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Towards Digital Well-being Education in High-School / Scibetta, L., Ballarini, F., Ceccarini, C., Monge Roffarello, A., Prandi, C., De Russis, L.. - ELETTRONICO. - 1:(2025), pp. 1-6. (CHI '25: CHI Conference on Human Factors in Computing Systems Yokohama (JPN) April 26 - May 1 2025) [10.1145/3706599.3720101].

Availability:

This version is available at: 11583/2997942 since: 2025-05-07T12:40:06Z

Publisher:

Association for Computing Machinery

Published

DOI:10.1145/3706599.3720101

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Towards Digital Well-being Education in High-School

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ABSTRACT

As technology becomes pervasive in our lives, particularly among young people, concerns about digital well-being are increasingly important. While self-regulatory approaches like digital self-control tools (DSCT) offer immediate solutions, their long-term effectiveness is not guaranteed. Though less explored, educational interventions may provide more profound changes in digital habits. Combining four co-design sessions with 74 high-school students and online questionnaires with 18 teachers, we investigated both students' and educators' preferences to develop innovative and acceptable solutions for digital well-being challenges. Analyzing the findings of these investigations, we provide 7 guidelines on modalities and approaches to enhance the design of digital well-being educational applications. Our findings advance the understanding of effective educational digital well-being interventions.

CCS CONCEPTS

• **Human-centered computing** → **User studies**; *Collaborative and social computing systems and tools*; *Ubiquitous and mobile computing*; • **Applied computing** → **E-learning**.

KEYWORDS

Digital wellbeing, Educational technology, Young people and technology, Gamification in education

ACM Reference Format:

Luca Scibetta, Francesco Ballarini, Chiara Ceccarini, Alberto Monge Roffarello, Catia Prandi, and Luigi De Russis. 2025. Towards Digital Well-being Education in High-School. In . ACM, New York, NY, USA, 6 pages. <https://doi.org/10.1145/nnnnnnn.nnnnnnn>

1 INTRODUCTION & BACKGROUND

The pervasive use of smartphones and digital technologies has become a pressing concern in modern society. Although people can

experience various benefits through technology, from social opportunities [19] to democratization of knowledge, people are often hooked to their phone [11]. Technology dependence represents a problem with current solutions that are not sustainable in the long run [14]. This phenomenon raises preoccupation since it is linked with the risk of negative impacts on mental health, productivity, and overall well-being [18]. Especially among teenagers, studies have demonstrated there is a correlation between excessive technology use and symptoms of depression and anxiety [16, 20]. As digital technologies become increasingly integrated into daily life, the need for effective, sustainable solutions to manage their use becomes more critical.

Considering technology as not negative per se, there is a need for helping people with their self-control and only limit themselves to helpful and constructive usage of it. Digital self-control tools (DSCTs) have emerged as a response to this challenge, with various tools gaining popularity [2, 3, 9]. These applications offer various features, such as usage tracking, app blocking, and screen time limitations. However, while these tools provide immediate intervention options, they ultimately place the burden of monitoring and maintaining digital wellness entirely on the user. Consequently, such solutions often fail to create lasting behavioral changes, as people typically revert to their previous usage patterns once the initial motivation decreases [14].

This limitation highlights the opportunity for alternative approaches to foster sustainable digital well-being improvements. Since technology offers immense possibilities for learning and growing to young people [4], it is not desirable to (try to) prevent teenagers from using it. Educational interventions present a promising direction [13]. By providing individuals with more detailed knowledge about digital well-being, attention economy, and DSCTs, they can develop the necessary awareness and skills to independently manage their digital interactions and maintain healthy technology habits over time.

There are already examples of educational approaches to digital well-being applied in different contexts. At the university level, initiatives have focused on teaching students about digital well-being and DSCTs with their proposed self-control solutions, either making them commit to some self-defined strategy to try [12] or to design new and more sustainable solutions [17]. While these educational initiatives demonstrate potential, they are limited to young adults and may not lead to lasting lifestyle changes. Regarding digital well-being in high-school contexts, a previous study has

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Conference'17, July 2017, Washington, DC, USA

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ACM ISBN 978-x-xxxx-xxxx-x/YY/MM

<https://doi.org/10.1145/nnnnnnn.nnnnnnn>

demonstrated that workshop-like sessions represent both a valuable learning experience and a source of people's needs and app ideas [5]. Anyway, educating high-school students about digital well-being needs to be integrated into existing school curricula to obtain more engagement and participation and, consequently, better results [13]. Various health-related courses for preventing substance, tobacco, or alcohol abuse or promoting sexual health are already successfully integrated inside secondary schools [6, 8]. Digital well-being education can be similarly incorporated, leveraging these proven patterns while addressing a new challenge teenagers face in the digital age.

