Digital Wellbeing Applications: Adoption, Use and Perceived Effects

Douglas A. Parry¹, Daniel B. le Roux, Joshua Morton, Ruth Pons, Ruan Pretorius, Andre Schoeman

Department of Information Science, Stellenbosch University, South Africa.

Abstract

Increasingly, mobile applications, services, and features enable people to monitor and regulate their smartphone use in the support of their digital wellbeing. Herein we report a mixed-method study involving the collection of both quantitative and qualitative data from a student sample conducted with the aim of investigating, firstly, the adoption of applications and features designed to support digital wellbeing, secondly, the factors that influence the continued use of such applications and, thirdly, the effects users perceive these applications to have on their digital wellbeing. The outcomes of this study highlight the importance of individual motivations and the need to understand digital wellbeing as more than simply the use of an application or tool but, rather a subjective consideration of the place of digital media in an individual's life. The present study provides a rich descriptive account of the temporal variability, person-specificity, and device-contingent nature of digital wellbeing.

Keywords: Digital Wellbeing, Screen Time, Quantified Self, Behaviour Tracking, Self-regulation

¹CONTACT Douglas A. Parry. Email: dougaparry@sun.ac.za

1. Introduction

A growing number of smartphone applications and features enable users to track and regulate their smartphone use. Examples include those provided at the operating system level—*iOS Screen Time* and *Android Digital Wellbeing*—as well as stand-alone applications such as *Forest:Stay Focused* and *Moment*. Using these tools to monitor and regulate media use can, for some, form part of a phenomenon broadly conceptualised as *digital wellbeing*. Vanden Abeele (2020, p. 7) defines digital wellbeing as the “subjective individual experience of optimal balance between the benefits and drawbacks obtained from mobile connectivity.” For many, this involves becoming more intentional with how digital media are used (Monge Roffarello and De Russis, 2019), and aligning device use with general goals (Parry et al., 2020).

While various third-party services enabling the monitoring and regulation of digital media use have been available for a number of years, following recent operating system developments, exposure to, and possible adoption of, applications designed to support digital wellbeing is now a widespread possibility. In 2018, Apple launched *iOS Screen Time*, which tracks the time users spend with various application categories as well as overall device usage. Additionally, users can set limits, which are enforced by the application, on the time spent with particular applications, categories of applications, or the device itself (Apple Newsroom, 2018). In the same year, Google launched *Android Digital Wellbeing* which provides similar functionality to its iOS counterpart (Google, 2018).

Although studies in other domains (e.g., health and fitness) have generated much knowledge about the user characteristics, motivations, features, and outcomes that predict use of behaviour tracking applications (see, Lee and Cho, 2017; Putri et al., 2019), in the context of digital wellbeing, little research has been conducted to understand the factors that might motivate continued use. Given the ubiquity of smartphones in both developed and emerging economies (Silver, 2019) and, in addition to the myriad benefits that these devices provide (Vanden Abeele et al., 2018), the possibility of adverse effects (Tarafdar et al., 2013; Gazzar-

ley and Rosen, 2016; David et al., 2018), there exists a need to understand how smartphone applications can be used to support individuals’ in their digital wellbeing. In this study we adopt a uses and gratifications (Rubin, 2009) perspective and conduct a mixed-methods study to advance knowledge in this domain.

1.1. *Theoretical Background*

A growing number of studies have begun to investigate applications relating to digital wellbeing through a variety of quantitative, qualitative, and design-led approaches (Rooksby et al., 2016; Monge Roffarello and De Russis, 2019; Oeldorf-Hirsch and Chen, 2020; Parry et al., 2020; Saariketo, 2019). Studies in related areas (i.e., tracking of health and fitness metrics through mobile applications) have used various adoption models to investigate user motivations and behaviour. Such models include the *Technology Acceptance Model* (TAM; Davis et al., 1989), which emphasises perceived usefulness, attitudes, and behavioural intentions; the *Unified Theory of Acceptance and Use of Technology* (UTAUT; Venkatesh et al., 2003), which explains behaviour through performance and effort expectancies, social influences, and facilitating conditions; the *Uses and Gratifications* theory (U&G; Blumler and Katz, 1974), which focuses on the needs gratified through technology use; and the *Theory of Planned Behaviour* (TPB; Ajzen, 2011), which understands technology use as a function of behavioural, normative, and control beliefs.

Out of all of these approaches, the U&G theory provides a particularly useful lens for the investigation of the motivations for digital wellbeing application adoption and use as it frames these behaviours as resulting from a technology’s capacity to gratify users’ needs (Blumler and Katz, 1974). While early applications of the theory concerned the use of traditional mass media (e.g., TV, radio, etc.), following Rubin and Rubin (1985) this theory has been used to investigate the use of various personal media. More recently, researchers have adopted the U&G theory to investigate the factors that motivate the use of various modern digital technologies (e.g., social networking sites, smartphone applications, and web platforms; Zhang et al., 2011; Pai and Arnott, 2013). The adoption of the U&G theory in

the current study presents a departure from its typical application in earlier work where needs are seen to be gratified through media use (e.g., watching television, using social media, listening to music etc.). In contrast, it is likely that digital wellbeing applications are generally adopted to support efforts to regulate or restrict media use (Parry et al., 2020; Vanden Abeele, 2020). As such, needs are not gratified through media use *per se*, but through improved (media-based) regulation of excessive media use. While seemingly paradoxical, the application of U&G in this context does not violate its central premise—that a technology (i.e., digital wellbeing applications) is adopted to gratify a need (i.e., improved regulation of media use).

