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Original
Novel Interactive Systems Promoting More Intentional Technology Use / Scibetta, Luca. - ELETTRONICO. - 4151:(2026). (16th Biannual Conference of the Italian SIGCHI Chapter - CHItaly 2025 Salerno (ITA) 6-10 October 2025).

Availability:
This version is available at: 11583/3002407 since: 2026-02-20T13:54:11Z

Publisher:
CEUR-WS

Published
DOI:

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14 May 2026

Novel Interactive Systems Promoting More Intentional Technology Use

Luca Scibetta[1,*]

[1]Politecnico di Torino, Corso Duca degli Abruzzi 24, Torino, 10129, Italy

Abstract

Digital technology permeates modern life, offering numerous benefits while simultaneously creating potential risks of dependency and overuse. Digital Self-Control Tools (DSCTs) represent the predominant attempted solution for digital wellbeing problems; however, they frequently prove ineffective for sustainable behavior change. My research investigates novel interactive systems that promote more intentional technology use, overcoming existing limitations. One of the approaches I pursued, grounded in psychological theories of behavior change, focused on improving current DSCTs through artificial intelligence integration to provide personalized guidance tailored to individual needs and help users improve their digital habits. Future validation may prove that an AI-based tailored approach to digital self-control can lead to actual change of habits and improvement in the long run. A second approach consisted of educational interventions through an educational system promoting digital wellbeing among youth to encourage young people to develop independently healthier technology usage patterns. Future approaches may emphasize more gamified or game-like systems to widen the target of digital educational means.

Keywords

Digital wellbeing, DSCTs, Digital wellbeing education, AI for wellbeing

1. Introduction

Contemporary society is characterized by the pervasive integration of digital technologies across all domains of human activity. Smartphones and personal computers have become essential tools for professional tasks, recreational activities, and social interaction, offering increasingly sophisticated functionalities that ease daily operations. However, this technological ubiquity presents significant challenges. Many digital platforms are deliberately engineered to promote compulsive engagement patterns, monetizing user attention through advertising-driven revenue models leading to the so called "attention economy" [1]. Consequently, users frequently report experiencing distress and frustration when losing temporal awareness and behavioral control, particularly during social media interactions. These prolonged, unintended usage episodes have been conceptualized as "falling down the rabbit hole" phenomena [2].

Extensive research has focused on Digital Self-Control Tools (DSCTs) as interventions to help users regain autonomy over their technology consumption. However, these solutions demonstrate several critical limitations. Paradoxically, users habit change depends on using a specific technology, DSCTs, as these tools are typically designed to be used continuously to control each own usage rather than encouraging one's behavioral autonomy. Most DSCTs employ standardized approaches that fail to accommodate individual user differences, thereby diminishing intervention effectiveness. Additionally, research validation periods are frequently insufficient to capture long-term usage patterns, overlooking the common trajectory of initial enthusiasm followed by frustration and tool abandonment, ultimately resulting in regression to previous bad habits [3].

Current DSCT design inadequately addresses the critical "detachment phase," during which users should gradually move away from the intervention while maintaining newly acquired healthy behav-

CHItaly 2025: Technologies and Methodologies of Human-Computer Interaction in the Third Millenium, Doctoral Consortium, 6-10 October 2025, Salerno, Italy

*Corresponding author.

luca.scibetta@polito.it (L. Scibetta)

0009-0001-5689-9399 (L. Scibetta)

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CEUR Workshop Proceedings ceur-ws.org ISSN 1613-0073

published 2026-01-21

CEUR-WS.org/Vol-4151/short6.pdf

iors [4]. Furthermore, many existing tools lack theoretical grounding in established psychological frameworks, such as Self-Determination Theory (SDT) [5] and Dual Systems Theory [6], which could enhance their behavioral change efficacy [7].

Educational interventions represent an alternative approach to digital wellbeing promotion. However, existing programs typically target university [8, 9] or secondary school [10] populations through brief interventions ranging from single workshops to semester-long courses. While these approaches demonstrate effectiveness in raising awareness of digital wellbeing challenges and available solutions, they consistently fail to produce sustained behavioral modifications, indicating the need for more comprehensive, age-diverse educational frameworks.

The literature clearly indicates the necessity for novel solutions that more effectively address digital wellbeing challenges. My research aims to develop systems that demonstrably improve users' digital wellbeing while investigating optimal approaches for diverse user populations across varied contexts. This involves enhancing DSCT personalization and adaptivity, including consideration of detachment phases, while simultaneously developing innovative educational approaches that promote conscious technology use from early developmental stages.

2. Research approach

In my work towards designing novel systems that can help improve people's digital wellbeing, I was guided by the following research questions:

- **RQ1**: In which ways new systems should be designed to effectively impact on people digital wellbeing leading to a change for the better?
- **RQ2**: Which users and contexts with specific digital wellbeing challanges can be targeted to improve the effects of new proposed solutions?