Since digital technologies are ubiquitous among teenagers nowadays, we aim to propose scalable and accessible educational interventions to reach as many as possible. While workshops and courses are valuable, they inherently limit reach due to constraints of expert availability and logistical complexity. An app-based approach, to be used at school and outside, offers a viable solution, enabling widespread dissemination of digital well-being knowledge. By leveraging technologies that are already familiar to students, we can transcend traditional educational boundaries, providing learning experiences that can potentially impact a significantly larger student population. To enhance the effectiveness of an app-based educational approach, we propose incorporating gamification elements, which have been demonstrated to improve engagement and attention levels in educational contexts [7]. This aspect is particularly crucial when targeting teenagers, who may otherwise find traditional educational methods unengaging [1]. Therefore, we foresee that gamified learning experiences can increase motivation, participation, and knowledge retention, also for digital well-being-related topics.

In this paper, we explore two studies aimed at understanding the needs for app-based educational approaches to digital well-being for teenagers and their potential integration into high-school curricula. Our research methodology involved conducting co-design sessions with 74 high-school students and administering 18 online questionnaires with high-school teachers. Analyzing the collected data, we outline 7 guidelines that can inform future research in this domain. When concluding, we present, as an example of our findings, the prototype currently under development that embodies such guidelines.

2 DESIGN SESSIONS

This section presents the two user studies conducted to gather insights from students and teachers regarding digital well-being education in high schools and the possibility of a related tool. Two separate studies were carried out to understand the perspectives and needs of both parties involved. Our investigations also aimed to understand how a digital well-being educational system could be effectively integrated into existing school curricula while concretely improving students' well-being. Both of our studies were carried out in Italian.

2.1 Co-design Sessions

The first study explores digital well-being education through four co-design workshops conducted across four classes in Italian high schools in February 2024. The workshops, each involving one class

of students, were integrated into the "Percorso per le Competenze Trasversali e per l'Orientamento" (Path for Transversal Skills and Orientation) and engaged 74 students in the third and fourth year of their five-year career. The sessions, lasting about 5 hours each, were two-fold: educating students about and promoting digital well-being, considering topics such as attention economy and deceptive patterns, while gathering insights through participatory design methods and extrapolating a primary set of features desirable from a student point of view to inform the development of an interactive digital well-being educational tool.

2.1.1 Participants. The study involved 74 students from different classes across two Italian high schools: two third-year classes from a high school in Savignano and two fourth-year classes from a high school in Cesenatico. Participants were between 16 and 18 years old, with a gender distribution of 42 males and 32 females (43.2% female). During the co-design activities, students worked in 20 small groups of 3-4 participants. All participants, or their parents for those still under age, provided informed consent to participate in the workshops.

2.1.2 Methodology. The workshop methodology was structured in three main phases designed to guide students through the process of ideating and designing an interactive gamified mobile application for digital well-being education at school (see Figure 1). Each workshop was scheduled to last approximately 5 hours. Throughout the activities, two of the authors were always present as facilitators.

The first step, a one-hour explanation session, provided students with key pieces of knowledge in three critical areas: mobile computing as the contextual framework for app development; game-thinking principles to enhance the user engagement of an app through gamification; digital well-being concepts as the main aim of their to-be-designed app.

The second and most extended phase was a three-hour co-design session divided into four steps concerning crucial aspects of the application design. Students first explored digital well-being concepts to develop a deeper understanding of technology's impact on daily life and adjust the focus of their apps. They then examined aspects related to attention economy and deceptive patterns, highlighting the underlying mechanisms influencing user behavior that the app should try to overcome [15]. The third module focused on time management and self-control, where students analyzed existing tools, such as DSCTs, and their functionalities that must be considered in designing a new app related to digital well-being. Finally, students engaged in the practical design phase, where each group could choose between developing high-fidelity, for example on Canva, or low-fidelity hand-drawn prototypes of an interactive and intelligent gamified digital wellbeing educational application intended for use within the school curriculum among peers.

