Teaching and Learning "Digital Wellbeing"

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Abstract

Nowadays, the traditional approach to supporting people's digital wellbeing is providing them with digital self-control tools that can delay or block access to websites and mobile apps. As recent works demonstrate, however, such an approach is often ineffective, and developing proper boundaries to technology (over)use is still a challenge. In this paper, we support the idea that achieving digital wellbeing is a path of personal growth that requires education rather than restrictions, and that education may foster the emergence of a new generation of designers and practitioners that considers digital wellbeing and social good. To this end, we report on the results of a case study (N=93) in an Italian university during which we measured the impacts and outcomes of a multidisciplinary course on the digital wellbeing topic. The course introduced the digital wellbeing research area from the HCI and psychology perspectives, and challenged students in the design and prototype of technological solutions respecting and promoting people's digital wellbeing. Results from the case study confirm that educational solutions may positively impact students' digital wellbeing and inspire them to prototype technologies for the social good, opening the way to exploring and establishing more sustainable design practices.

Keywords: digital wellbeing, technology overuse, attention economy, dark patterns, project-based learning (PBL).

1. Introduction

A few years ago, Google started a new campaign to *"enhance people's digital wellbeing through supporting an intentional relationship with technology"* [1]. This commitment towards supporting *digital wellbeing* is nowadays shared by other companies, e.g., Apple, and resulted in different initiatives, including introducing new tools for monitoring, understanding, and limiting technology use in operating systems [1, 2]. Unfortunately, these recent efforts are not free from contradictions, and tech companies continue to follow an advertisement-based business that incentivizes frequent and continuous usage [3, 4] – the so-called Attention Economy [5]. According to researchers working in different areas, from ethics [6] to HCI [7], truly supporting people's digital wellbeing is one of the most urgent challenges in the contemporary over-connected society. Indeed, it nowadays clear that excessive use of digital services like social networks and video streaming platforms may lead to compulsive behaviors [8] that distract users from their current tasks [9, 10], influence mental health [11] and social interaction capabilities [12], and undermine autonomy and sense of agency [13, 3]. The same final users are nowadays aware that their digital wellbeing is being threatened by passive and sometimes unconscious usage habits [14, 15], and they would like to reduce or improve their technology use [16].

For over a decade, HCI researchers and practitioners have tried to help people achieve digital wellbeing by developing and evaluating a variety of Digital Self-Control Tools (DSCTs) [17, 18]. These mobile apps or web browser extensions allow users to self-monitor technology use, e.g., through productivity dashboards, and define self-imposed interventions like usage timers and lockout mechanisms, e.g., to use Instagram for 10 minutes daily, only. Despite their popularity and ease of use, previous works warned that DSCTs might not be the right approach to support people's digital wellbeing, as they implement too simplistic intervention strategies [7, 17], they present a high risk of attrition [19], and their effectiveness decreases over time [7]. Although alternative approaches that focus on supporting a good relationship with technology without necessarily restricting it are starting to emerge [15, 20, 21], researchers also highlighted the need to explore how a better technology could be designed in the first place [22], hopefully by promoting greater awareness and involvement of end users [23, 16].

In this paper, we support the idea that digital wellbeing can be seen as a path of personal growth that requires education rather than restrictive tools [16, 24], and that education may take the role of an alternative intervention strategy that foster the emergence of a new generation of designers and practitioners that take into account digital wellbeing and social good. In particular, we investigate the possibility and effectiveness of *teaching* (and *learning*) digital wellbeing through a novel, multidisciplinary university course called "Benessere Digitale[1]." Our approach – through which we challenge students in envisioning innovative digital technologies – can be seen as a practical strategy to collaboratively solve a societal problem, represented by the negative impacts of the contem-

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[1] "Benessere digitale" is the Italian translation of *digital wellbeing*.

porary Attention Economy, while envisioning new sustainable business models in the field of digital services like social media and video-streaming platforms. Specifically, we explored the following research questions:

RQ1. Does taking a course on digital wellbeing impact students' digital wellbeing?

RQ2. How do students tackle digital wellbeing problems, and which technological solutions do they envision?

We designed the "Benessere Digitale" course stemming from our research activities in the digital wellbeing context [7, 16, 4, 18] and existing frameworks and resources available on the web [25, 26], by involving a multidisciplinary group of HCI experts and psychologists. The course aims at providing the fundamentals for avoiding or, at least, minimizing the negative aspects deriving from the contemporary Attention Economy. In detail, it introduces students to digital wellbeing and gives them practical and conceptual methods for investigating and facing the impact of technology on people's wellbeing. Such methods are presented both from a psychological and technical point of view, with students learning about technology's impact on their wellbeing and society at large. Besides theoretical lessons, the course adopts a project-based learning approach: students, divided into multidisciplinary groups, are asked to design and prototype technological solutions that respect and promote people's digital wellbeing.

We conducted a case study at the Politecnico di Torino, Italy, by delivering "Benessere Digitale" as an elective course for all the students enrolled in the second and third year of the Bachelor's degree. The course involved 93 students with different backgrounds enrolled in different degrees, from computer engineering to design and architecture. To evaluate whether attending "Benessere Digitale" impacted students' digital wellbeing and how they use their devices (**RQ1**), we asked them to complete a questionnaire at the beginning and end of the course. The questionnaire contained two state-of-the-art scales that are typically used to measure people's digital wellbeing, i.e., the Smartphone Addiction Scale [27] and the General Self-Efficacy Scale [28]. Along with qualitative feedback collected at the end of the course, results highlighted an effect of the course on students' self-perceived sense of digital wellbeing: attending the course, in particular, significantly impacted students' self-perceived smartphone addiction and self-regulation capabilities, thus demonstrating the effectiveness of using education as a novel intervention strategy to support digital wellbeing. Furthermore, during the course, students successfully cooperated to produce different low-fidelity (Figure 1a) and high-fidelity (Figure 1b) prototypes of digital wellbeing solutions, from redesigned versions of current social networks like Instagram to novel applications to support study sessions. The solutions envisioned by the participants aimed at solving the drawbacks of contemporary DSCTs from different perspectives, thus demonstrating that educational solutions may function as a strategy to start collaboratively solving the societal problems brought by the Attention economy, inspiring students in efficiently tackling digital wellbeing problems and proposing innovating digital technologies (**RQ2**). The solutions proposed by the students, in particular, could serve as a foundation for inspiring researchers and practitioners working in the field of *designing for digital wellbeing* [29, 30], a vision according to which digital wellbeing should be taken into account at *every stage of the design process* of a digital service [22].

Overall, our study confirms that educational solutions may be a viable alternative to traditional DSCTs and restrictive solutions to promote the digital wellbeing of future generations and demonstrate the importance of involving end users in the design of better technology that respects and preserves people's attention and time.

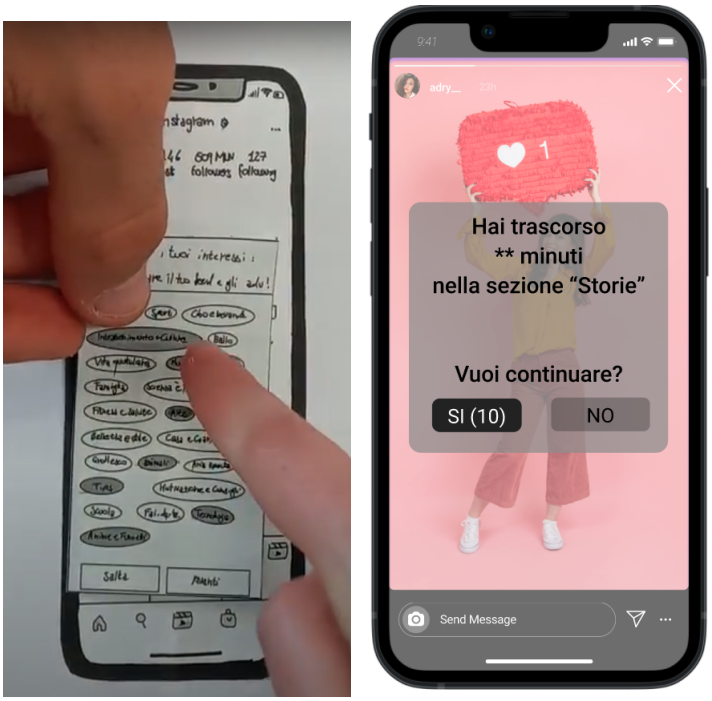
2. Background and Related Work

2.1. Digital Wellbeing

The contemporary Attention Economy makes users think they can use digital services for free, while in reality, they pay with their attention and time spent on the platform [31]. Unfortunately, researchers have demonstrated that such a controversial business model can harm people's sense of agency [3] and self-control [13]. Users, in particular, are often biased to use their digital devices unconsciously [15] and passively [32] by tech companies through the use of "attention-capture damaging patterns" [33]. These design patterns, e.g., infinite scrolling and content autoplay, deliberately exploit people's psychological vulnerabilities to assert control over users' behaviors and digital habits, aiming to maximize the time users spend on digital services like social networks and video-streaming platforms. The same final users are sometimes of the threats brought by these patterns to individual and societal digital wellbeing, as recently demonstrated by the study of Monge Roffarello and De Russis [16] on digital wellbeing in multi-device settings.

