patterns, enabling them to recognize when digital engagement becomes socially isolating and to employ self-regulatory strategies accordingly (76, 77). Because Today, digital literacy is an essential component of everyone's personal and professional lives to survive and thrive in the digital world (78).

Looking at similar research in the literature, previous studies established links between various psychological factors and phubbing behaviors, including boredom and Fear of Missing Out (FoMO) (79), loneliness and smartphone addiction (80), and excessive internet or gaming engagement (22, 81–85). The observed negative relationship between digital literacy and self-isolation might arise from the broader benefits of digital literacy, such as improved critical thinking about technology use or enhanced online self-regulation, which have been reported in various contexts (67, 68, 75–77, 86–90). However, digital literacy did not significantly predict other phubbing dimensions like nomophobia, interpersonal conflict, or problem awareness in our sample, indicating a more nuanced role of digital literacy in mitigating specific facets of phubbing.

4.1 Implications for university athletes

The unique context of university athletes presents particular considerations for digital literacy and mental well-being relationships. Athletes face distinctive pressures related to performance, social media presence, and maintaining relationships across multiple social contexts (teammates, coaches, family, peers). Enhanced digital literacy may be especially valuable for this population in managing online reputation, accessing performance-related information, and maintaining social connections during travel and competition periods.

The finding that digital literacy predicts reduced self-isolation has particular relevance for athletes, who depend heavily on team cohesion and social support for optimal performance. Athletes who engage in self-isolating phubbing behaviors may compromise team dynamics and miss opportunities for crucial social learning and peer support.

4.2 Limitations and future directions

Several limitations warrant acknowledgment. The cross-sectional design precludes causal inferences about the relationships between digital literacy and outcome variables. Longitudinal research would provide stronger evidence for the protective effects of digital literacy over time. Additionally, the relatively modest effect sizes observed (particularly for the self-isolation relationship) evince that digital literacy represents one factor among many influencing these outcomes. The sample's focus on university athletes limits generalizability to broader populations, though it provides valuable insights into this specific demographic. Future research should examine these relationships across diverse samples and consider potential moderating variables such as sport type, competitive level, and cultural context. The measurement of digital literacy through self-report instruments, though validated, may not capture the full complexity of digital competencies. Future studies might benefit from incorporating behavioral measures or performance-based assessments of digital skills. Finally, as the study was conducted with Turkish university students, cultural factors influencing digital technology attitudes and mental well-being perceptions may limit the direct applicability of findings to other cultural settings.

5 Conclusion

This study provides evidence that digital literacy serves as a significant predictor of both enhanced mental well-being and reduced self-isolation behaviors among young university athletes. The findings have important implications for educational practice and mental health promotion in higher education settings. Institutional investments in digital literacy education may yield dual benefits: improving students' technological competencies whilst concurrently promoting psychological well-being and healthy social engagement. For universities, particularly athletic programs, integrating digital literacy initiatives that emphasize critical reflection on technology use, mindful engagement, and digital ethics-beyond mere technical skills—may foster healthier social behaviors and contribute to overall student development. As digital technologies become increasingly embedded in daily life, fostering these competencies is crucial for young adults' psychosocial adjustment.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

This study was conducted in accordance with the ethical standards established by the Declaration of Helsinki and received formal approval from the Mersin University Faculty of Sports Sciences Scientific Research and Publication Ethics Committee (Decision No: 014; Date: 01/04/2024). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

TT: Writing – original draft, Writing – review & editing. AÖ: Writing – original draft, Writing – review & editing.