The last step of the workshop consisted of the designed apps presentations by all groups. Each had to present their application prototype to the class within 10 minutes, followed by short question-and-answer sessions. This final phase allowed students to articulate their design decisions and receive immediate feedback from peers and facilitators. It enriched the collaborative learning experience and allowed the authors to gain potentially valuable insights about their choices and motivations. All the prototypes presented by the

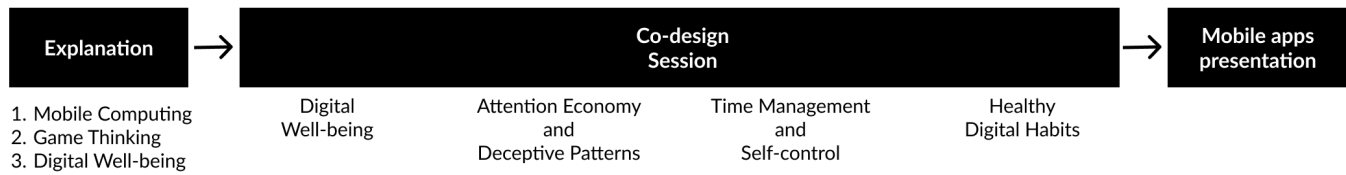


Figure 1: The organization of the three steps of the co-design workshops.



Figure 2: Parts of some of the prototypes made during the workshops.

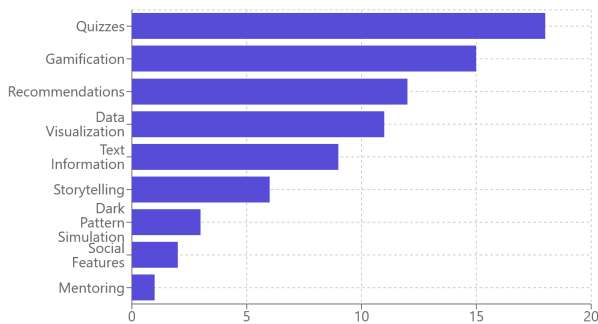


Figure 3: Distribution of features in students' prototypes.

students were collected, also taking notes on their presentations, to carry out analysis afterward.

2.1.3 Results. Throughout the four workshops, the participating groups (N = 20) developed and presented each a prototype of an educational digital well-being application, with selected examples illustrated in Figure 2. These co-design outcomes revealed diverse approaches and solutions. The distribution of implemented features across prototypes is visualized in Figure 3.

The findings indicate a high presence of educational components, with most groups (N = 18) considering *assessment* mechanisms through quizzes and questionnaires to evaluate user knowledge and facilitate self-reflection regarding digital habits. *Gamification* emerged as the second most prevalent feature (N = 15), with groups incorporating various engagement mechanisms such as achievement systems (badges, points, rankings) and interactive mini-games.

Behavioral intervention strategies were included in 60% of the prototypes (N = 12), manifesting through algorithmic recommendations and suggestions for alternative activities, with a subset (N = 3) specifically emphasizing outdoor activities as reward-generating behaviors. *Data visualization* and *temporal tracking* mechanisms were included in the prototype by 11 groups, including some that presented user-customizable analytics or growing trees following data humanism principles. For some groups (N = 9), receiving textual information and explanations from the app was significant, including this type of element in their prototypes.

Storytelling approaches were observed in many prototypes (N = 6), with most (N = 5) including decision-based narratives integrated with digital well-being educational content. An interesting example included a narrative about a child crossing a road to reach a park, where progression depends on correctly answering questions about digital well-being.

A smaller subset of groups (N = 3) employed *simulation-based methodologies* for deceptive pattern awareness, including a simulated social media environment and two gamified demonstrations of addictive design patterns. *Social interaction features* were less frequently implemented (N = 2), primarily focusing on progress sharing and collaborative activity planning. A single prototype incorporated *peer education* elements through a structured mentoring framework.

Qualitative analysis of the presentations revealed insightful understanding, evidenced by the groups' use of metaphorical language and abstract representations. Notable examples include the characterization of smartphone engagement as "time waste" and dark patterns as "ruthless mechanisms," alongside the metaphorical comparison of dark patterns to optical illusions. Some groups anthropomorphized digital well-being as a "luminous and wise entity," indicating deep engagement with the theoretical framework.