Overall, several previous works have demonstrated that overusing technology may (negatively) interfere with people's mental health [11] and social interaction capabilities [12]. Researchers, for example, have shown the potential for technology to become a source of external distractions [34] and self-interruptions [35] that interfere with current tasks like studying and working, making users less productive [36] and more stressed [37]. Given this body of evidence and a growing discussion on mainstream media [38, 39], it is not surprising that terms like "compulsive use [8]," and "tech-addiction[2] [41]" have gained momentum in the common debate. Furthermore, a new kind of psychological *digital wellbeing* has been defined by researchers in different areas, from ethics [6] to HCI [7, 29], and adopted by tech companies in some of their campaigns [1]. In general, digital wellbeing can be defined as *"the impact of digital technologies on what it means to live a life that is good for a human being in an information society"* (Burr et al. [6], p. 2313). In our work, we adopt a narrower definition of digital wellbeing by referring to the growing body of literature [7, 3, 4]

[2] Although addiction has been associated to technology use by several studies, its relationship with technology is currently debated (see the work of Lanette et al. [40]).



(a) (b)

Figure 1: Examples of low-fidelity (a) and high-fidelity (b) prototypes of a new version of the Instagram social network proposed by a group of students during the first edition of the *Benessere Digitale* course. Students envisioned the possibility of having more control over the visualized posts and stories, e.g., by specifying preferred topics and categories (a), and embedded self-regulation tools in the interface, e.g., a usage timer for Instagram’s stories (b).

associating digital wellbeing with using digital technologies intentionally and for the right amount of time without being overwhelmed by the psychological manipulations of the Attention Economy.

2.2. Supporting Digital Wellbeing

Stemming from *AppDetox* [42], a mobile application through which users can create rules to avoid using specific apps, HCI researchers have tried to support people’s digital wellbeing through the so-called Digital Self-Control Tools (DSCTs) [17, 18], i.e., dedicated mobile apps or web browser extensions that allow users to self-monitor technology use and manually define interventions like usage timers and lockout mechanisms. *MyTime* [43], for example, is a mobile application that allows users to monitor the time they spend on specific apps and the number of visits by allowing them to set up daily time limits. *Let’s FOCUS* [44] is a mobile application through which users can enter a “virtual room” where specific apps are blocked and notifications are muted. *LocknType* [45] is a mobile app that makes users complete lockout tasks before opening distraction applications. Similarly, *TypeOut* [46] is a just-in-time intervention technique that introduces an additional interaction cost to decrease the value of mobile apps use, asking users to complete sentences, e.g., *“I could put down my phone and [...]”*, when a target app is being launched. A similar approach has been explored by Terzimehić et al. with their *MindPhone*. In parallel, many DSCTs are now available in digital stores like Google Play and Apple App Stores. Similar tools have been inserted in the mobile operating systems of Google [1] and Apple [2].

Despite their popularity and ease of use, some researchers have started to warn that traditional DSCTs are contradictory by nature [3, 18] – as they are a technology to disincentivize the usage of other technologies – and may not be the right approach to support people’s digital wellbeing. One of the main limitations of these tools lies in their self-monitoring nature [7]: users (alone) need to constantly monitor and use DSCTs in order to progress and maintain newly acquired behaviors, e.g., using Instagram no more than 10 minutes per day, and any discontinuity in the use of the tool typically make users come back to the old behaviors. In other words, a traditional DSCT cannot assist users in creating new habits that persist beyond the tool [17], and its effectiveness is limited to the short term only, as the user’s motivation in using DSCTs is likely to decrease over time [19]. Another limitation can be found in the intervention strategies adopted by DSCTs, which are rather simplistic [7, 17]. A usage timer, for example, can indiscriminately block the user’s interaction, e.g., by blocking the usage of an app for the rest of the day, without considering the user’s context and usage intention. As a result, users often hold unreasonable expectations about interventions, and the settings of their DSCTs may not match their expectations, thus increasing the risk of abandoning the tool [19].

Stemming from these findings, researchers started to investigate alternative methods for digital self-control. Terzimehić and Aragon-Hahner [21], for example, investigated the possibility of suggesting users pursue desired real-world activities instead of (over)using the smartphone and then experiencing

feelings of regret. Such a possibility has been practically implemented by some recent attempts of developing proactive and smarter DSCTs: *Socialize* [15], for example, analyzes usage behaviors and notifies smartphone habits to the users, allowing them to define alternative intentions that are linked to specific contexts. With similar goals, i.e., promoting real-world activities without necessarily restricting mobile technology use, Genç et al. [20] developed *WHISPER*. This audio narrative box can play pre-recorded stories to enrich collocated social interactions during lulls in the conversation. Instead, Haliburton et al. [47] developed and tested a physical prototype – consisting of a box for the device with a sliding cover – to tackle absent-minded smartphone use at bedtime.

Despite these efforts, how to design solutions that promote and support people's digital wellbeing remains a challenge. Researchers, in particular, highlighted the need for technology that respects people's digital wellbeing *by design* [29, 30]. The underlying goal of such an approach is to develop new processes and best practices that consider digital wellbeing and meaningful interactions at every stage of the design process [22], by involving end users – i.e., the subjects that experience first hand the problems brought by the Attention Economy – in the same process [23, 16]. To achieve this vision, we support the idea that achieving digital wellbeing can be seen as a path of personal growth that requires *education* rather than (often restrictive) tools for digital self-control [16]. To this end, we present a university course on digital wellbeing and investigate its effectiveness in influencing students' digital wellbeing and inspiring novel technological solutions through a case study conducted at the Politecnico di Torino, Italy. An educational course on digital wellbeing may deepen our understanding of how students tackle the problems related to the contemporary Attention Economy. At the same time, it may foster the emergence of a new generation of designers and practitioners that consider digital wellbeing and social good. We decided to target university students since they are one of the populations that are most susceptible to problems like smartphone overuse [48], online stress and multitasking [37], and lack of self-control on social networks [49].

3. The "Benessere Digitale" Course

In this Section, we detail the design of "Benessere Digitale", i.e., the university course through which we explored the potential impacts of education on students' digital wellbeing and students' attitudes in tackling digital wellbeing problems and designing related solutions.

3.1. Course Design and Learning Objectives

The digital wellbeing topic has two primary coexisting natures, one more technical – related to the use of digital technologies – and one more related to people's wellbeing and mental health. *Benessere Digitale* has been designed as a multidisciplinary container to include both visions. To this end, two groups were involved in the design of the course:

POLITO: the POLITO group was composed of an assistant professor and a post-doc researcher (the two authors of this paper) coming from the Department of Control and Computer Engineering of the Politecnico di Torino[3], one of the leading technical universities in Italy. The POLITO group has a technical background with research and educational experience in HCI and digital wellbeing. Both the components of the group authored several publications related to digital wellbeing and digital self-control tools, e.g., [7, 16, 15] and organized a research workshop on the same topics [30].

UNITO: the UNITO group was composed of two associate professors of the department of psychology of the Università Degli Studi di Torino[4]. The UNITO group has a psychological background with research and educational experience in work and organizational wellbeing. The components of the group authored several research papers analyzing the relationships between technology use and people's digital wellbeing, e.g., [50, 51], and held a course on the topic of digital disconnection[5].