Funding

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Rodriguez-de-Dios I, Van Oosten JM, Igartua JJ. A study of the relationship between parental mediation and adolescents' digital skills, online risks and online opportunities. *Comput Hum Behavior*. (2018) 82:186–98. doi: 10.1016/j.chb.2018.01.012

2. Mok KH, Leung D. Digitalisation, educational and social development in Greater China. *Globalisation Societies Education*. (2012) 10:271–94. doi: 10.1080/14767724.2012.710118

3. Park Y, Chang SJ. The impact of ageism experiences on social participation among community-dwelling older adults: Exploring the moderating role of digital literacy. *Geriatric Nursing*. (2024) 59:372–8. doi: 10.1016/j.gerinurse.2024.07.029

4. Chen Y, Wei M, Ortiz J. How do digital lives aect resident mental health in the digital era? Empirical evidence based on Chinese general social survey. *Front Public Health*. (2022) 10:108525. doi: 10.3389/fpubh.2022.108525

5. Palumbo R, Cavallone M. Is work digitalization without risk? Unveiling the psycho-social hazards of digitalization in the education and healthcare workplace. *Technol Anal Strategic Management*. (2022) . 36:1136–49. doi: 10.1080/09537325.2022.2075338

6. Qiu Y, Zhao X, Liu J, Li Z, Wu M, Qiu L, et al. Understanding the relationship between smartphone distraction, social withdrawal, digital stress, and depression among college students: A cross-sectional study in Wuhan, China. *Heliyon*. (2024) 10(15):1–10. doi: 10.1016/j.heliyon.2024.e35465

7. Krumsvik RJ. Situated learning and teachers' digital competence. *Educ İnformation Technologies*. (2008) 13:279–90. doi: 10.1007/s10639-008-9069-5

8. Martin AA. European framework for digital literacy. *Nordic J Digital Literacy*. (2006) 2:151–61. doi: 10.18261/ISSN1891-943X-2006-02-06

9. Prete AL. Digital and financial literacy as determinants of digital payments and personal finance. *Economics Letters*. (2022) 213:110378. doi: 10.1016/j.econlet.2022.110378

10. Ozsari A, Deli SC. The relationship between digital literacy and digital addiction: a research of hockey athletes. *Online J Recreation Sports*. (2023) 12:491–501. doi: 10.22282/tojras.1283899

11. Nguyen TT, Tran TNH, My Do TH, Dinh TKL, Nguyen TUN, Dang TMK. Digital literacy, online security behaviors and E-payment intention. *J Open Innovation: Technol Market Complexity*. (2024) 10:100292. doi: 10.1016/j.joitmc.2024.100292

12. Mohammadyari S, Singh H. Understanding the effect of e-learning on individual performance: The role of digital literacy. *Comput Education*. (2015) 82:11–25. doi: 10.1016/j.compedu.2014.10.025

13. Chase Z, Laufenberg D. Embracing the squishiness of digital literacy. *J Adolesc Adult Literacy*. (2011) 54:535–7. doi: 10.1598/JAAL.54.7.7

14. Santos MR, Gomes MMF. Lifelong digital learning: Computer literacy, digital literacy, and digital competence as dimensions for digital skills. *Rev Gestão Soc E Ambiental*. (2023) 18:e04403. doi: 10.24857/rgsa.v18n1-028

15. Ozeren E. Predicting secondary school students' 21st-century skills through their digital literacy and problem-solving skills. *Int Educ Stud*. (2023) 16:61–75. doi: 10.5539/ies.v16n2p61

16. Weninger C. Digital literacy as ideological practice. *ELT J.* (2023) 77:197–206. doi: 10.1093/elt/ccad001

17. Sefton-Green J, Nixon H, Erstad O. Reviewing approaches and perspectives on digital literacy. *Pedagogies: Int J.* (2009) 4:107–25. doi: 10.1080/15544800902741556

18. Roberts JA, David ME. My life has become a major distraction from my cell phone: Partner phubbing and relationship satisfaction among romantic partners. *Comput Hum Behav.* (2016) 54:134–41. doi: 10.1016/j.chb.2015.07.058

19. Karadag E, Tosuntas SB, Erzen E, Duru P, Bostan N, Mızrak Sahin BM, et al. The virtual world's current addiction: Phubbing. *Addicta: Turkish J Addiction.* (2016) 3:250–69. doi: 10.15805/addicta.2016.3.0013

20. Aykac S, Yıldırım S. Nomophobia and phubbing the effects of them in the developing world. *Bolu Abant Izzet Baysal Univ Faculty Educ J.* (2021) 21:243–56. doi: 10.17240/aibuefd.2021.21.60703-780598

