



Awareness, Control and Impact in Digital Wellbeing - Results from Explorative Self-experiments

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Abstract. Research and design for digital wellbeing commonly focus on a single device, and time spent is the most common indicator of digital wellbeing. In this paper, we examine digital wellbeing along three dimensions: awareness, control, and impact, including positive and negative aspects. We report from two-week explorative self-experiments with 29 participants that made diary entries and reflection reports. The study discusses how digital wellbeing can be seen across devices and tasks to understand the usage patterns that can be used to identify possible interventions and problematic use that can be addressed by new designs. The impact of computers and smartphones differed among participants, with laptops receiving a more positive evaluation than smartphones. While the choice of the device itself may not be the primary factor in understanding digital well-being, further research efforts should identify different usage patterns - across devices and over the three dimensions of awareness, control, and impact.

Keywords: Digital Wellbeing · Self-experiment · Multi-device · Self-monitoring · Technology Overuse

1 Introduction

Digital wellbeing concerns how comfortable people are with their use of their digital devices and how that use affects their physical health, mental health, and overall life satisfaction. Ongoing debates about digital wellbeing adopt different perspectives within human-computer interaction. There is a clear need to understand the measurable impacts of digital devices on wellbeing, and this concern is shared with psychological research [2, 17]. Much clinically-oriented research frames current usage as potentially harmful and pathological, characterizing specific patterns of smartphone [7], game [10], and social media [1] usage as addictions. Research conducted within this framework has produced scales that aim to measure the negative impact of interactions with these digital devices and assess whether usage needs to be treated clinically. There is a similarly influential narrative within HCI, where the notion of ‘overuse’ is often assumed as a starting point for the research [14, 17], and screen-time is seen as a proxy measure of digital wellbeing.

Often, screen-time is used as the dependent variable as well as a target for behavior change. Nevertheless, others have taken a more critical stance towards the debate on addiction [8]. One problem with the addiction narrative is that it focuses on overuse while de-emphasizing the benefits of using digital devices. Nor does it identify different, positive motives for device usage. For example, certain types of information work would be impossible without digital devices. Social media and communication technologies represent important ways to maintain vital social ties with friends and family.

In contrast with the addiction narrative, Cecchinato et al. [4] take a more analytical and balanced stance. They argue that digital wellbeing can be framed from multiple perspectives, including medical, user-oriented, or design perspectives. A recent analysis of the effects of social media [13] found a very small but significant negative correlation between the use of social media and mental health. Similarly, Przybylski et al. [15] suggest a weak negative effect on mental health for overuse - measured as screen-time. Still, Meier and Reinecke [13] further claim that the finding varies according to what mental health indicators are used, and the diverse approaches to conceptualizing, framing, and measuring the problem make it hard to reach conclusive evidence, suggesting that research on digital wellbeing should move beyond a focus on screen-time as the indicator of use.

The ability to control the use of digital devices has been linked to the notion of self-regulation [12] and can be considered fundamental for digital wellbeing [11]. This ability to exert control over digital devices is crucial for how you can align use with your own goals. Still, using control as the only aspect of digital wellbeing could take away focus from how different usage patterns can have different impacts on overall wellbeing and give a too-narrow understanding of the different facets of digital wellbeing.

Meier and Reinecke [13] characterize the research on the relation between computer-mediated communication, including social and mobile media, and mental health as conceptually diverse. They identify various indicators of technological use and a similar diversity in how to conceptualize mental health. In mental health, the two main approaches are psychopathology and psychological well-being. In this paper, we focus on the latter. Psychological well-being refers to how an individual experiences and functions in everyday life. Digital well-being can then be seen as a way of conceptualizing how digital devices play a role in the overall psychological well-being of an individual.

To this end, this paper explores the relationship between how digital devices are used and how they impact users' wellbeing. To examine these questions, we devised an exploratory self-experiment with 29 participants. We focused on smartphone use and examined other devices, such as computers, tablets, interactive TVs, and gaming consoles. Seeing digital wellbeing as dependent on an ecology of tools [3] counters a sole focus on a single device, which has been a focus of much of the research on digital wellbeing, which has targeted smartphone use [14]. Focusing on digital wellbeing across devices [9] can help us identify use patterns and how different applications and tasks are allocated across and between different devices. Tools for time-tracking, such as Apple's Screen Time and Google's digital wellbeing tools, also consider this cross-device use and enable tracking across devices. This study's contributions are results from exploratory self-experiments and a questionnaire for measuring digital wellbeing with three dimensions: awareness, control, and impact.