The main learning goals of the course are the following:

- knowing and understanding the fundamentals of the digital wellbeing topic from both an engineering-technological and a psychological-social perspective;
- being able to compare and use different methodologies to investigate and address issues related to the digital wellbeing topic;
- designing solutions to avoid/minimize any negative aspects deriving from habitual and excessive use of digital devices and online services;
- applying the acquired knowledge in project work within an engineering group.

As detailed in Section 3.2.1, the course was designed to include three main modules, i.e., Introduction, Threats, and Strategies, each including technical and psychological lessons and topics, respectively. The underlying idea for the theoretical part of the course is that increasing students' awareness on digital wellbeing threats and on contemporary strategies to support it has the potential to quantitatively impact students' own digital wellbeing (**RQ1**). Furthermore, we leveraged a Problem-Based Learning (PBL) approach, defined as *"learner-centered approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem"* (Savery [52], p. 9). The course, in particular, has been designed to adopt an extended form of PBL that combines project

[3] `https://www.polito.it/`, last visited on August 6, 2022.

[4] `https://www.unito.it/`, last visited on August 6, 2022.

[5] `https://comunicazione.campusnet.unito.it/do/corsi.pl/Show?_id=s9km`, last visited on August 6, 2022.

and team-based learning [53] with theoretical lectures and assignments. This practice has been adopted and successfully experienced in different university courses, e.g., [54, 55, 56, 57]. As detailed in Section 3.2.2, the course challenges groups of students to work together and find a solution to a problem – i.e., a technological solution that respects and promotes people's digital wellbeing – by applying well-known methodologies adopted in psychology, design, and HCI. The underlying idea for the laboratory part is to provide students with an environment and a set of tools to collaboratively solve a societal problem, i.e., the negative impacts of the contemporary Attention Economy, through the design of innovative technological solutions (**RQ2**). No prerequisites are required to follow the course, as each project step includes basic theoretical and practical notions about the methodologies to be applied and tools to be used. All the materials used in the course (in Italian) can be found at the following link: `https://elite.polito.it/teaching/01del-benesseredigitale`.

3.2. Course Overview

3.2.1. Theoretical Lessons

Table 1 summarizes the theoretical topics covered in the *Benessere Digitale* course. The course includes psychological and engineering lessons and is organized into three main modules, i.e., introduction, threats, and strategies.

Module 1: Introduction. The first module provides students with the foundations of the digital wellbeing topic. It starts with an introduction of theoretical concepts and constructs used in psychology to define wellbeing in general, especially in the context of studying and working environments (Table 1, psychological perspective, first row). To this end, the job/demand/support model [58, 59, 60] is used as a reference. The model incorporates a wide range of working conditions in analyzing organizations' and employees' wellbeing. It focuses on adverse outcomes, e.g., burnout, and positive indicators, e.g., engagement and commitment. Then, the module moves toward "digital" wellbeing by showing how researchers, especially in HCI, have defined this particular kind of wellbeing in their studies (Table 1, engineering perspective, first row). Different definitions and visions are proposed and analyzed, from the generic one by Burr et al. [6] to the ones more related to technology overuse and addiction, e.g., [7, 3, 4]. The goal is to make students come out with their own definition of digital wellbeing. Furthermore, the introductory module describes how digital wellbeing can be measured according to previous studies and experiments. It highlights the limits and inaccuracies of measuring digital wellbeing through screen time, only [61, 62, 18], and it details different state-of-the-art scales that have been used to measure people's self-perceived digital wellbeing, e.g., the Internet Addiction Test [63], the Smartphone Addiction Scale [27], and the General Self-Efficacy Scale [64].

Module 2: Threats. The second theoretical module dig into the problems that threaten the digital wellbeing of individuals and society. From the psychological point of view (Table 1, psychological perspective, second row), the module details how technology use can undermine students' and workers' (digital) wellbeing. It highlights the difference between workaholism e work engagement and how technology affects them. Work engagement and workaholism, in particular, are two different kinds of wellbeing [65], with the latter being related to different adverse outcomes, including difficulties in communication and burnout [66, 67]. Technology has indubitably an essential role in workaholism. Theoretical psychological lessons of the second module explain how the relationship between workaholism and ICTs, by referring to the phenomenon of technostress, i.e., *"the phenomenon of stress experienced by end users in organizations as a result of their use of ICTs"* [68]. Furthermore, particular attention is posed to show how excessive use of technology (negatively) affects remote working, especially after the COVID-19 pandemic. From a technical point of view (Table 1, engineering perspective, second row), the module focuses on the Attention Economy [5] and the negative impacts of this business model on people's digital wellbeing, e.g., distractions [36], tech-addiciton [41], and mental health problems [11]. In particular, the module presents the attention-capture damaging patterns [3, 4, 33] employed by current digital services, e.g., infinite scrolling and content autoplay, by using examples, screenshots, and videos. Furthermore, it highlights what people's psychological vulnerabilities are exploited by these dark patterns, e.g., variable reward schemes [69] and interface interferences [70]. It also explains how they affect and shape technology use, e.g., by promoting endless usage sessions [71].

Module 3: Strategies. The final theoretical module aims to give students the tool they need to face and contribute to the current "race towards digital wellbeing [7] by introducing what strategies have been used in the past and what their advantages and limits are. To this end, psychology lessons (Table 1, psychological perspective, third row) first focus on the importance of analyzing and considering individual differences. In particular, the module provides the students with basic information on different personality traits and cognitive styles, from the locus of control to self-efficacy and self-concept, that need to be considered when thinking about digital wellbeing solutions. Then, the module addresses how well-known strategies like coping, i.e., a variable cognitive and behavioral effort to handle specific demands that challenge the person's resources [72], can be influenced and applied in the context of technology use. Furthermore, it explores how recovery and the right to disconnect are essential to preserving people's wellbeing. The technical lessons of the module (Table 1, engineering perspective, third row) finally introduce the different solutions that have been used by the computing and HCI literature to support people's and societal digital wellbeing, by using the framework of Leverage Points for how to intervene in the extractive tech ecosystem proposed by the Center for Humane Technology [25]. The framework highlights how researchers and stakeholders can act at different levels, from changes to the platforms to cultural and economic changes, to overcome the different problems brought by the contemporary Attention Economy. In particular, the module details the field of Digital Self-Control Tools by showing

Table 1: The theoretical part of the *Benessere Digitale* course in a nutshell. Theoretical lessons mix two perspectives, i.e., psychological and engineering, and are organized into three modules: introduction, threats, and strategies.

Module	Psychological Perspective	Engineering Perspective
Introduction	Wellbeing in general Wellbeing for students and workers Job/demand/support model	Digital wellbeing definitions Digital wellbeing measures Digital wellbeing scales
Threats	Workaholism & work engagement Techno-stress Remote working & wellbeing	Attention Economy Attention-capture dark patterns
Strategies	Individual differences Personality traits and cognitive styles Coping strategies, recovery, and right to disconnect	Leverage Points framework Digital Self-Control Tools Radical changes, policies, and regulations

their limits and how researchers are trying to introduce more intelligent and proactive support into them [73]. Furthermore, the module highlights that more radical changes are needed to align technology with people's digital wellbeing by introducing recent initiatives to develop guidelines, policies, and regulations for the digital wellbeing area [74, 75].

3.2.2. Laboratory and Project

Figure 2 summarizes the laboratory part of the *Benessere Digitale* course. In this part, students work in multidisciplinary groups and develop a project with the supervision and feedback of the teachers. The project concerns the idealization, design, and prototyping of a technological solution that respects and promotes people's digital wellbeing. Students can think about different solutions, from redesigned social networks to novel DSCTs, without any particular constraints. The project's development is divided into four exercises representing consecutive and incremental design steps,i.e., journey map, needfinding, low-fidelity prototyping, and high-fidelity prototyping. Before each step, theoretical and practical notions about methodologies and tools to be used are introduced to the students. Prior to the high-fidelity prototyping step, in particular, students are a 1-hour hands-on tutorial about Figma.

After each step, each group is required to hold an intermediate (or final, in the case of the last step) oral presentation. Teachers can therefore give students detailed feedback on their group project, and students can use this feedback to improve their solutions step-by-step.