21. Ansari S, Azeem A, Khan I, Iqbal N. Association of phubbing behavior and fear of missing out: a systematic review and meta-analysis. *Cyberpsychol Behav Soc Networking.* (2024) 27:467–81. doi: 10.1089/cyber.2023.0761

22. Chotpitayasunondh V, Douglas KM. How "phubbing" becomes the norm: The antecedents and consequences of snubbing via smartphone. *Comput Hum Behavior.* (2016) 63:9–18. doi: 10.1016/j.chb.2016.05.018

23. Beranuy M, Oberst U, Carbonell X, Chamarro A. Problematic internet and mobile phone use and clinical symptoms in college students: The role of emotional intelligence. *Comput Hum Behavior.* (2009) 25:1182–7. doi: 10.1016/j.chb.2009.03.001

24. Ghaemi SN. Digital depression: a new disease of the millennium? *Acta Psychiatrica Scandinavica.* (2020) 141:356–61. doi: 10.1111/acps.13151

25. Kılıcarslan S, Parmaksız I. The mediator role of effective communication skills on the relationship between phubbing tendencies and marriage satisfaction in married individuals. *Comput Hum Behavior.* (2023) . 147:107863. doi: 10.1016/j.chb.2023.107863

26. Doruk M, Mustafaoglu R, Gul H. The impact of using technological devices on mental and physical health in Adolescents. *Eur J Ther.* (2023) 29:194–200. doi: 10.58600/eurjther.20232902-592.y

27. Arenas-Escaso JF, Folgado-Fernández JA, Palos-Sánchez PR. Internet interventions and therapies for addressing the negative impact of digital overuse: a focus on digital free tourism and economic sustainability. *BMC Public Health.* (2024) 24:1–12. doi: 10.1186/s12889-023-17584-6

28. Scott DA, Valley B, Simecka BA. Mental health concerns in the digital age. *Int J Ment Health Addiction.* (2017) 15:604–13. doi: 10.1007/s11469-016-9684-0

29. George MJ, Russell MA, Piontak JR, Odgers CL. Concurrent and subsequent associations between daily digital technology use and high-risk adolescents' mental health symptoms. *Child Dev.* (2018) 89:78–88. doi: 10.1111/cdev.12819

30. Twenge JM, Martin GN. Gender differences in associations between digital media use and psychological well-being: evidence from three large datasets. *J Adolescence.* (2020) 79:91–102. doi: 10.1016/j.adolescence.2019.12.018

31. Alonzo R, Hussain J, Stranges S, Anderson KK. Interplay between social media use, sleep quality, and mental health in youth: A systematic review. *Sleep Med Rev.* (2021) 56:101414. doi: 10.1016/j.smrv.2020.101414

32. Wright M, Reitegger F, Cela H, Papst A, Gasteiger-Klicpera B. Interventions with digital tools for mental health promotion among 11–18 year olds: A systematic review and meta-analysis. *J Youth Adolescence.* (2023) 52:754–79. doi: 10.1007/s10964-023-01735-4

33. World Health Organisation. Mental well-being. (2024). Available online at: www.who.int/health-topics/mental-healthtab_1 (Accessed October 15, 2024).

34. Demirtas AS, Baytemir K. Adaptation of warwick-edinburgh mental well-being scale short form into Turkish: Validity and reliability study. *Electronic J Soc Sci.* (2019) 18:689–701. doi: 10.17755/esosder.432708

35. Keller S. What does mental health have to do with well-being? *Bioethics.* (2020) 34:228–34. doi: 10.1111/bioe.12702

36. Dolinsek S, Scholz C, Giani S, Van Weert JCM, Van Den Putte B, Meppelink CS. The role of mental well-being in the effects of persuasive health messages: A scoping review. *Soc Sci Med.* (2024) . 353:117060. doi: 10.1016/j.socscimed.2024.117060