2.2 Questionnaires

After the co-design sessions with students, we administered online questionnaires with 18 high-school teachers. The questionnaire was designed to explore teachers' perceptions of technology personally and in classroom settings, their understanding of digital well-being and the feasibility of using a digital well-being educational app within schools. This section outlines participant characteristics and the methodology of the questionnaire.

2.2.1 Participants. The study involved 18 high-school teachers from various Italian schools recruited through convenience and snowball sampling. All participants provided informed consent for their participation in the questionnaires. The sample consisted predominantly of female teachers (83.3%). Regarding age distribution,

while the youngest participant was under 29 and the oldest were 60 or above, the group of 50-59 was both mode and median. The participants represented a diverse range of academic disciplines, both scientific and literary. Six participants teach Mathematics, and three of them also teach Physics. Two teach English, and another two teach Latin, one teaching also Italian and the other also Greek. Two participants were Physical Education teachers. The remaining subjects, each represented by one teacher, included Computer Science, Design, Law, Art, and Religious Instruction. A special education teacher also participated in our study.

2.2.2 Methodology. The questionnaires were administered online using Google Forms, following a structured format. They were organized into four sections, as illustrated in Figure 4. The included questions had the aim of investigating how well teachers understand the topic, in which way an educational app for digital well-being can be integrated into high-school curricula, and how it should work to obtain better results. Most questions involved either an open-ended response or an answer on a 5-value likert. The remainder allowed choosing between several available options

Upon accessing the form, participants were presented with a description of the study objectives and an estimated completion time of 10 minutes. This first section also contained the privacy statement requesting the participant's informed consent. Teachers could either accept and proceed with the questionnaire or decline and leave. Participants were informed of their right to withdraw from the study at any time. If they moved on, the subsequent section collected essential *demographic information*, intentionally kept minimal.

The third section focused on *technology use* and was structured around three main themes: personal and in-class use and general opinions about it. Questions in this section explored teachers' comfort level with technology, their use in the classroom, student restrictions, and their views on technology's effectiveness as an educational tool.

The fourth section addressed *digital well-being* through four key areas: (i) subjective evaluation, (ii) knowledge, (iii) education in schools, and (iv) perception of the problem. Teachers were asked to assess both their own and, in their opinion, their students' technology usage patterns and understanding of digital well-being. This section also investigated teachers' perspectives on the potential for enhanced digital well-being education for themselves and their students. Additionally, it explored practical aspects such as optimal timing and methods for implementing digital well-being education in schools and anticipated student responses to such initiatives.

The final section concentrated on questions about a hypothetical *educational application*, examining three primary aspects: usage, user perception, and interaction modalities. Teachers were questioned about the potential utility of such an app and their likelihood of using it, including specific contexts for usage. They were also asked to predict student reactions to this educative approach. The section concluded with detailed questions about activity management preferences, including preferred devices for administration, activity planning timing, desired level of personalization, results visualization options, preferred activity approach (competitive, cooperative, gamified, ...), and how to handle results visibility or anonymity among students.

2.2.3 Results. Almost all teachers reported feeling at least "sufficiently" comfortable with technology, with one-third feeling "quite comfortable" and another third feeling "very comfortable." Only one participant reported feeling "somewhat uncomfortable," while none reported complete discomfort. Most teachers (N = 14) reported using technology daily in their teaching, while the remaining four used it weekly or monthly. The most commonly mentioned tools included interactive whiteboards, computers, and tablets, with some also utilizing smartphones. Tools like Google Classroom¹ and Geogebra² were also mentioned. Regarding device restrictions, most teachers allow students to use devices for educational purposes or by asking explicit permission. At the same time, a minority of teachers altogether prohibited smartphones and smartwatches or granted free access to computers and tablets. All but one teacher viewed technology as at least moderately valuable for education, with one-third considering it very useful. Teachers cited benefits such as "making teaching more immediate," being a "tool for verification, deepening understanding, and discovery," and an "indispensable support." Some highlighted the ease of material sharing and the environmental benefits of reducing paper usage. One teacher emphasized the importance of education and responsibility in technology use, while some neutral comments stressed that technology cannot replace teachers.