Step 1: Journey Map. The course project starts with a laboratory exercise during which student groups produce a collective journey map on technology use and digital wellbeing (Figure 2, 1). A journey map is a UX tool to graphically visualize an individual's process to accomplish an objective [76]. The first step when producing a journey map is identifying a set of actions (by one or more actors) and their temporal relationships. The temporal sequence of actions is then enriched with users' thoughts and emotions to create a narrative. The narrative is finally condensed and polished into a visual diagram. In the context of the course, students are asked to think about their typical day, from when they wake up to when they go to sleep, and to reflect on the relationships between their typical technology use and digital wellbeing. A set of open-ended questions guides this reflection. An example of questions used in the case study reported in Section 4 is the following:

- Where/how did technology come into play during your day?
- How did you interact with it?
- At what times was technology helpful?
- At what times was technology not useful or distracting to you?

All in all, the outputs that should emerge from the journey map are the following:

- a category of digital services on which to focus the project;
- the target users for the project;
- the contexts in which the project will operate;

Step 2: Needfinding. The second step of the project (Figure 2, 2) is a needfinding process to validate the choices made in the first exercise and extract the specific needs of the target users in the contexts and for the category of services selected. Needfinding is defined as a human-centered design process to understand system requirements and user needs [77]. Besides user needs, the process is essential to delineate further who the users are, in which context(s) they operate, and how they accomplish their activities and goals. Different tools and methodologies can be used to conduct a needfinding process. Examples include observations, surveys, interviews, and focus groups. Depending on the tool, collected data can be analyzed with different methodologies, from qualitative methodologies like template analysis [78] to quantitative and statistical methods. In the context of the course, the exercise requires the group of students to:

- select and design one or a combination of needfinding methods;
- define a set of specific research questions to be investigated;

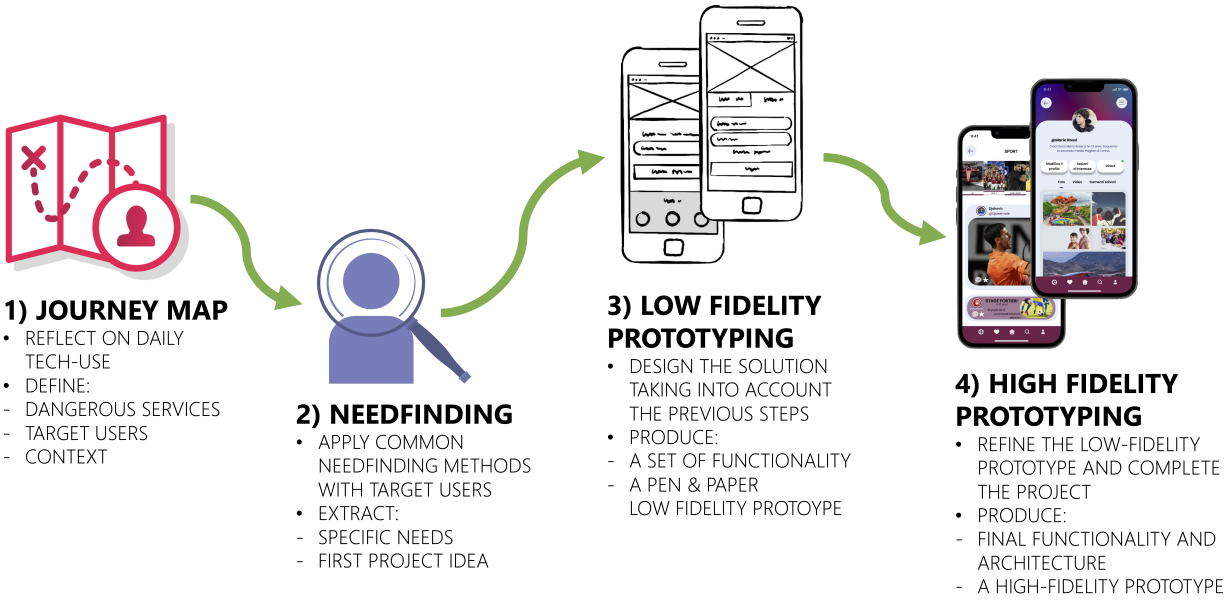


Figure 2: The laboratory part of the *Benessere Digitale* course. Students are asked to complete a project concerning a technological solution that respects and promotes people's digital wellbeing in four consecutive and incremental steps,i.e., journey map, needfinding, low-fidelity prototyping, and high-fidelity prototyping.

- recruit a (small) sample of target users and conduct the needfinding process;
- analyze the collected data through qualitative or quantitative techniques.

The outputs of the needfinding phase should be the following:

- a list of specific needs extracted from the target users;
- a qualitative description of how the project will address the identified needs.

Step 3: Low-fidelity Prototyping. After the journey map and the extraction of user needs, the third exercise (Figure 2, 3) is a paper & pen prototyping activity. A prototype is a tangible approximation of the behavior and appearance of the system that allow a quick evaluation and exploration of various design decisions [79]. Paper prototypes, in particular, are hand-drawn mock-ups of the user interface (usually) on multiple sheets of paper of varying sizes and are defined as low-fidelity. The fidelity of a prototype refers to how it conveys the look and feel of the final product. Low-fidelity prototypes are used to test the functionality of a product rather than its final appearance. They include only some (drawn) elements of the visual interface, and the interaction is simulated by a user. They are typically helpful in the early design stages as they are inexpensive and fast and can be easily produced collaboratively, even by non-technical people. In the course exercise, students groups are asked to translate users' needs and ideas extracted in the second exercise into the following outputs:

- a list of functionality that the project should implement;
- a paper & pen prototype of the project with its basic functionality.

Step 4: High-fidelity Prototyping. The final step of the project (Figure 2, 4) concerns the development of a high-fidelity prototype. Unlike low-fidelity prototypes, high-fidelity prototypes look like the real system, with a final-looking layout, colors, and graphics. These prototypes are also typically interactive, meaning that users can perform basic operations by directly manipulating the artifact, e.g., clicking on an icon. While they are more expensive to build and require more time to deal with graphic design, high-fidelity prototypes convey an accurate idea of how the system works and can be used to effectively demonstrate and present a project. As digital wellbeing research mainly focus on graphical user interfaces, the course provide students with tutorials and hands-on sessions on tools to create (digital) high-fidelity prototypes of web and mobile applications. In particular, students follow a 1-hour hands-on tutorial about Figma [80]. Besides Figma, users are also free to use open-source electronics platforms like Arduino [81] to prototype more complex systems with different hardware and physical components. Overall, stemming from the outcomes of the previous steps, each students group should produce the following in the final project step:

- a detailed summary of the functionality implemented by the project and architecture of the envisioned system;
- a high-fidelity interactive prototype of the project.

4. Case Study: The 2022 Edition

In this Section, we report on a case study during which we implemented the *Benessere Digitale* course in an Italian university. Through the study, we were interested in understanding whether *Benessere Digitale* can be an effective alternative strategy to support students' digital wellbeing (**RQ2**) and, at the

Table 2: Distribution of students across degree programs for the 2022 edition of the *Benessere Digitale* course.

Degree program	**Students #**
Management Engineering	33
Computer Engineering	21
Telecommunications Engineering	13
Cinema and Media Engineering	8
Mechanical Engineering	8
Aerospace Engineering	6
Electrical Engineering	5
Chemical and Food Engineering	2
Energy and Nuclear Engineering	2
Materials Engineering	1
Mathematical Engineering	1
Construction Engineering	1
Physical Engineering	1

same time, a strategy to empower students to collaboratively contribute to the "race towards digital wellbeing [7]" and propose innovative technological solutions respecting users' attention and time (**RQ2**).

4.1. Participants

We proposed *Benessere Digitale* as a 6-credit[6] elective course offered to all students enrolled in the second and third years of the bachelor's degree program at Politecnico di Torino, Italy. The first edition of the course was held in 2022 and had 102 enrolled students (44 female and 60 male) with an average age of 21. Table 2 summarizes the distribution of the students across degree programs. The majority of them came from Management Engineering (32,36%), Computer Engineering (20,58%), Telecommunications Engineering (12,74% of students), Cinema and Media Engineering (7,84%), and Mechanical Engineering (7,84%). The variety of involved degree programs ensured that students had different points of view on topics like digital wellbeing and attention economy. Students independently formed 13 multidisciplinary groups able to deal with a project from different perspectives and with different skills.