In the context of behaviour tracking, many studies have used U&G to investigate the use of applications which support the monitoring of various health and fitness indicators (e.g., Lee and Cho, 2017; Putri et al., 2019). Although there are naturally overlaps between technologies, as would be expected, these investigations reveal a unique set of needs and motivations driving the adoption and use of different media technologies. Consequently, while findings from related areas are likely to be generally informative, there is a need for specific research into the motivations that underlie the adoption and use of digital wellbeing applications.

1.2. Uses and Gratifications of Digital Wellbeing Applications

While research into digital wellbeing is still in its infancy, and there remains a need for conceptual clarity (Vanden Abeele, 2020; Büchi, 2020), studies have begun to investigate the design, use, and outcomes of mobile applications developed to support users’ “quest for digital wellbeing” (Mason, 2018). While a majority of extant research regarding digital wellbeing applications concerns either their design and development or, in interventionist studies, the outcomes associated with their use, a number of recent studies have begun to consider the predictors for using digital wellbeing applications. To provide a foundation for the present investigation, this burgeoning body of research is briefly reviewed.

In a recent study applying the TAM Oeldorf-Hirsch and Chen (2020) found that use of

the iOS Screen Time application was driven by its perceived usefulness and the ease with which it could be used. More generally, in earlier research Rooksby et al. (2016) found that, while there was limited interest in tracking overall device use, participants expressed interest in quantifying their use of specific applications, especially to support productivity and reduce excessive use. In a related manner, Saariketo (2019) found that monitoring of smartphone use was driven by participants' curiosity about their behaviour, a motivation to learn about their use patterns, and their general awareness of "unpleasant and distressing" (p. 137) aspects of excessive media use. For some, as also found by Parry et al. (2020), this awareness served as a catalyst for re-arranging usage patterns and aligning behaviour with goals. Supporting this, in a study of user-reviews for 42 Android applications related to digital wellbeing, Monge Roffarello and De Russis (2019) found that digital wellbeing applications were most frequently used for time-management, impulse-control, and to support productivity and concentration while studying or working. Despite this, Saariketo (2019) observes that, while initially enthused by monitoring of smartphone use, many users are subsequently indifferent and regard the information provided by tracking applications to be irrelevant or uninteresting.

Studies have also shown that smartphone usage does not tend to differ between users and non-users of digital wellbeing applications (Oeldorf-Hirsch and Chen, 2020; Monge Roffarello and De Russis, 2019). Despite these negligible differences in usage levels, Schmuck (2020) shows that, for users of digital wellbeing applications, mobile social media use was not negatively associated with well-being, while it was for non-users of digital wellbeing applications. While this may simply represent other underlying differences in, for example, mindfulness (see Oeldorf-Hirsch and Chen, 2020), as Schmuck (2020) argues, self-monitoring through the use of digital wellbeing applications may lead users to perceive their smartphone usage as goal-oriented and intentional and, on this basis, produce positive affective states. Such perceptions, like more instrumental outcomes (e.g., productivity, time management), drive subsequent use of digital wellbeing applications.

Considering their novelty, the limited evidence about the adoption and use of digital wellbeing applications is to be expected. Nonetheless, synthesis of the studies reviewed here suggests that four underlying motivations are likely to drive adoption and use. Firstly, users are generally curious about their smartphone use levels (1); secondly, some users perceive excessive smartphone use as problematic (2); and, thirdly, some users experience a desire to change their smartphones use patterns (3) with the aim of improving the balance between device use and general goals (4).

2. Current Study

To advance knowledge in this domain we identify four specific knowledge gaps to address in the current study. These are, firstly, the absence of evidence about adoption and use rates of digital wellbeing applications among university students (in general and especially in developing countries), secondly, the lack of evidence for the impact of these applications on their smartphone use behaviour, thirdly, a lack of knowledge about use motivations of digital wellbeing applications, and, finally, a lack of knowledge of students' perceptions of the value of these applications in their efforts to achieve digital wellbeing. University students present an important demographic for the study of digital wellbeing due to their high levels of smartphone ownership and use (Panova et al., 2020; le Roux et al., 2021). Additionally, studies have found that students are generally aware that excessive smartphone use, particularly in learning contexts, can be negatively associated with learning and academic performance (Junco, 2012; Parry, 2017; Whelan et al., 2020).

To address these gaps we conducted a mixed-method study to investigate, firstly, the awareness and adoption of applications and features designed to support digital wellbeing, secondly, the factors and motivations that predict their adoption and, thirdly, users' perceptions of their effectiveness. Targeting a student sample, quantitative data were collected with an online-questionnaire and, following this, qualitative data were collected with individual semi-structured interviews. The following research questions were posed to structure our

investigation:

- RQ1: *What are the levels of awareness and adoption of smartphone applications targeting digital wellbeing among students*
- RQ2: *Which applications and features are most commonly used to support efforts to achieve digital wellbeing?*
- RQ3: *Which factors and motivations predict the adoption and awareness of smartphone applications targeting digital wellbeing?*
 - Adopting a confirmatory stance and building on the premises of the U&G theory and previous research in this regard, we hypothesized that: *Information seeking motivations (H1); consciousness of negative outcomes associated with smartphone use (H2); the desire to align behaviour with goals (H3); and desires to change behaviour (H4) will positively predict self-reported integration of digital wellbeing applications into daily life.*
- RQ4: *Do users of digital wellbeing applications perceive them to be useful and/or effective?*

Noting recent calls for greater transparency in Communication research (Dienlin et al., 2020), following approval by the relevant ethics boards (REC:SBE 15133), prior to data collection, we preregistered our hypotheses and methodologies for the quantitative (https://osf.io/n3c2p/?view_only=357262128e774814a83fb79300939428) and, acknowledging debates about the registration of qualitative research (Haven and Van Grootel, 2019), the qualitative (https://osf.io/kazdt/?view_only=2139551dc24e4a17804264196f7da659) components of our study. Additionally, all materials (i.e., the full survey instrument), quantitative data, and analysis scripts are available through the OSF (https://osf.io/9ry6t/?view_only=a4a062bb14734545ab73c913c37a298b).