Regarding personal digital well-being, 13 teachers characterized their technology use as healthy, four as neutral, and one as unhealthy. While only five teachers reported being very knowledgeable about digital well-being, and one-third reported adequate knowledge, their provided definitions generally demonstrated accurate understanding, mentioning concepts like addiction, balanced use, responsible usage, autonomy, and technology's role in life improvement. Only one teacher declined to provide a definition, and just two gave slightly misaligned responses. Half of the teachers expressed interest in receiving more training on the topic, with seven considering it quite helpful and two moderately useful. Teachers' assessment of students' technology use was notably more pessimistic, with 11 characterizing it as "unhealthy" and two as "extremely harmful". Only 5 considered it "neutral". Many teachers (N = 13) believed students had little knowledge of digital well-being, four thought students had "sufficient knowledge", and only one reported "adequate knowledge". Teachers unanimously supported the idea of an increased digital well-being education in schools, citing reasons such as increasing digitalization, limited risk awareness, and perceived student isolation. The proposed frequency of related activities varied widely, with monthly integration being the median and mode response. Many emphasized the need for expert involvement and collective discussion spaces.

Regarding the proposed educational app, responses were generally positive, with 3 teachers considering it "very useful", 7 "quite useful", 6 "sufficiently useful", and 2 "somewhat useful". Usage frequency predictions were evenly distributed between "less than monthly", "more than monthly", and "more than weekly", with three teachers suggesting integration into all lessons. Integration suggestions ranged from incorporation in the lessons of general subjects

¹<https://sites.google.com/view/classroom-workspace/>, visited 2025/01/23

²<https://www.geogebra.org/?lang=en>, visited 2025/01/23

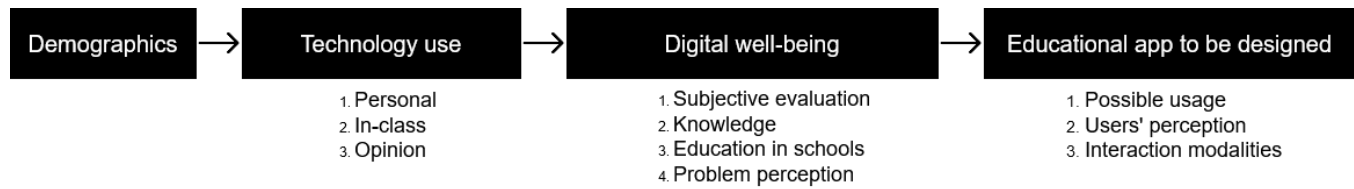


Figure 4: The structure of the questionnaires with their 4 sections.

to specific subjects like civic education, computer science, or extracurricular activities. Most teachers anticipated positive student reception, with only two predicting low interest. On technical preferences, 77.8% of teachers preferred preparing activities in advance, predominantly using computers ($N = 9$), followed by smartphones ($N = 6$) and tablets ($N = 4$). Most teachers ($N = 12$) preferred class-level customization, with 4 favoring individual student customization. For results visualization, preferences were distributed among graphical representations, textual reports, and detailed individual student performance data. While many teachers supported the idea of students viewing their own and class results for comparison, others advocated for varying levels of anonymity. Teachers generally favored cooperative approaches, although many considered also competitive or individual ones. They mostly showed positive feelings toward gamified achievement goals and in-app rewards.

3 GUIDELINES

The results of the conducted studies reveal a strong interest in digital well-being and a positive attitude toward educational apps. Students actively contributed creative ideas to their prototypes, while teachers stressed the need for greater awareness, both for themselves and their students. Some teachers perceived students' relationship with technology as problematic and highlighted the importance of integrating such tools into curricular or extracurricular activities. However, successful implementation depends on teachers' willingness to embrace technology in the classroom and let students use it.

Starting from the results of the studies, we extracted 7 guidelines that sum up the most critical aspects designers should keep in mind if they want to propose new educational approaches to digital well-being in schools. We now proceed to enumerate and explain them.

GL1. Involving digital well-being experts: Digital well-being experts should be involved in the app's design to provide activities and content that truly support students and teachers, ensuring guidance. This guideline emerged both from teachers, who expressed a need for training and support to better guide students, and students themselves, who manifested the need for informative sections in the app. Involving digital well-being experts in the design process could produce in-app material to ease teachers' guidance and students' learning.