4.2. Course Details

The 2022 edition of the course spanned 14 weeks in the second semester (March-June), with an average of three 90-minute classes per week. The distribution of theoretical and practical lessons was carefully planned and split between POLITO and UNITO teachers to emphasize the course's multidisciplinary nature. In particular, a higher density of theoretical lessons was provided in the first half of the course, when students needed to learn about digital wellbeing. In contrast, a higher frequency of laboratory sessions characterized the second half of the course. Students were encouraged to interact with teachers during theoretical lessons through open discussions and exercises. In particular, we conducted a collaborative session in Padlet [7] asking students to provide their own definition of digital wellbeing. The course's main modules (introduction, threats, and strategies – see Section 3.2.1) were alternated with theoretical lessons on methodologies and tools needed to conduct the laboratories, i.e., needfinding methods, analysis of needfinding data, and prototyping strategies and tools. Laboratories were organized as supervised work sessions. At the beginning of a given project step, student groups received some basic instructions and constraints to be respected. For example, in the needfinding laboratory, we asked students to involve at least five users if they selected interviews as the target methodology or 20 users if they decided to use a survey. Then, students could work together by asking questions and feedback to the teachers as needed. To help students deal with the engineering and psychological perspectives, all the laboratories – including the most technical ones – had in-class sessions with POLITO and UNITO teachers. After each project step, student groups held intermediate presentations (10 minutes, with slides) and received step-by-step feedback to improve their project. In the final presentation, i.e., the exam, student groups were required to give a 15-minute presentation summarizing all the steps of their projects and including a live prototype demo.

4.3. Measures

We adopted several measures to answer our research questions.

First, we used a *satisfaction questionnaire* completed at the end of the course to investigate whether students appreciated the course and to provide further evidence on the validity of our findings. As for all the courses at Politecnico di Torino, such an anonymous questionnaire contained 16 questions on a four-point response scale (from 1 - *definitely no* to 4 - *definitely yes*) and a free area for comments and suggestions. Closed questions were organized in the following thematic areas: teaching organization, teachers' effectiveness, and interest and satisfaction.

To measure the impacts of *Benessere Digitale* on students' digital wellbeing (**RQ1**), we asked students to complete twice, at the beginning and end of the course, an *impact questionnaire* that included two different state-of-the-art scales relating smartphone use to digital wellbeing problems. The goal was to understand whether attending the course impacted how students perceived their digital wellbeing. We decided to focus on smartphones given their popularity and ubiquitousness and because they have been found to be a source of distraction, compulsive habits, and digital wellbeing problems by several previous works, e.g., [48, 11, 8]. The scales included in the questionnaire were the following:

[6] In Italian universities, a credit corresponds to 25 hours of required student engagement, including lessons, laboratories, and personal study hours

[7] `https://padlet.com/`, last visited on August 9, 2022.

Smartphone Addiction Scale. The Smartphone Addiction Scale (SAS) [27] is a self-diagnostic scale to evaluate smartphone addiction using self-reporting. It is composed of 33 questions with a six-point Likert scale that are divided according to 6 factors that can be influenced by smartphone usage: daily-life disturbance, positive anticipation, withdrawal, cyberspace-oriented relationship, overuse, and tolerance. SAS is validated for different countries, ranging from USA [82] to Italy [83] and Spain [84], and has been used in several papers around the digital wellbeing topic, e.g., [85, 86, 7, 87]. In our course, we used the Short Version of the Smartphone Addiction Scale (SAS-SV [88]), a specialization of the Smartphone Addiction Scale for young adults consisting of 10 questions.

General Self-Efficacy Scale. The General Self-Efficacy Scale (GSE) was originally developed by Jerusalem and Schwarzer [28] as a 10-item psychometric scale to assess optimistic self-beliefs and perceived self-efficacy to cope with daily activities and isolated stressful events. Over the years, it has been revised and adapted to more than 25 languages, thus becoming a universal construct [89], and has been used multiple times to relate self-efficacy and technology use [87, 7]. In the course, we used the GSE adopted in [7] to measure students' confidence in self-regulating smartphone use.

To measure the impacts of *Benessere Digitale* on students' attitudes in tackling digital wellbeing problems and designing related solutions, we analyzed the quality and comprehensiveness of the outcomes of the exercises conducted during theoretical lessons and of the developed projects. Regarding the projects, in particular, we qualitatively explored how students tackled digital wellbeing problems and how they developed solutions to mitigate these problems, linking students' outcomes to the digital wellbeing literature (**RQ2**).

4.4. Results

4.4.1. Students Satisfaction

To initially investigate whether the students appreciated the course and provide evidence for the validity of our findings, we analyzed the responses to the course's *satisfaction questionnaire* administered at the end of the course. The response rate to the questionnaire was 30%, in line with the last available data of the Politecnico di Torino [90]. Students were highly satisfied with all the evaluated aspects of the questionnaire, i.e., teaching organization, teachers' effectiveness, and their own interest and satisfaction, with the overall teaching satisfaction rate being 93,24%. Table 3 reports the percentage of students who were satisfied (scoring 3 - *yes* or 4 - *definitely yes*) across the questions more related to the quality of the course. All the percentages are well above the average last available data at the university level [90].

Students confirmed their enthusiasm toward the course in the questionnaire's free comments, and provided several suggestions to improve future course editions. To summarize, students asked for a better and stronger link between the engineering and psychological perspectives, as sometimes the connection between the different topics was unclear.

4.4.2. Impact on Students' Digital Wellbeing

We analyzed the responses to the *impact questionnaire* to understand whether the course had a (measurable) impact on students' digital wellbeing (**RQ1**). Overall, 47 students out of 93 answered the questionnaire at the beginning of the course and after its end (response rate = 46,08%). Figure 3 shows that attending the course significantly impacted both the students' self-perceived smartphone addiction (Figure 3a, Smartphone Addiction Scale) and self-efficacy (Figure 3b, General Self-Efficacy Scale).

At the beginning of the course, the impact questionnaire revealed an average SAS score[8] across all the students of 33,14 (SD = 4.35). At the end of the course, the average SAS score decreased to 30.25 (SD = 6.56). A paired t-test confirmed that this reduction was statistically significant (p ¡ 0.05), thus confirming that attending the course mitigated the students' self-perceived level of smartphone addiction. A significant impact also characterized the GSE scale. The initial average GSE score[9] was 27,87 (SD = 4,24). At the end of the course, the average GSE score increased to 30,51 (SD = 4,59). A paired t-test confirmed that this reduction was statistically significant (p ¡ 0.05), thus confirming that students were more confident in their self-regulation capabilities after attending the course on average.

4.4.3. Digital Wellbeing According to the Students

To initially investigate how the course influenced students in tackling digital wellbeing problems (**RQ2**), we performed a thematic analysis with the Taguette tool [10]on the definitions of digital wellbeing provided by the students during the course. Students mainly defined digital wellbeing as a *mental and physical condition* that is linked to technologies that are *beneficial* for the user and can *augment* its daily activities. According to a student, in particular, *"digital wellbeing is promoted by a technology that benefits the user and makes daily activities easier."* Having a technology that better aligns with people's needs and digital wellbeing is fundamental. However, according to the students, users need to find a *balance* between their online and offline worlds, thus establishing a *good relationship* with their digital devices and services. Students said that *"digital wellbeing is an effective, healthy, and fruitful relationship between humans and technology,"* and that achieving digital wellbeing means *"establishing a healthy and educational relationship with the digital world so that the user can take advantage of the benefits it offers."* Thus, the digital wellbeing challenge must be shared among tech companies and final users: the former have a responsibility to avoid the use of *persuasive and ad-*