2 Methods

We explored digital well-being using both self-experiments and a questionnaire. Self-experiments investigate how people identify a habit or behavior for change, enact a plan to change that behavior, and experience the results [5]. The participants analyze their behavior, interventions, and outcomes in such self-experiments, where tracking and systematic note-taking are key analytic tools. The method's strengths are that it is based on reflections and a contextualized understanding of how the incurred changes fit into daily routines and the particulars of each participant's life situation. Self-experiments are exploratory as each participant documents and reflects on the impact of digital devices on their wellbeing to discover a habit or behavior they want to change. They also reflect on the process of monitoring and experiencing the impact of the chosen variable when they implement their intervention.

A total of 29 master's students carried out individual self-experiments as a mandatory task as part of a master's course. Over two weeks, they filled out a daily diary according to a template provided by the researchers, where they documented how much and for what purpose they used their digital devices. They were encouraged to actively use the time-tracking tools that come with their devices (such as Apple screen time or Google's digital wellbeing tools). Each day they also wrote a short reflection note. After the first week, the participants were tasked with identifying one habit or usage pattern they wanted to change based on the first week of logging and reflection. They attempted to change that behavior for the second week, keeping track of their successes and failures. When the two weeks were over, the participants wrote a longer reflection note, analyzing if it was easy to change their habit, if they were surprised by their usage, if they found the tracking tools useful, and whether they perceived that their modified use of digital tools impacted their wellbeing. These reflection documents and daily diaries were subsequently anonymized and then analyzed for patterns and themes by the researchers.

We also had the students answer a questionnaire on digital well-being. The questionnaire has three primary constructs concerning awareness, control, and impact. The questions on impact addressed both eudaimonic and hedonic [10] aspects of digital well-being and their impact on health and social connectivity. We determined the Cronbach Alpha score to be .618, indicating an acceptable level of reliability of the items. Only parts of the results from the survey are reported in this paper. The Institutional review board for research ethics approved the study, and anonymized data was used for the analysis.

3 Results

Participating students were enrolled in a master-level human-computer interaction course. Of the participants, 15 (52%) were female, 13 (45%) were male, and one did not state their gender. Their mean age was 25.1 years ($SD = 3.14$). The questionnaire showed that overall time online was high: a significant proportion (31%) reported that they spent 9–10 h per day on their digital devices, followed by 11–12 h (24%), 5–6 h (17%), and 7–8 h (17%). Participants ranked which devices were necessary. Smartphones (69%) and computers/laptops (31%) were rated as the most important digital

devices the participants used, while interactive TV, game consoles, and wearables were rated as the least important digital devices. Participants also ranked the importance of how they used their devices. Entertainment/media streaming and communication were the most important ways the participants used their digital devices, followed by school/work tasks, social media, time management, games, information seeking, and finance/business. We next explored the well-being constructs by analyzing participants' self-experiment reflections.

3.1 Awareness

Awareness Level. Reflections indicated that most participants ($n = 19$) felt they had a clear picture of their use of digital devices. "I am pretty adamant about not letting digital devices and social media take over too many aspects of my life." [ID8] As part of their diary entries, the participants kept a record of their screen-time, and many chose to use the built-in tools in their devices and received daily or weekly notifications, so they could easily keep track of their usage. "I am very aware of how much time I spend in front of screens. I use digital wellbeing tools, so I feel I have the use under control." [ID11].

Another 6 participants were somewhat aware of using digital devices in everyday life. "I wouldn't say accurate, but neither was I surprised. I'm aware that I spend much time with digital devices, as work and hobbies depend on them." [ID7] Although they reported being somewhat aware of their use, some expressed being surprised by the screen-time measures. "I realize that I spend much more time on my phone than I thought. It was not really shocking to me, but it was definitely interesting." [ID28] There were only four participants who did not have a precise picture. "I also have never thought of my Apple TV as screen-time, so I was a bit shocked at how many hours I look at a screen." [ID9] They had never checked screen-time features in the settings of their digital devices. "I thought I was not using my phone that much. Then when I enabled the digital wellbeing features on my phone, I was surprised to see that I was still using my phone around 2 to 3 h a day." [ID27].