2.1. Participants and Procedure

The study involved a sample of undergraduate students at a large, research-intensive university in South Africa. Previous research shows that students at such institutions are comparable to their Western counterparts when it comes to media use (Broughton et al., 2019; Chokalingam et al., 2019; le Roux et al., 2021). Invitations to complete an online survey were emailed to all undergraduate students at the institution in mid-2020. To ensure that our analyses were adequately powered, we conducted an a priori power analysis using G*Power to determine the minimum sample size needed (Faul et al., 2009). Given the generally small effect sizes observed in Communication research (Dienlin et al., 2020), we planned to be able to detect at least an effect of $f^2 = .05$ with 80% power and $\alpha = .05$. For a multiple regression analysis with four predictors, we required a minimum sample size of $n = 244$. Notably, we planned to conduct this analysis only with respondents who were users of digital wellbeing services. Therefore, given previous research showing that approximately 50% of those queried used these services (Oeldorf-Hirsch and Chen, 2020; Schmuck, 2020), we targeted a sample of at least $n = 500$ respondents.

Data collection occurred over two weeks, with 5648 respondents accessing the survey. Of these, 3772 incomplete responses and 16 responses for which informed consent was not provided were removed, leaving a sample of $n = 1860$. While those who indicated that they do not own a smartphone (0.59%) were removed, 58.30% reported using an Android smartphone and 41.70% an iPhone. Thus, the final sample included 1849 students. Corresponding to the demographics of the institution, the sample included more female (62.67%) than male (36.88%) respondents (0.65% used other gender descriptors). The mean age of respondents was 20.53 years ($SD = 1.87$), and 43.10% were in their first year of study, 25.20% their second, 20.50% their third, and 11.20% had been enrolled for four or more years.

2.2. Survey Measures

As there are no existing scales specifically concerning motivations for use of digital wellbeing applications, items were developed based on the literature on technology use and

adoption, previous studies of digital wellbeing, and research concerning personal analytics in general (Oeldorf-Hirsch and Chen, 2020; Lee and Cho, 2017; Monge Roffarello and De Russis, 2019; Saariketo, 2019; Putri et al., 2019). All items were piloted with a student sample and, where appropriate, we performed assessments for internal consistency and confirmatory factor analyses. All items with relevant descriptive statistics are available in the appendix and the full survey is available through the OSF (https://osf.io/9ry6t/?view_only=a4a062bb14734545ab73c913c37a298b).

To understand if use of personal analytics or mental health related applications predicts use of digital wellbeing applications respondents indicated if they regularly use applications for 1) health and fitness or 2) mental health (e.g., mindfulness) purposes (for both: yes/no). To assess whether use of digital wellbeing applications is associated with differences in self-reported smartphone use, using a slider ranging from zero to 960, respondents provided an estimate of the amount of minutes that they spend on their phone during an average day.

For adoption and awareness of digital wellbeing applications we first asked respondents whether they knew about such applications (yes/no) and, following this, to characterise their engagement as either ‘never’, ‘ceased’, ‘occasional’, or ‘regular’. To determine which applications and features are most commonly used, those who indicated either occasional or regular use (classified as users) were asked to select 1) the applications and 2) the features that they use from provided lists. For both items, respondents could augment the list with additional options. For these same respondents, to assess use integration, motivations, and perceived value, we developed items on the basis of technology use and adoption literature, and previous studies in this domain. For these items responses were provided through 7-point Likert scales (1 = strongly disagree, 7 = strongly agree). For integration and each of the four hypothesized motivations we presented four items, with responses being independently averaged to produce overall values. Integration items concerned intentions to continue using, use-frequency, integration into daily life, and reliance. For perceived outcomes of using digital wellbeing applications, responses for three items which concerned the value of the

data provided, the effectiveness at behaviour change, and the effectiveness at supporting productivity were collected. Finally, for respondents classified as non-users, we presented a single use-intention item for which they could respond either ‘yes’ or ‘no.’ These respondents were then presented with the motivation items (rephrased to pertain to future use intentions and not actual use).

2.3. Interview Procedures

Given the need to produce data with individuals who have experienced the phenomenon of interest (Creswell, 2013), those who reported either occasional or regular use of digital wellbeing applications in the questionnaire could indicate their willingness to be invited for an interview on their experiences ($n = 322$). Noting Creswell (2013)’s prescriptions, we targeted a sample of 20 individuals, and randomly selected respondents for the interviews.

Due to lockdown regulations at the time, the interviews were conducted with online videoconferencing software. The researchers were previously unknown to the participants and each interview lasted approximately 40 minutes. After informed consent was received, the interviews were recorded for later transcription. Based on previous literature in this domain and the research question, an interview guide was developed to direct the semi-structured interviews (see: https://osf.io/9ry6t/?view_only=a4a062bb14734545ab73c913c37a298b). This guide included questions to enable participants to describe their understanding of digital wellbeing, use of relevant applications, the factors that have motivated or averted use, and the perceived outcomes of such applications for their digital wellbeing. The suitability of the topic guide was assessed with a convenience sample of postgraduate students who provided feedback on content and phrasing.