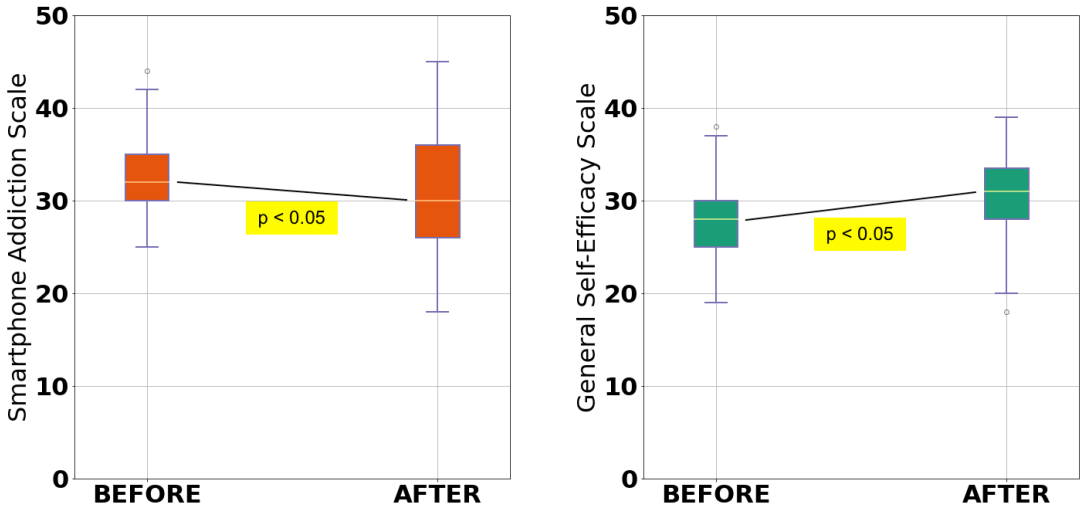
[8]The SAS score represents the sum of the scores of the individual questions included in the scale.

[9]The GSE score represents the sum of the scores of the individual questions included in the scale.

[10]`https://www.taguette.org/`, last visited on August 09, 2022.

Table 3: The percentage of students who were satisfied (scoring 3 - *yes* or 4 - *definitely yes*) across a restricted set of questions included in the course's satisfaction questionnaire.

Category	Question	% of satisfaction
Teaching organization	I achieved the expected learning outcomes	100%
	Learning material is adequate	100%
	Laboratories are useful for learning	97%
	Theoretical lessons are useful for learning	97%
Teachers effectiveness	The collaboration between teachers is useful	93%
Interest and satisfaction	I am interested in the topics of the course	93%
	I am satisfied by this course	97%



(a) SAS (b) GSE

Figure 3: The average SAS (a) and GSE (b) scores at the beginning (BEFORE) and end of the course (AFTER). Attending the course significantly impacted students' self-perceived smartphone addiction and self-regulation capabilities.

dictive technology, the latter need to learn how to use technology *intentionally* and *consciously*. According to the students, in particular, digital wellbeing is *"the ability to take advantage of technology positively and constructively without being overwhelmed by it,"* therefore requiring a *"conscious, intentional and balanced use of digital devices and their services."*

4.4.4. Developed Projects

To investigate how *Benessere Digitale* informed students in designing and prototyping digital wellbeing solutions (**RQ2**), we analyzed the 13 projects developed during the 2022 edition of *Benessere Digitale* (see Table 4 for a summary). All the groups successfully completed their projects, from the initial choices of the journey maps to the final high-fidelity prototypes, by integrating the step-by-step feedback received during the intermediate presentations. We were particularly surprised by the outcomes of the needfinding project step. Students involved a total of 975 participants in their needfinding processes, with an average of 75 participants per group. The majority of the groups decided to use a questionnaire to extract the specific needs of their target users, e.g., by sharing a Google Form. The choice was motivated by the ease of use and administration of these tools, especially given the available short time (roughly two weeks). Interestingly, six groups (*ZERO*, *Welfare State*, *Math-erassi*, *JOMO*, *Biancaneve e i 7 nani*, and *3D-4I*) adopted a 2-step needfinding process, by combining a questionnaire with a series of interviews. As shown in Table 4, target users were nearly always university students. While the choice of this category reflects the typical target users involved in studies of the digital wellbeing research area, it also highlights a limitation in the recruiting processes adopted by the students. A notable exception is the *ZERO* group, which conducted its 2-step needfinding process with parents and children.

As shown in descriptions of the projects reported in Table 4, no groups decided to explore and design a standalone DSCT, thus demonstrating that students understood the problems and contradictions that characterize these technologies. Rather, projects ideas can be classified into two main categories:

Redesigned Services. As shown in Table 4, nine groups (*ZERO*, *Welfare State*, *SAI*, *Math-erassi*, *JOMO*, *Digital-Salus*, *BelliCosì*, *BD8*, and *3D-4I*) decided to take an ex-

Table 4: A description of the projects developed during the 2022 edition of the *Benessere Digitale* course.

Group	Needfinding	Project Description
ZERO	Interviews (N = 10) Questionnaires (N = 48) Target: children and parents.	An enhanced TikTok version with community-based parental control features and a DSCT with an avatar to notify TikTok users when they spend too much time on the platform.
Welfare State	Questionnaires (N = 68) Interviews (N = 8) Target: university students.	A new mobile app for Snapchat that prioritizes online and face-to-face interaction with close ties, e.g., through memories and map features.
SAI	Interviews (N = 10) Target: university students.	A redesigned version of Instagram with integrated DSCTs, ads-management features, and the possibility to filter posts with preferences and preferred topics.
Math-erassi	Questionnaires (N = 118) Interviews (N = 7) Target: university students.	A redesigned version of Instagram with integrated DSCTs, fake-news detection mechanisms, and post-management features.
JOMO	Interviews (N = 9) Questionnaires (N = 200) Target: university students.	A new mobile app for WhatsApp that provides users with more control over important messages and privacy and better and flexible management of notifications.
Gruppo Magic	Questionnaires (N = 61) Target: university students.	A generic social media for teenagers that focuses on security and educational aspects by encouraging socialization and prioritizing cultural and educational content.
DigitalSalus	Questionnaires (N = 62) Target: university students.	A redesigned version of Instagram that follows a business model based on creators and subscription plans rather than advertisements.
DES-ING	Interviews (N = 12) Target: university students.	A new mobile app to help students organize their study sessions, avoid distractions, and find materials and answers to their problems.
Biancaneve e i 7 nani	Interviews (N = 8) Questionnaires (N = 50) Target: university students.	A new mobile app to help students during their study sessions with social support, goals and achievements, and integrated DSCTs.
BelliCosì	Questionnaires (N = 132) Target: university students.	A redesigned version of the HayDay mobile game promoting time awareness and intentional usage, e.g., through to-do lists and persuasive messages.
BD8	Questionnaires (N = 81) Target: university students.	A redesigned version of Instagram that prioritizes close ties, minimizes social comparison, and promotes intentional usage, e.g., with integrated DSCTs.
3D-4I	Questionnaires (N = 82) Interviews (N = 9) Target: university students.	A redesigned version of Instagram with the possibility to filter and personalize posts, stories, ads, and notifications.

isting digital service and redesign it to take into account users' digital wellbeing explicitly. Different groups, in particular, decided to focus on Instagram, TikTok, and Snapchat's mobile apps. This choice supports previous works describing smarphones [7] and social networks [91] as potential threats to users' digital wellbeing. Rather than focusing on external supports like DSCTs, the services redesigned by the students confirm the importance of considering digital wellbeing in every stage of the design process of a digital service, as recently advocated by Docherty and Biega [22]. Figure 4a, for example, shows a screenshot of a high-fidelity prototype through which the group envisioned a redesigned version of Instagram that randomly shows to the users educational posts and allows them to filter the newsfeed with preferences and preferred topics. This and other similar solutions, e.g., the redesigned Instagram version of the *BD8* group, deliberately focus on the quality of the newsfeed, prioritizing meaningful and relevant content (and contacts) instead of viral and attention-capture videos and posts. Furthermore, they empower users to personalize the digital environment they are interacting

(a) (b) (c) (d)

Figure 4: Some examples of high-fidelity prototypes. Students either redesigned an existing digital service or proposed novel applications to support people's digital wellbeing in different contexts. Figure 4a is a redesigned version of Instagram that randomly shows to the user educational posts (*SAI* group, Table 4), while Figure 4b is a redesigned version of TikTok through which users can use an avatar to control the time they spend on the platform (*ZERO* group, Table 4). Figure 4c and Figure 4d, instead, refer to a novel application (*Biancaneve e i 7 nani* group, Table 4) that allow students to start collaborative study sessions, with visualizations of paths that include goals and achievements (c) and personalized screens through which students can only use certain mobile apps (d).

with to better suit their goals and digital wellbeing and support experiences of meaningful and fair connection to others, e.g., by prioritizing interactions with close ties. Despite the absence of standalone DSCTs in the projects, students saw promise in integrating these tools directly inside attention-capture digital services (see the *ZERO*, *SAI*, *Math-erassi*, and *BD8* groups in Table 4). Figure 4b, for example, show a redesigned version of TikTok through which users can interact with an avatar to control (and hopefully reduce) the time they spend on the platform. In the same projects, students envisioned having community-based parental control features. In this redesigned version of TikTok, users can give feedback on the contents they see through a green/yellow/red semaphore-like metaphor. At the same time, parents can set up, with a custom interface, what content their children can see. A better integration of tools for digital self-control into a digital service could support users in "learning" what digital wellbeing is, allowing them to understand and internalize good practices to improve their technology use or solidify existing behaviors that are already well aligned with their digital wellbeing.