GL2. Diversify activity types: The app should include diverse activity types, such as quizzes, storytelling, and simulations, to suit different approaches for different needs, ensuring broad learning opportunities. Student prototypes featured a variety of activities, with quizzes and surveys being the most common, and hence, they

are strongly recommended to be inserted. However, less common activities such as storytelling, simulations, and usage monitoring could further enrich engagement. A diverse range of activities can make the app adaptable to various classroom needs and teaching approaches.

GL3. Include gamification elements: Gamification elements should be included to enhance engagement and improve students' learning outcomes. Among students, gamification was well received, with 75% of prototypes including elements like points, goals, and badges. Teachers also appreciated the motivational potential of features such as in-app prizes or objectives.

GL4. Adapt to learning time constraints: The app's activities should be flexible in duration to fit different schedules and teaching contexts. Teachers varied in the amount of time they would or could allocate to digital well-being education. Some would see it integrated into regular lessons, while others saw it as separate activities. Thus, the app should be able to fit in with available time or be flexible if not known in advance if brief sessions or longer courses will be held.

GL5. Anonymity and results visibility: Allowing students to have a higher or lower knowledge of each other's results may be helpful depending on class dynamics and students' sensitivity. Teachers are to be entrusted with this choice based on their class knowledge. Different classes' dynamics can vary widely. Teachers who daily interact with students can know in advance what level of anonymity to set to foster positive learning and not counterproductive dynamics. This was reflected by the varying requested levels for anonymity in teachers' responses.

GL6. Support different learning approaches: Various learning approaches should be available, including cooperative and competitive ones. Teachers showed varying preferences regarding approaches they would like to apply. The most favorite was cooperative learning, but some teachers preferred competitive or individual methods.

GL7. Mind for technology availability: When designing the educative application, it is important to consider what devices are available to target teachers and students and consequently adapt to the case. It would be meaningless to develop an app that students should use from their PCs if they do not have any in class. It is essential to consider whether smartphones are banned for students or if teachers are not proficient with them. Teachers manifested different preferences in the devices from which they would like to use an educational app and different bans on the use of various devices by students.

These 7 guidelines can enhance the design and development of educational apps for digital well-being, pushing for more engaging

experiences and better learning outcomes. These recommendations provide a guide to help designers consider important aspects and include essential elements in digital well-being educational applications.

4 CONCLUSIONS & FUTURE WORKS

This work investigated digital well-being education through co-design workshops with students and questionnaires with teachers to understand their needs, preferences, expectations, and potential perceptions of a gamified educational app. The analysis of the collected data supports the potential of this approach and has provided valuable insights that have been translated into 7 guidelines. These guidelines will guide future development efforts and assist designers in considering key aspects to achieve better outcomes.

Based on these guidelines, we are developing an interactive educational application for digital well-being with a web-based React app for teachers, accessible from various types of devices, and a mobile React-Native app for students who are likely to have access to a smartphone with teacher permission (GL7). Both interfaces communicate with a Firebase database, serving as the unified back-end. The app is designed to be used during regular class hours without requiring dedicated courses. Hence, we offer short tasks that do not interfere with lessons and more extended exercises that are completable outside of school over days (GL4). To align with GL1, educational content, including activities, descriptions, and informative text, has been developed based on reputable expert sources. Following GL2, various activities have been incorporated, emphasizing quizzes and surveys but also including storytelling activities, group works, and monitoring features to ensure diverse engagement opportunities. Gamification elements insertion, adhering to GL3, was guided by the Octalysis gamification framework [10]. We provide badges and an in-app currency system, among others, to enhance motivation and engagement. The app offers multiple customization options, allowing teachers to adapt activity approaches (GL6) and anonymity settings (GL5). Our prototype will soon undergo field testing in classrooms to further evaluate the effectiveness of this approach for digital well-being education.

Future studies could expand to other regions to enhance and generalize the guidelines since our research was limited to the Italian school environment. Also, while our focus has been on gamification to boost engagement, other approaches might prove equally or more effective.

ACKNOWLEDGMENTS

We truly thank all the participants in our workshops and questionnaires.

This study was carried out within the “Improving digital well-being 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).

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Received 20 February 2007; revised 12 March 2009; accepted 5 June 2009