2.4. Analyses

All quantitative analyses were performed with the *R* programming language (v. 3.6.3; R Core Team, 2013), with an a priori alpha level of .05. To address RQ1, we calculated the proportion of respondents who were 1) aware and 2) reported either occasional or regular use

of digital wellbeing applications. RQ2 was addressed by summarizing the proportion of users reporting use of the relevant applications and features. To address RQ3 we first considered the effects of age, gender, use of fitness and mental health applications, and device type by computing either independent samples *t*-tests or chi-square tests as appropriate. Next, to test H1-4, we used a multiple linear regression predicting integration of digital wellbeing applications with the four motivations targeted. All composite variables were evaluated for internal consistency and single-factor model fit. For RQ4, we first analysed the difference in mean reported smartphone use between users and non-users with an independent samples *t*-test before evaluating the proportion of users who expressed either agreement or disagreement with the statements provided.

For the qualitative analysis, the transcribed interviews were analysed using CAQDAS software. Our inductive thematic analysis, following Braun and Clarke (2006), began with the identification and coding of potentially relevant statements. The first author created an initial codebook after reviewing the transcriptions. The research team reviewed these codes and provided suggestions for additional codes. Two coders then followed an iterative coding process. Coded statements were clustered into themes which enable the provision of rich descriptions of students' understanding and experiences of digital wellbeing.

Noting that findings from qualitative designs are influenced by the lens through which the researcher(s) have produced and interpreted the data, and that such research requires bias clarification (Creswell, 2013), we acknowledge that our own experiences with digital wellbeing applications are either non-existent or they have been futile. While our experiences are diverse, generally, initial high-hopes have faded to neglect and relapse to entrenched behavioural patterns. To attempt to account for this possible bias and remain faithful witnesses to the participants and their experiences, we tried to bracket our experiences by, firstly, posing broad open-ended questions which were followed with focusing questions for elaboration, secondly, involving a group of researchers with diverse experiences, ages, opinions on digital wellbeing, and educational backgrounds in the research process and,

thirdly, using reflexive journaling to express our interpretations during the analysis process and aid us in understanding our own evolving perspectives on the data.

3. Findings

We structure the presentation of our findings around the four research questions we formulated to guide our investigation (see Section 2). To address each question we present integrated findings from both the quantitative and qualitative analyses.

3.1. Awareness and adoption of digital wellbeing applications

Of those who responded to our survey, 80.48% indicated that they are aware of digital wellbeing applications, while only 36.94% reported either occasional (27.80%) or regular (9.14%) use. In contrast, 63.06% of respondents indicated that they have ceased using (16.12%) or have never (46.94%) used such applications. Those who reported occasional or regular use were classified as users ($n = 683$), while those who did not were classified as non-users ($n = 1166$) for further analysis.

Analysis of the data obtained from interviewing active users of these applications suggests that users tend to adopt one of two use patterns or styles. The first—which we term *active and regular*—involves checking smartphone usage statistics on a weekly and sometimes daily interval. For interviewees who fall in this category, knowledge of their smartphone behaviour is important, not only for the management of use volume, but also for general time management, behavioural alignment, and self-conception. Such knowledge enables them to balance the benefits they associate with their devices with the negative effects they associate with poorly regulated use. For these interviewees it is important to maintain awareness of both overall and application-specific usage. For the latter, time spent on social media applications is a particularly important indicator.

P20: “I like that Screen Time tells you that this is how much more or how much less you have spent this week or over this period. I like that it tells you for social

media apps, this is how much use you have had for productivity or social. [...]
So it really narrows it down very nicely. So you can see where every bit of your time is going.”

The second pattern—which we term *passive and occasional*—describes users who only monitor their smartphone behaviour based on weekly reports that are automatically provided by their device. For such individuals, awareness of and control over media use is not of particular importance and the information provided by these reports has little or no impact on their device use patterns.

P13: “I used the Screen Time app that the iPhone has, but not actively. It just tells me at the end of the week how much time I’ve spent on my phone, but I just go like, ‘Oh, that’s a bit of a problem.’ And then I just keep on doing what I was doing before.”

Students’ conceptions of digital wellbeing seem to be dominated by their perceptions of what constitutes acceptable use volumes. High levels of digital wellbeing, accordingly, are associated with the ability to self-regulate behaviour to achieve a balance between excessive media use and personal goal achievement.

P14: “If you spend enormous amounts of time on your phone then your digital wellbeing is going to suffer so I don’t think it is healthy to spend four hours per day on your phone. During the holidays I am now probably spending about three hours per day on my phone which isn’t healthy.”

While interviewees were cognisant that smartphone overuse can lead to various negative outcomes, they also emphasised the important benefits they gain from the affordances smartphones offer (e.g., maintaining social connections, management of day-to-day activities, etc.). Thus, while digital wellbeing is primarily framed in relation to use volume, the nature of use is also acknowledged as an important factor. Forms of use which are viewed

positively generally support the achievement of personal goals by, for example, enhancing the user’s productivity, sense of belonging or creativity, as well as presenting opportunities for relaxation and escape from academic or other stressors.

P9: “I think it’s how much time you spend on your phone, but also how you spend the time on your phone when you’re on your phone. So do you use your phone for just social media? Do you use it for games? Do you use it for any purpose other than social media?”