Novel Applications. Rather than focusing on existing digital services, other three groups (*Gruppo Magic*, *DES-ING*, and *Biancaneve e i 7 nani*) developed a project concerning a novel application to support people's digital wellbeing in different contexts. *Gruppo Magic*, in particular, proposed a generic social network for teenagers focusing on security and educational aspects. This social network encourages socialization through dedicated sections and functionality and prioritizes cultural and educational content. Again, the focus of the proposed solution is on maximizing the quality of the interaction rather than the quantity. The other two groups, i.e., *DES-ING* and *Biancaneve e i 7 nani*, proposed a mobile application to help students organize and conduct their study sessions by avoiding distractions and self-interruptions with attention-capture digital services. Figure 4c and Figure 4d, in particular, show two screenshots of the high-fidelity prototype of the *Biancaneve e i 7 nani* group. The proposed app allows students to start collaborative study sessions. Furthermore, it assists them in avoiding distractive applications by implementing configurations through which students can only use certain mobile apps (Figure 4d), and it uses path-based visualizations that display goals and achievements (Figure 4c). By allowing users to assess their progress and achievements, these kinds of visualization may support users in establishing a pathway to improvement towards digital wellbeing.

5. Discussion

As the usage and popularity of devices like smartphones and digital services like social networks are continuously growing, so do studies and media articles on the negative aspects of overusing technology in the current Attention Economy. Researchers from different areas and tech companies like Google coined the term digital wellbeing to describe the need for technology to support users rather than capture their attention. In parallel, the HCI community has highlighted the advantages and limits of assisting users to self-regulate their technology use via external (digital) support. In particular, Digital Self-Control Tools like those introduced by Google and Apple in their latest mobile operating systems have been found to be ineffective in the long term [19, 7].

Recently, researchers highlighted the possibility of *teaching* digital wellbeing rather than imposing it through coercive interventions like usage timers and lockout mechanisms [16, 24]. In our work, we sought to realize this possibility by presenting the *Benessere Digitale* course. In this section, we discuss the findings of our case study (Section 4) around our two main research questions. First, we elaborate on the impacts of *Benessere Digitale* (**RQ1**), linking our educational strategy to existing approaches for promoting digital wellbeing. Then, we discuss how our students tackled the digital wellbeing topic (**RQ2**), showing how the course can be considered as a practical strategy to start solving the digital wellbeing challenges collaboratively between students and teachers from different backgrounds: the solutions envisioned by the students, in particular, differ from the state-of-the-art and could serve as a foundation for inspiring researchers and practitioners working in the field of *designing for digital wellbeing* [29, 30].

5.1. Promoting Digital Wellbeing Via Education

Through our work, our first goals were to assess whether a course like *Benessere Digitale* – with its multidisciplinary approach in which both teachers and students have different skills – may have an impact on students' digital wellbeing (**RQ1**). In our opinion, answering this research question is fundamental to inspire researchers and teachers to further contribute to the current "race towards digital wellbeing" [7] of future generations through education. Overall, results of the 2022 edition of "Benessere Digitale" (see Section 4.4.1 and Section 4.4.3) show that the course was appreciated by the students (overall satisfaction rate of 93,24%) and stimulated their critical thinking, e.g., in finding their own definition of digital wellbeing. Furthermore, we found that the collaboration between teachers of different universities and students from different degree programs was fruitful for designing and prototyping innovative solutions to promote people's digital wellbeing (see Section 4.4.4), as acknowledged by the same students in the satisfaction questionnaire.

In 2004, Abowd et al. [92] discussed the findings of the Ubicomp Education Workshop and already highlighted the benefits of adopting methodologies based on projects and learning through experience in the field of ubiquitous computing education. Stemming from our results, we believe that the project-oriented structure described in this paper has been one of the key points of success of *Benessere Digitale*, differentiating it from the few similar courses and initiatives, e.g., [93, 94]. Indeed, digital wellbeing is a cross-device topic [16] strongly linked and influenced by today's ubiquitous and ultra-connected world. Thus, supporting digital wellbeing also means developing and (re)designing novel tools, devices, and digital services. In this context, we see particular value in multidisciplinary groups tackling a problem from different perspectives. As reported in our paper, the digital wellbeing topic involves many different multidisciplinary aspects, from DSCTs to the psychological and regulatory dimensions. During the *Benessere Digitale* course, students learned how to consider digital wellbeing's technical and psychological nature. Within the groups, then, students contributed with their experiences and skills. For example, we noticed that Management Engineering students were typically in charge of analyzing the data collected during the needfinding process. In contrast, Computer Engineering and Telecommunications Engineering students typically led the prototyping phase. Despite the positive aspects, we must acknowledge that bringing different perspectives into a single container is difficult. As reported in Section 4.4.1, the connection between the technical and psychological part of the *Benessere Digitale* was not always clear to some students who asked for a more cohesive program. We are now trying to refine the course program by considering the students' feedback, e.g., by extending the psychological part to include a more generic view of the digital wellbeing topic. Furthermore, we also noticed some non-homogeneous groups in which students mainly came from the same degree programs. In future editions, we are considering the possibility of reviewing (and changing) the composition of the groups at the beginning of the course.

5.1.1. Heading Towards Long-Term Influences

One of the central underlying hypotheses of our work was that attending a course like the one presented in this paper may have a (measurable) impact on people's digital wellbeing [16]. In other words, we wanted to investigate whether digital wellbeing education can be considered a practical intervention strategy like other solutions, e.g., DSCTs. In this sense, results reported in Section 4 are promising and confirm that learning digital wellbeing and strategies to pursue it can improve how students perceive their own level of addiction to devices like smartphones and their capabilities to regulate and limit their use. Although we did not compare the effectiveness of our approach against the one of digital self-control tools, we are confident that *Benessere Digitale* may complement these technologies and solve many of their limits already highlighted in previous studies. Being a solution based on education, indeed, the course could have a long-standing influence on people's digital wellbeing, hopefully surviving months and years after taking the course as in other contexts like politic [95] and entrepreneurship [96] education. Education at the university level may also be an effective strategy to instill the concept of digital wellbeing in the next generation of designers, developers, and regulators, shaping future technologies and business models. Specifically, we deem such an educational process particu-

larly important to solve the contradictions that nowadays exist between digital wellbeing – which seek to promote a meaningful (and often lower) use of technology – and current business interest, bringing the same tech companies in the digital wellbeing discourse [18]. Furthermore, education might foster the development of new social norms, e.g., not using the smartphone while talking to someone, and might even promote the development of new initiatives, policies, and regulations that could help society consolidate such norms [16]. For example, the Center for Humane Technology [25] is a nonprofit organization dedicated to inspiring a future with new technology that supports people's wellbeing, democracy, and shared information environment. The center supported the development and release of the famous Netflix documentary "The Social Dilemma", through which the founder Tristan Harris and other organization members have shed light on how digital services like Facebook, YouTube, and Instagram are designed to maximize users' engagement and time spent. The organization's website also includes tools and frameworks for educators, e.g., the Youth Toolkit, to help high-school and college students reimagine a new social media environment supporting people's digital wellbeing.