37. Kayis AR, Satıcı SA. The mediating role of forgiveness in the relationship between coping humor and mental well-being. *Kastamonu Educ J.* (2019) 27:1495–504. doi: 10.24106/kefdergi.3099

38. Karakus G, Ocak G. An investigation of digital literacy self-efficacy skills of pre-service teachers ın terms of different variables. *Afyon Kocatepe Univ J Soc Sci.* (2019) 21:129–47. doi: 10.32709/akusosbil.466549

39. Camacho E, Torous J. Impact of digital literacy training on outcomes for people with serious mental illness in community and inpatient settings. *Psychiatr Services.* (2023) 74:534–8. doi: 10.1176/appi.ps.20220205

40. Kazu I, Erten P. Prospective teachers' perception levels of their digital literacy. *Int J Multidiscip Thought.* (2013) 3:51–68.

41. Mudra H. Digital literacy among young learners: how do EFL teachers and learners view its benefits and barriers? *Teach English Technol.* (2020) 20:3–24.

42. Ouahidi LM. Constraints on developing digital literacy skills in higher education. *Int J Linguistics Literature Translation.* (2020) 3:197–205. doi: 10.32996/ijllt.2020.3.2.22

43. Sandy F, Suryaningtyas AA. Research takeaways: The benefits of digital literacy in the early and middle. *Jurnal Ilmiah Media Public Relations dan Komunikasi.* (2022) 3:1–5. doi: 10.20961/impresi.v3i2.71427

44. Oh EA, Bae SM. The relationship between the digital literacy and healthy aging of the elderly in Korea. *Curr Psychol.* (2024) 43:16160–9. doi: 10.1007/s12144-023-05557-2

45. Liang Q, de la Torre J, Law N. Do background characteristics matter in Children's mastery of digital literacy? A cognitive diagnosis model analysis. *Comput Hum Behavior.* (2021) 122:106850. doi: 10.1016/j.chb.2021.106850

46. Tong W, Jia J, Wang P, He W. The associations between parental phubbing, adolescent phubbing, and adolescents' adjustments: a cross-lagged panel network analysis. *J Youth Adolescence.* (2024) 53:1529–41. doi: 10.1007/s10964-023-01909-0

47. Wang X, Wang S, Wang H, Dong W. Females suffer more from partner phubbing? The roles of romantic jealousy and relational aggression between partner phubbing and intimacy quality. *Curr Psychol.* (2024) 43:1–13. doi: 10.1007/s12144-024-05826-8

48. McAneney H, Tully MA, Hunter RF. Individual factors and perceived community characteristics in relation to mental health and mental well-being. *BMC Public Health.* (2015) 15:1237. doi: 10.1186/s12889-015-2590-8

49. Ng W. Can we teach digital natives digital literacy? *Comput Educ.* (2012) 59:1065–78. doi: 10.1016/j.compedu.2012.04.016

50. Ustundag MT, Gunes E, Bahcıvan E. Turkish adaptation of digital literacy scale and investigating pre-service science teachers' digital literacy. *J Educ Future.* (2017) 12:19–29.

51. Chotpitayasunondh V, Douglas KM. Measuring phone snubbing behavior: development and validation of the generic scale of phubbing (GSP) and the generic scale of being phubbed. *Comput Hum Behavior.* (2018) 88:5–17. doi: 10.1016/j.chb.2018.06.020

52. Orhan-Goksun D. Adaptation of general scales of phubbing and being phubbed into Turkish. *Afyon Kocatepe Univ J Soc Sci.* (2019) 21:657–71. doi: 10.32709/akusosbil.505642

53. Tennant R, Hiller L, Fishwick R, Platt S, Joseph S, Weich S, et al. The Warwick-Edinburgh mental well-being scale: Development and UK validation. *Health Qual Life Outcomes.* (2007) 5:63. doi: 10.1186/1477-7525-5-63

54. Karasar N. *Scientific research method.* Turkey: Nobel (2019).

55. Gurbuz S, Sahin F. *Research methods in social sciences.* Turkey: Seckin (2017).

56. Byrne BM. *Structural equation modeling with AMOS Basic concepts, applications, and programming. 2nd ed.* New York: Routledge Taylor and Francis Group New York (2010).