3.2. Applications and features used to achieve digital wellbeing

Figure 1 summarises the applications (panel A) and features (panel B) reported to be used to support digital wellbeing by survey respondents.² Overall, the most used application was iOS Screen Time, followed by Forest:Stay Focused, Huawei Digital Balance, and Android Digital wellbeing. As depicted in Figure 1, although 43.63% of users indicated that they use features that disable notifications, the features most frequently reported concern usage tracking: overall weekly usage (65.74%), weekly application category usage (43.63%), and daily overall usage (41.00%).

The interview data provided further insight into these findings. Across interviewees the primary use case for digital wellbeing applications involved monitoring of smartphone use volume.

P2: “When I get the notifications it tells you your screen usage is 15% up from last week or whatever. So I kind of have an idea of where I’ve increased but I always go there to check and see the facts not just my gut feel. [...] so I do actually go into the analytics because I feel like they help me hold myself more accountable.”

²Figure 1 differentiates between iPhone users and Android users due to the different applications and features available on these devices. The sample included more Android (58.30%) than iPhone (41.70%) users.

Figure 1: Summary of digital wellbeing applications and features used.

Interviewees who reported proactively restricting their use volumes, tend to do so when they need to focus on academic work. Additionally, those who restrict the use of specific applications or application-categories generally targeted social networking or instant messaging services. This is perceived as a meaningful and effective way to avoid overuse.

P10: “I limited my time on Instagram to be 45 minutes a day. After that, my phone shuts down Instagram and I can’t go onto it anymore. Secondly, I basically make Instagram stop being available from half past ten at night until ten in the morning. Cause, often when you go to bed, then you scroll through Instagram.”

Interview data also echoed the patterns observable in panel A of Figure 1. While some interviewees have experimented with non-native applications for monitoring their smart-

phone usage, the largest proportion use native applications. This is primarily due to the ease of use and accessibility of these applications.

P9: “I don’t like voluntarily use it, but it’s kind of just built into my settings that every week it gives me a little here’s what you’ve done this week. It’s gone up by 38%. It’s gone down by 2% and then it shows you like a breakdown of what you’ve been using.”

Among participants who use restrictive features, native applications are perceived as poor, lacking desired features and easy to bypass. In contrast, while shortcomings were still noted, most participants who use restrictive features reported using third-party applications. In these cases, there seem to be more purposeful and directed attempts to utilise restriction and goal-setting features. However, it was also reported that the advertising which appears in free versions discourages continued use, with many participants noting that they are unwilling to spend money on applications for digital wellbeing.

P10: “I don’t use it anymore, so I kind of just stopped using them. I think it’s because they had too many adverts and I don’t trust buying apps.”

3.3. Factors and motivations predicting the adoption and awareness of digital wellbeing applications

3.3.1. Demographics and device characteristics

Our quantitative analysis of the survey data indicated that a respondent’s gender did not predict whether they were aware of digital wellbeing applications ($\chi^2(1) = .17, p = .68$) but it did predict whether they were users of digital wellbeing applications ($\chi^2(1) = 13.24, p < .001$), with 40% of female respondents compared to 31.52% of male respondents classified as users. In contrast, although age was a statistically significant predictor for awareness ($t(430.55) = 2.45, p = .02, d = .19$), it did not predict whether a respondent was a user of digital wellbeing applications ($t(1530.08) = .42, p = .67, d = .02$). Neither awareness ($\chi^2(3) = 6.04, p = .11$) nor use ($\chi^2(3) = 2.13, p = .55$) were influenced by year of study.

Users of mental health applications like ‘calm’ or ‘headspace’ (23.91%) were not more likely to be aware ($\chi^2(1) = .85, p = .36, \varphi = .02$) of digital wellbeing applications, but they were more likely to be users of these services ($\chi^2(1) = 21.17, p < .001, \varphi = .11$), with 46.15% using digital wellbeing applications compared to 34.04% of those who do not use mental health applications. Use of fitness applications (49.11%) was associated with whether a user was aware of digital wellbeing applications ($\chi^2(1) = 9.51, p < .01, \varphi = .07$) and whether they were users of such applications ($\chi^2(1) = 21.94, p < .001, \varphi = .11$). For all of the above comparisons the effects of these variables on awareness or use were generally small to negligible. In contrast, whether an individual’s smartphone was an Android or an iPhone had a much larger effect on whether they were aware ($\chi^2(1) = 85.11, p < .001$) or used ($\chi^2(1) = 93.98, p < .001$) digital wellbeing applications. Only 27.74% of Android owners were classified as users compared to 49.81% of iPhone owners.

3.3.2. Needs and gratifications

As stated in Section 2, we hypothesized that integration of digital wellbeing applications into daily life would be predicted by information seeking motivations, consciousness of negative outcomes associated with smartphone use, the desire to align behaviour with goals, and desires to change behaviour. Table 1 summarises the descriptive statistics and bivariate correlations for these variables for the users sub-sample. All variables were internally consistent and approximately symmetrical. As indicated by the CFI and SRMR outcomes the fit for the single-factor model for each variable was acceptable. All motivations were positively correlated and, with the exception of the association between behaviour alignment and behaviour change motivations, all correlations were small to moderate.

To test H1–4, we conducted a multiple linear regression to predict use integration based on the four motivations ($R^2 = .37; F(4, 678) = 100.36, p < .001$). Table 2 summarises the outcomes of this analysis. Supporting our first, third, and fourth hypotheses, information seeking ($B = .28, p < .001$), behaviour alignment ($B = .28, p < .001$), and behaviour change ($B = .23, p < .001$) motivations all positively predicted integration of digital wellbeing

Table 1: Descriptive statistics and zero-order bivariate correlations for reported integration and use motivations.