Overall, stemming from the investigation of our second research question (see Section 5.2 for the related discussion), we believe that a project-based approach may help to move from the contradictory practice of designing digital self-control tools [18] to designing technologies that promote positive and meaningful experiences *by nature* [14]. To reach this vision, educational solutions like *Benessere Digitale* should be complemented with new policies and regulations to motivate key stakeholders to support a more responsible and sustainable business model with respect to the current Attention Economy [97, 18]. As reported by the Center for Humane Technology [98], some policies and regulations already exist or have been proposed – especially in the US – to mitigate deceptive and manipulative designs in digital user interfaces. Examples include the Platform Accountability and Transparency Act[11] to preserve people's privacy in social networks, and the SMART Act[12] to prohibit the usage of design that exploit people's psychological vulnerabilities and promote tech-addiction.

5.2. Bringing End-Users' Innovation in the Digital Wellbeing

Besides providing evidence for how *Benessere Digitale* may impact students' digital wellbeing, our work also sheds light on how students tackled the digital wellbeing topic, providing interesting insights that may inform future works in the field of *designing for digital wellbeing* [29, 30]. In other words, our work demonstrates the effectiveness of empowering students and teachers with different backgrounds in exploring innovative technological solutions for digital wellbeing targeting alternative business models (**RQ2**).

First, we deem involving end users in shaping future technology design as fundamental to overcoming the individualistic view of the digital wellbeing topic that the HCI community has had so far [18]. In such an individualistic view, problems related to excessive use of technology have traditionally been considered a responsibility that belongs solely to the user [99]. In providing their own definitions for the digital wellbeing 4.4.3, however, students explicitly highlighted that promoting and pursuing digital wellbeing should be a challenge **shared** among tech companies and final users. Facing digital wellbeing from an educational point of view may promote a change in core beliefs, values, and operating norms, towards a double-sided view of the digital wellbeing topic that includes both users, researchers, and tech providers at the same time [18]. According to the custom Leverage Point Framework proposed by the Center for Humane Technology [25] – inspired by the twelve leverage points to intervene in a system proposed by Donella Meadows [100] – such changes are the most difficult to shift. Still, they may have the most significant long-standing impacts.

At the same time, our work confirms the need to go beyond the contemporary self-monitoring nature of DSCTs [18], mainly based on measuring screen time and providing feedback [17]. Some previous works warned that using time spent as the sole measure for people's digital wellbeing may not be the right choice [61, 62, 18]. Indeed, measures like screen time are insufficient to reflect the variety of goals and different kinds of tech usage of the users [18]. Furthermore, using self-monitoring tools that display how much time has been spent on a device or specific service may produce negative reactions [61], thus inducing the user to stop using the tool. As reported in Section 4.4.3, none of our students explicitly related digital wellbeing to time spent and screen time, but they rather talked about the importance of having a "good relationship" with technology to "benefit" from the advantages that it offers. Such a view contrasts with most contemporary DSCTs that instead focus on blocking the user's interaction with devices and digital services. Students' definitions of digital wellbeing are also reflected in the technological solutions designed and prototyped during the course (Section 4.4.4). Three groups proposed novel applications to proactively support people's digital wellbeing in specific contexts, e.g., studying. Furthermore, the other groups envisioned tools focused on *improving* existing services, e.g., by offering the possibility to customize social networks' feeds, without blocking interactions and behaviors. We see particular value in further exploring such a strategy in future works, as it would solve the contradictions [3, 18] and low effectiveness [7] of DSCTs. Redesigning user interfaces considering people's digital wellbeing as a top design goal has recently gained interest in the HCI community with the Adaptable Commitment Interfaces proposed by Lukoff et al. [101]. According to the authors, such interfaces can be used to modify or recreate an existing interface to prioritize instrumental use and promote users' sense of agency and control. Through them, in particular, users can toggle between different interfaces, varying designs and available functionality to meet their situational needs. As a practical example, Lukoff et al. [101] proposed

[11] `https://www.coons.senate.gov/download/text-pata-117`, last visited on August 18, 2022

[12] `https://www.congress.gov/bill/116th-congress/senate-bill/2314/text`, last visited on August 18, 2022

SwitchTube, an alternative to YouTube that allows users to activate a focus mode in which recommended videos are hidden. As a step further, we highlight the possibility of exploring *adaptive* interfaces that can be automatically redesigned according to the current context, as also suggested by Lukoff et al. in their discussion of the SwitchTube app [101]. HCI researchers have already demonstrated the feasibility of analyzing usage data to predict when a user is trapped in a passive usage session or when the same user has a specific, intentional goal guiding the session [14]. Ideally, an adaptive interface could adapt its design according to the target user and its current "digital wellbeing level," e.g., by presenting a search-only interface and hiding all recommendations when the user is at risk of overusing the platform [3].

Overall, the multidisciplinary course presented in this paper – during which students and teachers with different skills and backgrounds collaborated to produce technological solutions for digital wellbeing – exemplifies how the HCI community can collectively take responsibility and help to solve the digital wellbeing challenges. Recently, researchers called for greater involvement of end users in reasoning about digital wellbeing problems and related solutions. For example, Monge Roffarello and De Russis [16] conducted interviews and co-design exercises to explore how users make sense of their multi-device digital wellbeing. The authors demonstrated that end users envision different kinds of support for achieving digital wellbeing, encompassing social and political factors. Genç and Coskun [23] conducted observations in four coffeehouses to better understand smartphone use behavior in public settings, and identified alternative design approaches to mediate this behavior. Besides providing evidence on how students tackle digital wellbeing problems, *Benessere Digitale* allowed us to deepen our understanding of how they might shape the design of future technology. In conclusion, we consider our approach as a promising strategy to foster the emergence of a new generation of designers and practitioners that consider digital wellbeing and social good.

5.3. Limitations and Future Work

There are some limitations in our work that must be considered to shape future research efforts at the intersection between education and digital wellbeing. First, the generalizability of the results described in Section 4 is limited by the involved population, i.e., university students of an engineering faculty. The course, however, does not require any particular prerequisite and could be easily adopted in other universities and degree programs with minor adjustments. In our current work, we are designing a complementary version of the course for younger high school students. Another limitation is that, right now, *Benessere Digitale* only includes two main perspectives – technical and psychological. The course could be improved and extended to include other aspects related to the topic. Policymakers and regulators, for example, could further highlight and teach how digital wellbeing could be achieved and supported through a change in the underlying business models followed by contemporary tech companies. Regarding the impacts of the course, we only used the Smartphone Addiction and General Self-Efficacy scales to measure students' self-perception about their own digital wellbeing. An interesting and necessary future work will be analyzing whether following a course like *Benessere Digitale* actually influences students' technology use, e.g., in terms of time spent and usage patterns. This would be fundamental to compare the effectiveness of an educational approach with DSCTs. Relatedly, our findings cannot tell us whether the measured impacts may survive in the months and years after the course: as such, discussions on the long-term influence of educational solutions like *Benessere Digitale* (Section 5.1.1) are mostly speculative and should be quantitatively assessed in future works. Finally, digital wellbeing is a recent and evolving research area, and new work is constantly emerging. Consequently, we are aware that the course content may need to be constantly monitored and revised to reflect changes and findings in this interesting and important topic.

6. Conclusions

In this paper, we tried to move the focus of the digital wellbeing research area from digital self-control tools to education, with the underlying goal of cultivating a new generation of designers and practitioners who prioritize digital wellbeing and social good. To this end, we presented the design and implementation of *Benessere Digitale*, a course at the university level on the digital wellbeing topic that mixes two different perspectives – technical and psychological – with a multidisciplinary and project-based strategy. Through a case study in an Italian university, we measured the impacts of the course on students' self-perceived smartphone addiction and self-efficacy, and we explored how they used the learned notions to design and prototype innovative technological solutions in the digital wellbeing field. Results confirm our hypothesis that a course like *Benessere Digitale* can stimulate students' critical thinking and influence the perception of their own digital wellbeing. Furthermore, results demonstrate that students tackle digital wellbeing problems from different perspectives, envisioning technological solutions that go well beyond contemporary DSCTs. Overall, our work demonstrates that an educational approach could complement DSCTs by ensuring long-term impacts and influencing future generations of designers, developers, and regulators.

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