57. Kline RB. *Principles and practice of structural equation modeling. 4th ed.* New York: The Guilford Press (2019).

58. Cole DA. Utility of confirmatory factor analysis in test validation research. *J Consulting Clin Psychol.* (1987) 55:584–94. doi: 10.1037/0022-006x.55.4.584

59. Segars AH, Grover V. Re-examining perceived ease of use and usefulness: a confirmatory factor analysis. *MIS Quarterly.* (1993) 17:517–25. doi: 10.2307/249590

60. Erdogan G. Antecedent and consequences of perceived usefulness in mobile shopping applications. *Gazi J Econ Bus.* (2023) 9(2):162–77. doi: 10.30855/gjeb.2023.9.2.004

61. Capık C. Use of confirmatory factor analysis in validity and reliability studies. *Anadolu Anatolian J Nurs Health Sci.* (2014) 17:196–205.

62. Hair JF Jr., Hult GTM, Ringle CM, Sarstedt M. A primer on partial least squares structural equation modeling (PLS-SEM). 2nd ed. Los Angeles: Sage (2017).

63. Tabachnick BG, Fidell LS. *The use of multivariate statistics.* Turkey: Nobel (2015).

64. Kalaycı S. *SPSS applied multivariate statistical techniques.* Turkey: Dynamic Academy (2018).

65. Norusis MJ. *SPSS Statistics 17.0 Guide to Data Analysis.* Chicago: Published by prentice Hall Inc (2008).

66. Meng Q, Yan Z, Abbas J, Shankar A, Subramanian M. Human-computer interaction and digital literacy promote educational learning in pre-school children: Mediating role of psychological resilience for kids' mental well-being and school readiness. *Int J Human-Computer Interaction.* (2023) 41(1):16–30. doi: 10.1080/10447318.2023.2248432

67. König L, Kuhlmey A, Suhr R. Digital health literacy of the population in Germany and its association with physical health, mental health, life satisfaction, and health behaviors: Nationally representative survey study. *JMIR Public Health Surveillance.* (2024) 10:e48685. doi: 10.2196/48685

68. Adegbite WM. Unpacking mediation and moderating effect of digital literacy and life-career knowledge in the relationship between work-integrated learning and graduate employability. *Soc Sci Humanities Open.* (2024) 10:101161. doi: 10.1016/j.ssaho.2024.101161

69. Pinar G, Cetinkaya Bozkurt O. The role of creative self-efficacy and digital literacy in supporting academic success through innovative behavior. *J Appl Sci Mehmet Akif Ersoy University.* (2022) 6:1–31. doi: 10.31200/makuubd.988158

70. Alt D, Raichel N. Enhancing perceived digital literacy skills and creative self-concept through gamified learning environments: Insights from a longitudinal study. *Int J Educ Res.* (2020) 101:101561. doi: 10.1207/s15326934crj120411

71. Akyazı TE. The relationship between digital literacy and positive psychological capital in the context of Maslow 2.0 hierarchy of digital needs: a study in the manufacturing industry. *Selcuk Univ Soc Sci Institute J.* (2022) 49:345–63. doi: 10.52642/susbed.1160850

72. Abbas Q, Hussain S, Rasool S. Digital literacy effect on the academic performance of students at higher education level in Pakistan. *Global Soc Sci Review.* (2019) 4:154–65. doi: 10.31703/gssr.2019

73. Prior DD, Mazanov J, Meacheam D, Heaslip G, Hanson J. Attitude, digital literacy and self efficacy: Flow-on effects for online learning behavior. *Internet Higher Education.* (2016) 29:91–7. doi: 10.1016/j.iheduc.2016.01.001

74. Hong JW, Nam YJ, Hong S, Roh HW. Mediating effect of depressive symptoms on the relationship between digital literacy and cognitive function in older adults. *Front Psychiatry.* (2023) 14:1248347. doi: 10.3389/fpsyt.2023.1248347