Variable	Descriptive statistics					Correlations				
	<i>M</i>	<i>SD</i>	α	CFI	SRMR	1	2	3	4	5
1. Integration	3.72	1.52	.88	.98	.03	-				
2. Information seeking	4.32	1.49	.87	.97	.04	.46 ^c	-			
3. Negative outcomes	4.93	1.52	.86	.98	.02	.10 ^b	.20 ^c	-		
4. Behaviour alignment	4.36	1.48	.91	.97	.03	.53 ^c	.42 ^c	.29 ^c	-	
5. Behaviour change	4.18	1.42	.87	.95	.04	.53 ^c	.44 ^c	.29 ^c	.82 ^c	-

Note. a: $p < .05$; b: $p < .01$; c: $p < .001$. CFI = Comparative Fit Index; SRMR = Standardized Root Mean Square Residual; α = Cronbach's α .

Table 2: Multiple linear regression analysis predicting integration of digital wellbeing applications.

Motivation	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	95% CI
Information Seeking	.28	.04	7.96	< .001	[.21, .35]
Negative Outcomes	-.10	.03	-2.98	< .01	[-.16, -.03]
Behaviour Alignment	.28	.06	5.01	< .001	[.17, .38]
Behaviour Change	.23	.06	3.99	< .001	[.12, .34]

Note. *B* represents unstandardised regression coefficients.

applications. However, in contrast to H2, experiences of negative outcomes associated with smartphones did not positively predict integration of digital wellbeing applications ($B = -.10, p < .01$).³

Although the interview data generally aligned with these findings, it provided a more textured perspective on adoption motivations and, in some cases, ran counter to the quantitative data. Interviewees' monitoring of their smartphone use is primarily grounded in a desire to become informed about their own usage patterns. For some, this information seeking is prompted by a general curiosity about their media behaviour while, for others, it is prompted by a need to gain an objective indication of their usage patterns. In many

³For non-users of digital wellbeing applications, 60.72% indicated that they intend to use these applications in the future. Based on a binary multiple logistic regression ($\chi^2(4) = 297.90, p < .001$) only information seeking ($B = .63, p < .001$) and behaviour alignment ($B = .25, p < .01$) were significant predictors of use intentions, while negative outcomes associated with smartphones ($B = .02, p = .62$) and behaviour change ($B = .05, p = .52$) were not.

cases, interviewees reported that they started monitoring their smartphone use in response to fears about overuse.

P1: “A few years ago during my exams I was wondering how much time I spent on my phone, so I went to look and it was quite [a lot] more than I expected. Ever since then I have kept my eye on it just to make sure I do not stay on my phone for too long every day.”

Developing an objective, quantifiable understanding of their usage is viewed as an important step towards bringing their smartphone use in-line with their intentions.

P14: “If you can’t measure it, you can’t manage it. It is just much easier to see the raw facts in front of you than just relying on your intuition which could very easily be unreliable.”

Interviewees emphasised their desire to achieve a balance between smartphone use which aligns with their personal goals and unproductive, mostly hedonic, forms of use.

P13: “I feel like I’m not really using my time constructively due to my phone. I’ve come to realize there’s a lot of things that I would rather be doing than like being on my phone. Going through Instagram and just explore memes are funny and everything, but they’re not really constructive uses of your time at all.”

The distinction between “constructive” and non-constructive use was sometimes made with reference to emotional experiences during or after phone use. Here, again, the purpose of use seems to dictate affect. The use of applications for utilitarian purposes (planning, note taking, scheduling etc.) tends to evoke positive emotions and a sense of purposefulness. However, when use is perceived as unproductive or loafing, negative affect is experienced. This also applies to social media which, some interviewees argued, promote wellbeing when used purposefully but harm wellbeing when used mindlessly or aimlessly.

For users who actively restrict their media use, digital wellbeing applications take the form of a commitment device; participants make a choice—setting a time-limit on, or disabling access to, specific applications—that restricts their future options and enables them to avoid instances of akrasia. Such intentions to improve task scheduling, time allocation, and support attentional control peak around intensive periods of study like exams.

P5: “Because now I am able to budget my time with these apps. Especially with ‘Bakery’. If I know I want to achieve four hours or six hours I know how to structure my time. So, these apps have played a huge role in terms of time structuring and time management. I actually look forward to studying in a weird way. You look forward to it because you know you’re going to be productive and have something to show for it.”

Because interviewees perceive exam-periods to be particularly important for their academic performance, they tend to be more vigilant of the distracting effects of their smartphones during exams. In addition to more strict application-based device-management, they also attempt to regulate media use through non-technical methods.

P11: “When the first assessment exams came up I felt that I cannot spend much time on my phone so I just went cold turkey on it.”

3.4. The usefulness and/or effectiveness of digital wellbeing applications

Despite our data indicating that more than a third of students use digital wellbeing applications, no statistically significant difference in self-reported smartphone use in minutes ($t(1569.6) = .84, p = .40, d = .04$) was observed between users ($M = 330.49, SD = 170.93$) and non-users ($M = 337.75, SD = 193.14$). In terms of perceptions, as indicated in Figure 2, 68% of users indicated that the data provided by the applications were interesting and useful. However, only 52% perceived such applications to be useful for helping them change their behaviour and 51% reported that digital wellbeing applications help them to remain on task

Figure 2: Perceived outcomes of using digital wellbeing applications.

and focus on their work. For the latter two outcomes, a quarter of users did not regard digital wellbeing applications to be useful for behaviour change or task- or focus-management.