Temporal and Device Usage Patterns. The participants mostly used their mobile phones in the morning ($n = 5$), in the evening ($n = 5$), during the daytime ($n = 1$), or the whole day ($n = 2$). They used their computers/laptops in the middle of the day ($n = 3$) or evenings ($n = 2$). The participants used their mobile phones for social media ($n = 11$) and communication ($n = 6$), followed by entertainment ($n = 5$), banking ($n = 3$), and productivity ($n = 2$). Productive tasks (e.g., schoolwork) ($n = 14$), streaming ($n = 5$), digital games ($n = 3$), and entertainment ($n = 3$) were major activities performed on a computer/laptop. Fewer participants reported using a tablet device during the study period. They reported using their tablet device for productivity ($n = 3$), news ($n = 1$), streaming ($n = 1$), and games ($n = 1$). The participants also reported multitasking, such as listening to music/audiobooks ($n = 3$) or watching videos ($n = 3$) while doing another task (e.g., doing laundry, eating meals, cooking, cleaning).

Impression of Digital Time-tracking Tools. The participants used time-tracking tools more on mobile phones than computer/laptop and tablet devices. In-built screen-time applications were the most popular tools, with 19 participants on mobile phones, five

on computers/laptops, and two on tablet devices. Some participants used different time-tracking tools such as Action Dash, PostBox, Google Digital Wellbeing, Appblock, Rescue Time, and Webtime Tracker.

Most participants ($n = 21$) considered digital time-tracking tools useful for increasing awareness. “Very useful to see what parts of the day I spend most on my phone. I got more aware of my phone usage because of the weekly reports you get, which tell you how much time you spent on your phone compared to last week.” [ID15] Digital time-tracking tools gave the participants more control over how much time they spent on leisure time activities. “It gives me a choice to either put it down and do something else, or I have to choose to continue the mindless scrolling.” [ID24] Of those participants, some ($n = 3$) reported using digital time-tracking tools before but cut out using them due to the pandemic. “During the pandemic, I ignored both apps to improve my mental health. I think I will get back to that from now on.” [ID1] Besides, three participants preferred to keep track by themselves. “The digital time tracking tools felt pointless to me as I already know exactly what I get up to on my phone.” [ID19].

Seven participants considered digital time-tracking tools to be useless. Three of them reported that these tools did not affect their usage habits. “I don’t think it made me significantly more aware of my use of digital devices.” [ID18] Justifying this, one felt that they didn’t overuse their digital devices, another considered their personal information, another was not interested in how much time spent or setting limitations, and one didn’t want to spend less time on digital devices. Three participants reported that digital time-tracking tools didn’t work well. Hence, they were annoying. “It tracks every open application. For example, one day, I used “finder” for 5 h, but it was just because it was not closed. So, it should rather track the ones you are using.” [ID20].

3.2 Control

Regulation Level. More than half of the participants ($n = 19$) reported that it was hard to regulate and control their use of digital devices. “The hardest part was to get started and find something to replace my phone as a source of entertainment.” [ID18] The participants found it very challenging to break their habit of using their digital devices. “My problem was that it was way too easy to just extend the time limit set. This made it hard to change the behavior as I could click a button to keep scrolling.” [ID21] Furthermore, the participants found it difficult to separate leisure and work. “It’s all bundled together in a bit of hot mess where the result is that I’ll spend time worrying about school when I’m supposed to have time off, and then go and spend 50% of the time on procrastination when I’m supposed to be doing schoolwork.” [ID19].

Only 9 participants reported that it was easy to regulate and control the use of their digital devices. Most of these participants reported that they could prioritize productive tasks, communication, and leisure activities. “I don’t have the urge to answer a text message immediately; my only exception is if it is from my mom, dad, or boyfriend.” [ID20] One participant reported no need to regulate and control the use of their digital devices, and one reported it varied. “If I have had a good and productive day watching shows or scrolling on Instagram feels more justified and more like a treat.” [ID4].