75. Ozsari A, Gorucu A. Digital literacy, digital addiction and life satisfaction: study of judo athletes. *J Educ Recreation Patterns.* (2023) 4:169–80. doi: 10.53016/jerp.v4i1.100

76. Ji H, Dong J, Pan W, Yu Y. Associations between digital literacy, health literacy, and digital health behaviors among rural residents: evidence from Zhejiang, China. *Int J Equity Health.* (2024) 23:68. doi: 10.1186/s12939-024-02150-2

77. Yao N, Wang Q. Factors influencing pre-service special education teachers' intention toward AI in education: Digital literacy, teacher self-efficacy, perceived ease of use, and perceived usefulness. *Heliyon.* (2024) 10:1–12. doi: 10.1016/j.heliyon.2024.e34894

78. Reddy P, Sharma B, Chaudhary K. Digital literacy: a review in the South Pacific. *J Computing Higher Education.* (2022) 34:83–108. doi: 10.1007/s12528-021-09280-4

79. Akgul CS. An in-depth study of internet and smartphone addiction from a social work perspective. *J Youth Stud.* (2023) 11:69–101. doi: 10.52528/genclikarastirmalari.1328519

80. Kupeli T. *The relationship between loneliness, fear of missing out (FoMO) and smartphone addiction with phubbing in university students.* Turkey: Master's Thesis, Beykoz University (2023).

81. Karadag E, Tosuntas SB, Erzen E, Duru P, Bostan N, Sahin BM, et al. Determinants of phubbing, which is the sum of many virtual addictions: A structural equation model. *J Behav Addictions.* (2015) 4:60–74. doi: 10.1556/2006.4.2015.005

82. Ugur NG, Koc T. Time for digital detox: misuse of mobile technology and phubbing. *Procedia-Social Behav Sci.* (2015) 195:1022–31. doi: 10.1016/j.sbspro.2015.06.491

83. Roberts JA, David ME. (Put down your phone and listen to me: How boss phubbing undermines the psychological conditions necessary for employee engagement. *Comput Hum Behavior.* (2017) 75:206–17. doi: 10.1016/j.chb.2017.05.021

84. Wang X, Xie X, Wang Y, Wang P. Lei L. Partner phubbing and depression among married Chinese adults: The roles of relationship satisfaction and relationship length. *Pers Individ Differences.* (2017) 110:12–7. doi: 10.1016/j.paid.2017.01.014

85. Vanden Abeele MMP, Postma-Nilsenova M. More than just gaze: An experimental vignette study examining how phone-gazing and newspaper-gazing and phubbing-while-speaking and phubbing-while-listening compare in their effect on affiliation. *Communication Res Rep.* (2018) 35:303–13. doi: 10.1080/08824096.2018.1492911

86. Lepore SJ, Rincon MA, Buzaglo JS, Golant M, Lieberman MA, Bauerle Bass S, et al. Digital literacy linked to engagement and psychological benefits among breast cancer survivors in Internet-based peer support groups. *Eur J Cancer Care.* (2019) 28:1–8. doi: 10.1111/ecc.13134

87. Reddy P, Chaudhary K, Hussein S. A digital literacy model to narrow the digital literacy skills gap. *Heliyon.* (2023) 9:1–13. doi: 10.1016/j.heliyon.2023.e14878

88. Mokhtari F. Fostering digital literacy in higher education: Benefits, Challenges and implications. *Int J Linguistics Literature Translation.* (2023) 6:160–7. doi: 10.32996/ijllt

89. Laaber F, Koch T, Hubert M, Florack A. Young People's digital maturity relates to different forms of well-being through basic psychological need satisfaction and frustration. *Comput Hum Behavior.* (2024) 152:108077. doi: 10.1016/j.chb.2023.108077

90. Ozsari A, Tek T, Uysal H, Genc M, Toros T, Pepe S, et al. The effect of digital literacy on mental toughness: research on a sport branch. *Front Psychol.* (2025) 16:1385044. doi: 10.3389/fpsyg.2025.1385044