Based on the interview data, it is evident that knowledge of actual usage patterns provides a sense of being in control of media use. There is, however, disagreement on the extent to which monitoring impacted actual usage patterns. Most interviewees felt that monitoring can enable the achievement of use levels that fall below what they perceived to be acceptable, while a minority of interviewees felt that, although the data is informative, it does not impact their behaviour.

P14: “If you can’t measure something than you don’t really know if it is a problem or not. I mean you could get a gut [feeling] but it is so much easier to realise there is a problem when you have the raw facts in front of you that you just can’t deny. So, yes, it has definitely been successful for me to just realise I have been spending a lot of time on my phone and to change the trajectory of my life.”

P15: “I still have to make the conscious choice to not be on my phone. So it can help you a little bit, but it cannot say to you okay you must really stop now. At

the end its still me that has to decide to put away my phone. So it reminds you, but the decision is still mine”

The potential of monitoring to impact behaviour seems to be dependent upon various personal characteristics. Interviewees argued that such characteristics—self-control, self-awareness, conscientiousness—account for both the outcomes associated with behavioural monitoring and, importantly, the attitude with which monitoring is approached.

P7: “I think for me, even if none of these apps existed or the iOS didn’t have the built-in thing, it’s more a personal thing where you kind of realise that it’s becoming a bad habit, that you spend too much time on your cell phone or social media. So you kind of put things in place when you do it. And you’re like, it’s been a while now, put it down and try and be more interactive. [...] A lot of people that I’ve spoken to on a similar topic would say the same, that it’s more of a personal decision that you make, nothing else is going to make you not spend that much time on your phone, on social media, unless you decide, okay it’s enough now.”

The extent to which actively monitoring and restricting smartphone use require considerable pro-active configuration and planning emerged as an important theme in the interviews. While most interviewees reported monitoring with occasional restriction during crucial study times, only a minority reported continuous, long-term use of restrictive features. These participants typically display an orientation towards goal-setting, behaviour monitoring, and restriction, reporting use of similar applications in other domains of their lives.

P14: “I use the downtime feature where you can set specific times that you don’t want to be on your phone. So, mine is set so that at eight o’clock in the evening I am not on my phone anymore so that I stop. [...] I also use the app limits setting.

I use that to set a limit of 35 minutes per day on social networking. [...] I set up the day I am not supposed to use my phone for more than 45 minutes. [...] I tend to keep my limits consistent regardless of whether it is exams or normal term time.

In addition to application-based approaches many interviewees recounted the effectiveness of using more basic methods to support digital wellbeing. These techniques include reducing the physical proximity of the device by placing it in a different location, removing all applications perceived as distracting or harmful for their wellbeing from their phone (either temporarily or permanently), switching off mobile data, activating ‘airplane’ or ‘do-not-disturb’ modes to inhibit unwanted notifications, or simply turning the device off for a period of time. In many cases these approaches are used to facilitate short-term periods of concentration or relaxation during particular parts of the day or academic calendar, or longer term ‘sabbaticals’ from digital media.

P18: “I have also tried to make time for myself, especially during the day, wherever I am to just switch off my phone. I’m not available for those two or three hours. During those two or three hours, no one can reach me and after that I’ll switch my phone back on and continue with whatever is needed to be done or reply to whoever is looking for me. But otherwise I do like to have a little window period where I don’t talk to anyone on my phone. Then I don’t get bothered by whatever notifications are popping up on it.”

Some interviewees reported increasing their offline activities as a means of avoiding media overuse. In such cases, rather than explicitly restricting access to their device, they would occupy themselves with other enjoyable activities: pursuing offline hobbies, spending time outdoors, face-to-face socialising with friends.

P6: “Especially with Instagram, I tend to just take the app off my phone sometimes and then I leave it for a bit, just an attempt to lessen the amount of time

I'm on it. And then also I'm trying to keep busy, with other things. So little projects at home. I started painting or I'm helping with gardening or something like that. Just something else besides just being on the phone. So I'm trying to do other things and I think that's how I'm making a balance, I think between them."

Overall, when asked to evaluate the need for dedicated applications to support digital wellbeing, respondents fall in one of two categories. Those in the first category feel that such applications are essential to supporting their digital wellbeing and that they would struggle to maintain their desired behaviour without them. This dependence seems to be rooted in the idea that it is difficult to mentally track usage, creating the need for objective feedback to support regulation.

P10: "I couldn't really do it without the app. Not just because of the lack of self-control, but it's just because it's stuff you don't even think about. I didn't even realise how I subconsciously go onto Instagram. So I feel like I needed that to bring awareness to the fact that I was doing it subconsciously. I would say that I probably wouldn't have become aware of it if it wasn't for the app."

P18: "I think it keeps me working because sometimes I don't even realize it's a reflex that I just reach for my phone, but then when I unlock it, I can see that the tree is still growing and I'm like, Oh, wait, I'm not done with the time period. So I definitely think it's beneficial"

The second, larger category includes those who believe that the onus is on them to, firstly, consider their desired use levels and, secondly, put in place procedures, whether application-driven or not, that support this balance. Without this reflection and pre-commitment, they argue, any application is unlikely to be successfully utilised to manage digital wellbeing.

P20: “They just give me that awareness that I can be using my time better. Do I do something about it as something that I now need to like go and consider? I think if I really want, they can positively impact my digital wellbeing. But I have to make that decision. It’s not the apps that are going to do it for me.”

P14: “It definitely depends on the person themselves because you can have the best tools but if you yourself as an individual, if you’re not willing to actually make a change, then it is not going to help at all. So I know a lot of people that just simply switch off the screen time, or they just ignore the statistics. So, it is definitely helpful to be a wakeup call for people but, in the end, I think it depends on the individual. If you don’t act on the statistics that you are getting, then what’s the use of it.”