These research questions have been declined onto two lines that try to approach people digital wellbeing from two different perspectives, exploring how to obtain a change for the better. First, I aim to develop effective support mechanisms for individuals seeking to modify problematic digital behaviors. These mechanisms should facilitate sustainable change throughout the behavior modification process, ultimately enabling users to regain autonomy without persistent dependence on intervention tools. This approach should minimize frustration and tool abandonment, often accompanying digital behavior change attempts. Second, I intend to contribute to preventative strategies by fostering a culture of responsible technology use among younger populations, promoting the development of healthy digital habits from an early age.

Pursuing the first way, I examined AI's potential to enhance existing digital wellbeing interventions by transitioning from standardized approaches to personalized systems that better facilitate sustained engagement and goal achievement. I initially conducted an exploratory study evaluating commercial LLMs' capacity to comprehend digital wellbeing challenges and function as personalized digital wellbeing assistants [11]. This investigation involved developing four user personas derived from established digital wellbeing patterns in the literature and structured according to Self-Determination Theory (SDT) [5, 12]. Acting as each persona through a controlled script, I facilitated interactions with four distinct LLMs and analyzed the responses. Following this first work, I performed a systematic literature review examining AI-enhanced digital and mental wellbeing tools to establish the current state of the art and identify potential ways of improvement aligned with my research questions.

My second line of work focused on educational strategies targeting adolescents to foster digital literacy and promote cultural shifts in technology usage patterns among emerging generations. Collaborating with a team on a national project, we investigated the needs of secondary school students and educators to inform the design and development of an educational system for integrating digital wellbeing concepts into formal educational settings [13].

3. Contributions to date

3.1. AI for digital wellbeing

I initiated my research studying LLMs' capacity to address digital wellbeing challenges. Starting with the development of four theoretically-grounded user personas derived from problematic smartphone usage patterns documented in the literature [14, 15, 2], structured within the framework of SDT:

- **Time-Killer (Sonia)**: A 28-year-old who routinely engages with her smartphone during perceived idle periods as a boredom-avoidance strategy. She predominantly consumes messaging applications, games, and short-form content, often experiencing temporal distortion and subsequent feelings of remorse regarding her usage patterns.
- **Procrastinator (Francesco)**: A 17-year-old student who systematically defers academic responsibilities despite educational pressures. His behavior is characterized by frequent device-checking (every 5 to 10 minutes) during study sessions, resulting in extended, unplanned disengagement from academic work and consequent regret regarding time allocation.
- **Off-the-Railer (Riccardo)**: A 25-year-old student whose smartphone interaction typically begins with purposeful activities but transitions to unintended engagement patterns. His usage is marked by compulsive notification-checking and difficulty establishing effective boundaries between productive and recreational digital activities.
- **Micro-Escaper (Giulia)**: A 22-year-old professional who utilizes her smartphone as a temporary psychological relief mechanism during occupational stressors or social anxiety triggers. While achieving momentary emotional regulation, she often experiences difficulty re-engaging with primary responsibilities.

	Time-killer	Procrastinator	Micro-escaper	Off-the-railer
Alternative activities	♥ ♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♣
DSCTs	♥ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♣
Free-phone zones or times	♥ ♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♣	♥ ♦ ♣ ♠
Good sleep habits				♥ ♦
Time management	♥ ♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♣	♥ ♦ ♣ ♠
Awareness	♥ ♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♠
Coping with social anxiety	♥		♥ ♦ ♠	
Work environment and organization	♣ ♠	♥ ♦ ♣	♥ ♦ ♣	♥ ♦ ♣
Seek help or cooperation	♦ ♣ ♠	♥ ♦ ♣ ♠	♥ ♦ ♠	
Minimize distractions	♥ ♦	♥	♦ ♣	♥ ♦ ♣

Table 1
♥ = Bing, ♦ = ChatGPT, ♣ = Claude, ♠ = Gemini
This table shows the distribution of the proposed solutions of each group by the various LLMs to personas.

Analysis of interactions between the four personas and four commercial LLMs (ChatGPT[1], Claude[2], Gemini[3], and Bing Copilot[4]), which I simulated through a controlled script, revealed patterns summarized in Table 1. This table categorizes solution classes proposed by each LLM for each persona, though specific recommendations within classes varied across personas. The interventions demonstrated contextual appropriateness and personalization; for instance, recommendations for the micro-escaper incorporated workplace-specific strategies such as collaborative breaks with colleagues.

Seeking to leverage these findings to develop an LLM-enhanced DSCT with adaptive capabilities, I identified a significant research gap: the absence of structured guidance principles for practitioners

[1]https://chatgpt.com/, visited 2025/05/20
[2]https://claude.ai/, visited 2025/05/20
[3]https://gemini.google.com/, visited 2025/05/20
[4]https://copilot.microsoft.com/, visited 2025/05/20

developing AI-based wellbeing applications. Consequently, I conducted a systematic literature review, following the PRISMA framework [16], examining existing research at the intersection of LLMs and digital/mental wellbeing interventions. This analysis yielded a comprehensive design framework comprising 6 dimensions and 23 sub-dimensions, presented in Table 2. The framework addresses multiple aspects of AI-powered wellbeing tool design, including user data management, intervention design considerations, interaction modalities, and validation methodologies. As a practical checklist for practitioners, this framework ensures comprehensive consideration of critical design elements throughout AI-enhanced wellbeing tools design, development and validation processes.