Barriers to Changing Digital Behaviors. Five participants identified the pandemic as a barrier to changing their digital behaviors. Digital devices seemed to dominate their lives, especially since the pandemic. “I use my phone and computer a lot, and after corona hit even more, I have tried to cut down before, but with no real social options other than online, it is tough.” [ID17] Pandemic restrictions made participants less likely to socialize face to face, relying more on their digital devices to talk to friends or meet fellow students. “I am fully aware of my bad habits, and if it were not for the pandemic, I would maybe even consider changing them.” [ID1].

These social and communication needs provided strong incentives that kept participants ($n = 4$) tethered to their digital devices. “As I live literally on the other side of the country from my family at the moment, I also love my phone because it allows me to stay in touch with family and friends back home.” [ID24] Three participants reported that it depended on their school workload and how much it demanded digital devices. “Most things I do on my devices are necessary, and hence not controllable (such as attending class, necessary contact with, i.e., work, e-mails, etc.). “Mandatory use” is a barrier to change habits.” [ID12].

Three participants reported that the most significant barrier to changing their habits is the thought of missing out. They felt they had to be digitally available at all times. “I chat a lot with my friends, even more now due to Corona, and I always respond to messages when I see them. This is probably one reason why I kept wanting to open Instagram.” [ID22] Furthermore, unchangeable daily habits ($n = 2$) and easy access to social media accounts ($n = 1$) using different digital devices were other barriers reported by the participants to changing their habits.

3.3 Impact

Habit or Behavior to Change. Many participants chose to stop or reduce phone use before going to sleep at night ($n = 9$) or after just waking up before getting up ($n = 1$). “I tend to watch videos in bed. And studies have shown that this is a bad habit as it hurts your sleep. I have also noticed that my eyes get sorer and more strained when I watch a screen in a dark room, even if the brightness is on the lowest setting.” [ID4] This intervention made participants fall asleep earlier than usual, which enhanced productivity, suggesting that increasing sleep impacted wellbeing. “Putting the phone down before midnight allowed me to get more sleep. Some differences were noticeable. More productivity and less time spent on entertainment. The biggest difference would be that I went to bed earlier.” [ID13].

Six participants chose to reduce the time spent on their mobile phones during the day. “I tried to spend less time watching a series by setting a cap on a maximum of two episodes per day.” [ID5] They reduced the time spent on their mobile phone just procrastinating, especially for social media use. Overall, this helped them feel less stressed and focus more on productive tasks. “I feel less stressed and like I don’t check apps when I am supposed to do school, etc.” [ID26] Some participants chose to leave their mobile phones in another room ($n = 3$) when they were going to bed at night ($n = 2$). “I left my phone for charging in another room on day five of the first week of this experience. I experienced that I could concentrate well now that my phone was out of sight.” [ID15].

To handle excessive use, three participants deleted an app such as Instagram or TikTok that they tend to get most distracted by. “I noticed that when I picked up my phone to distract myself while doing schoolwork, the first thing I would do was go on Instagram.” [ID3] Two participants chose to turn off notifications on social media so as not to be distracted by their mobile phones during the daytime or when working on a productive task. “My phone was next to me all day, but I forgot it was there. It was liberating to control my day without the constant notifications from my phone. I will not change it back.” [ID9] Some participants chose not to use their mobile phones and computer/laptop at the same time ($n = 1$), to read a book instead of reading on the internet ($n = 1$), and to spend their time studying ($n = 1$). Most participants ($n = 18$) reported that changing the variable they chose was easy. Only 6 participants reported it to be complicated initially and getting more challenging as the week passed ($n = 2$) and easy to start but possibly harder to maintain over time ($n = 1$).