Dimension	Sub-dimensions
User Information	Demographics, Lifestyle, Goals, Personal Device Metrics
Intervention	Purpose, Approach, Adaptation, Non-Maleficence, Crisis Management
Interaction	Role, Tone, Timing, Modality, Appearance
Data Management	Transparency, Privacy, Sensitivity Handling
Model	Selection, Response Quality
Study	Type, Participants, Duration, Results Validation

Table 2
Dimensions and related sub-dimensions in the design framework.

3.2. Digital wellbeing education

A significant component of my research addresses digital wellbeing education for adolescents. As part of a collaborative project between two Italian universities, funded by the European Union and the Italian government, we conducted empirical investigations to identify key requirements for an educational digital wellbeing interactive system intended for usage in Italian secondary schools. My specific contribution centered on investigating educators' needs and perspectives and designing and developing parts of the system.

I designed and administered a comprehensive questionnaire to 18 Italian teachers representing diverse subject areas and educational institutions. The overall structure of the questionnaire can be observed in Figure 1. The instrument combined quantitative assessment through 5-point Likert scale items with qualitative exploration via open-ended questions, facilitating the collection of different perspectives and detailed insights. Results indicated that while teachers generally demonstrated adequate conceptual understanding of digital wellbeing principles and expressed significant interest in integrating such education into school curricula, they consistently identified a need for expert support, acknowledging limitations in their ability to deal with such topics. The data revealed heterogeneous requirements regarding classroom implementation timeframes and preferences for system configurations, particularly concerning student anonymity features and pedagogical approaches.

These findings were synthesized with parallel results from the student-focused investigation to inform the design of an integrated educational system of two complementary applications, one web-based for teachers and the other mobile for students. I contributed primarily to the development of the student mobile app. Both applications will undergo field testing in Italian secondary school classrooms, with formal validation studies forthcoming.

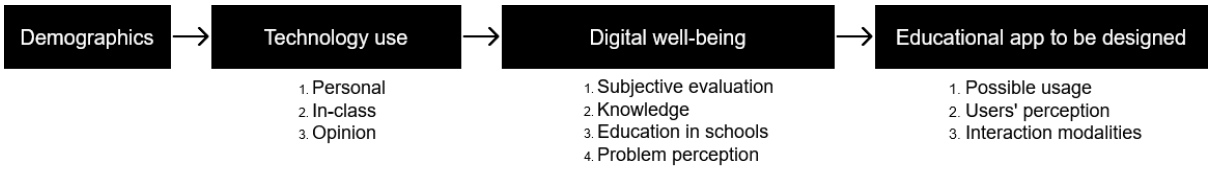

Figure 1: The structure of the questionnaire with its 4 sections.

4. Future works

Also future directions for this research can be grouped into two main areas: further integration with AI and more educational initiatives.

Regarding AI integration, I am currently working on the design and development of an AI-powered DSCT, based on the design framework previously described. This tool will guide users through activities recommended by an LLM to promote healthier digital habits and enhance digital wellbeing. The intervention will be structured in multiple phases to support long-term behavioral change, also supporting users in stopping their reliance on the application. Notably, a managed "detachment phase" will help users transition away from depending on the app while maintaining their new habits. Once developed, this tool will be evaluated over a longer period than the typical duration of one to two weeks used in many DSCT studies, to better assess its long-term effectiveness. The study focuses on whether AI integration in DSCTs can facilitate sustainable behavioral change and contribute meaningfully to users' digital wellbeing in the long run.

In the area of digital wellbeing education, I plan to broaden the scope of my work. An important future direction involves initiating digital wellbeing education at an earlier age, helping children become aware of technology-related risks before bad habits can set in. However, traditional educational apps may not be suitable or engaging for younger audiences. To address this, I aim to explore the potential of educational games and gamification. By incorporating age-appropriate game elements into digital wellbeing educative tools and adjusting difficulty and complexity for different age groups, this approach may offer a more engaging and effective way to raise awareness about digital wellbeing. Such games could teach children, teenagers, and also adults, strategies for healthy device use and methods to recognize and address compulsive or harmful usage patterns.

These two approaches, each targeting specific users and contexts, can complement each other, leading to new systems that can better contribute to a broader cultural shift toward more mindful and informed technology use. Together, they can support the development of healthy digital habits and a greater collective awareness of digital wellbeing challenges and solutions.

Acknowledgments

Part of my work was carried out within the "Improving digital wellbeing with and for teens: a gamified and personalized intelligent system" project – funded by the European Union – Next Generation EU, Mission 4 Component 1, within the PRIN 2022 program (CUP E53D23007840006).

Declaration on Generative AI

The author have not employed any Generative AI tools.

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