Impact of the Use of Digital Devices on Wellbeing. A significant number of participants ($n = 12$) reported that using mobile phones affected their wellbeing negatively. “It is a real time-thief, and it is easy to get distracted by it when doing other things.” [ID21] There were only five participants who reported that the use of mobile phones had a positive influence on their wellbeing. “Being able to socialize through messenger/Snapchat is something I truly appreciate.” [ID19] However, this depended on the device, as 13 participants reported that using their computer/laptop positively impacted their wellbeing because they mostly use them for productive tasks such as schoolwork. “Using my computer mostly makes me feel productive and doesn’t negatively affect my wellbeing.” [ID3] There was only one participant who reported that the use of a computer/laptop affected their wellbeing negatively. “I’ve struggled to separate leisure and work. I used to browse memes, watch tv-series, or mindlessly surf the internet.” [ID19] Seven participants reported mixed benefits, i.e., that digital devices (in general) positively and negatively affected their wellbeing. “It can keep me from being active by distracting me and keeping me sitting on the couch, or it can inspire me to be more active with exercises and inspirational people.” [ID25] They believed a fine line existed between using digital devices in moderation and excessively.

4 Discussion and Conclusion

Our study analyzed digital device use as part of an artifact ecology, with participants reporting on digital wellbeing across devices. This holistic approach points to the multiple purposes for which devices are used, which is central to digital wellbeing. Many participants reported different impacts when comparing computers and smartphones, with laptops judged more positively than smartphones. However, cross-device usage patterns suggest that it is not the particular device that is the key to understanding wellbeing; instead, usage patterns are critical. Laptops are generally used for work tasks, while smartphones are used more for entertainment and social media. These latter tasks gave rise to behaviors that participants thought were problematic. These complex heterogeneous forms of usage across devices and tasks also make it difficult for participants to analyze their behaviors if they wish to intervene, suggesting design opportunities we discuss below.

Awareness: Most participants reported a clear picture of their use, and few were surprised by how much time they spent. Higher awareness was correlated with higher scores on the digital wellbeing scale, while the reported time spent did not show such correlations. While the data is inconclusive, we can ask whether time spent does not necessarily affect digital wellbeing (as measured). Several digital wellbeing tools are focused on tracking how much time you spend to increase user awareness. Most participants struggled to manage their actions, particularly when using their phones, which was the primary source of their difficulties. However, they were positive about using a self-monitoring tool to increase their awareness and cut down on use. This aligns with previous research that individuals desire to use personal tracking devices to increase their productivity and reduce screen-time [6, 16]. When proposing and identifying interventions, it is clear that they can be something other than digital and can be as simple as leaving the phone in another room. There might also be opportunities for designs that allow people to create new habits and track these. Our findings also suggest that while these are useful tools for increasing awareness, more than general awareness is needed and that there might be a need for breaking down the usage by task and device as a step towards understanding certain usage patterns.

Control: Most participants reported finding it hard to control their behaviors, with most problems arising from phone usage. The ability to regulate the use depends on the patterns of use across devices and the different tasks users engage in when using these devices. This difficulty in controlling use shows how a singular focus on self-control as the most important barrier can be too narrow when researching digital wellbeing. Participants identified control as one of the main barriers to changing their behavior. They referred to their mixed usage of devices and their situation where they were reliant on their digital devices for doing work tasks and being in a situation due to the regulation of social distancing during the pandemic, where the digital devices were their primary tool for keeping in touch with others. An issue with digital device use is that there is a thin line between controlled and disorganized use. Our participants described needing to use their devices for various reasons, opening the door for unrestricted use.

Impact: When discussing digital wellbeing, an essential part is understanding its impact on daily life. The participants reported positive and negative effects in their reflection notes, but most reported negative consequences, such as impacting sleep. Again, many of them saw different impacts according to different devices. Participants reported a typical pattern of watching YouTube on the phone before going to sleep and being caught in an endless stream of new content. Too much YouTube at night before bed was an example of a habit that should be possible to change, and the participants, when tasked with changing a habit or behavior, were able to propose something that they wanted to change. Furthermore, most were able to propose a concrete way to change that habit or behavior, indicating that they could potentially change that behavior at any time.

In the paper, we have argued that a narrow focus on time-tracking or self-regulation can overlook important aspects of use, such as use across devices, and that a path forward could be to look at usage patterns across tasks and devices when designing for wellbeing and interventions for changing digital habits and behavior. In future work, we

plan to further explore the three dimensions of digital wellbeing and develop the digital wellbeing questionnaire to examine how we can measure digital wellbeing across different devices and tasks, including impacts on social connectivity, productivity, and eudaimonic and hedonic well-being.

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