4. Discussion

In response to the growing movement focused on digital wellbeing and deliberate non-use of various digital media, this mixed-method study was conducted to advance our knowledge of students’ adoption, use, and perceptions of smartphone applications designed to support digital wellbeing. Grounded in the U&G theory, this study provides a number of novel insights into the motivations for university students’ adoption of smartphone applications as a means of supporting their digital wellbeing. To follow, we briefly discuss these before outlining limitations of the study.

Addressing our first research question, extending Oeldorf-Hirsch and Chen (2020)’s results, our quantitative data indicate that a majority of students (63%) do not use digital wellbeing applications. This may, *prima facie*, indicate a low level of concern about digital wellbeing as one would expect concern to trigger some minimal level of self-monitoring. An alternative interpretation is that non-users are indeed concerned about their digital wellbeing but do not perceive smartphone applications as providing enough benefit to justify adoption, as was shown by Saariketo (2019). This interpretation is perhaps better supported by our

qualitative data which suggest high levels of awareness about the potential negative effects of smartphone overuse or misuse among this population. Moreover, the finding that there is no meaningful difference between the reported smartphone use levels of users and non-users of digital wellbeing applications, in addition to corroborating Oeldorf-Hirsch and Chen (2020), suggests that many non-users manage to effectively regulate their media use through alternative (non-technical) strategies.

Of those who do use digital wellbeing applications, a majority can be described as passive-occasional users for whom objective information about their phone use patterns is interesting, but does not serve to initiate efforts to change behaviour. For iOS users such information is, by default, provided periodically which explains the higher level of adoption among students with iPhones (50%) compared to those with Android-based devices (28%). Passive-occasional use seems to be driven primarily by information seeking needs rather than a motivation to improve the balance between phone use and personal goal attainment. This may, again, result from a lack of awareness about the role of phone use in wellbeing, apathy towards the improvement of digital wellbeing, the belief that such applications are not beneficial, no experienced negative effects associated with smartphone use or, as our qualitative data suggest, some combination of these. Additionally, passive-occasional users may value the benefits of high levels of phone use over the advantages they associate with actively regulated use. However, our qualitative data suggest that situations in which the importance of personal goals become accentuated (e.g., exam periods) serve to trigger more active regulation among this group.

About 10% of students surveyed can be described as active-regular users of digital wellbeing applications. Among this group we observe, firstly, high levels of awareness of the role of media use in both physical and mental wellbeing and, secondly, a motivation to achieve an optimal balance between the advantages offered by smartphone use, the attainment of personal goals, and the potential drawbacks associated with excessive smartphone use. Unlike their passive-occasional peers, these users utilise the restriction and goal-setting features

of digital wellbeing applications to support their self-regulation efforts.

In accordance with U&G theory, the support we found for H1, H2, and H4, indicates that active-regular use of digital well-being applications is associated with particular needs, including information seeking, behaviour alignment and behaviour change. We acknowledge the manner in which these findings seem to contradict U&G theory — i.e., rather than gratifying needs through media use, needs are gratified by effectively regulating media use. We argue, however, that because the medium itself serves as the instrument which facilitates regulation of its use, the central premise of the theory is supported. Adoption of an affordance-oriented perspective serves to clarify this argument. When studying media like smartphones which support an increasingly wide range of affordances, high-level use measures (e.g., use volume) tend to ignore the important differences in the needs that are gratified by different smartphone affordances. The present study suggests, firstly, that for such media different affordances are associated with different outcomes and, secondly, that a particular affordance (e.g., the ability to restrict use volume) can be used to gratify the need to regulate problematic use of another affordance (e.g., chronic monitoring of social media feeds). This affordance-oriented perspective of U&G theory may prove beneficial in future studies of affordance-rich media or meta-media like smartphones (Humphreys et al., 2018).

Consideration of our findings in their totality suggests that the success of attempts to improve smartphone regulation through the adoption of digital wellbeing applications depends upon a certain level of motivation and commitment by the user, and that these factors are often dictated by personal characteristics. Much like applications which track and support other forms of health and wellbeing improvement (e.g., fitness, meditation, diet etc., Fitzgerald and McClelland, 2017), supporting (Oeldorf-Hirsch and Chen, 2020)’s quantitative findings, the qualitative findings indicate that the successful integration of digital wellbeing applications seems to occur among students that are, firstly, mindful of the relationship between their behaviour and their wellbeing and, secondly, *motivated* to perform optimally in the pursuit of personal goals. Specifically, such individuals display high levels of awareness of

the role of smartphones in their lives and are intentional about achieving a balance between the benefits and drawbacks they associate with use of their smartphone. There is some evidence that occasional monitoring serves to raise the user’s awareness of their media use patterns and, on this basis, trigger some degree of regulation. However, in the absence of user motivation and commitment, attempts to regulate are likely to fail.

5. Conclusion

The findings presented in this paper contribute to broadening our theoretical and practical knowledge of digital wellbeing by identifying adoption rates, use motivations, perceived effects, and experiences with applications designed to support digital wellbeing. The findings highlight the importance of individual motivations and the need to understand digital wellbeing as more than simply the use of an application or tool. As Vanden Abeele (2020, p. 5) argues, digital wellbeing depends on a range of person-, device- and context-specific factors. The present study provides a rich descriptive account of the temporal variability, person-specificity, and device-contingent nature of digital wellbeing, adding to our understanding of this new media phenomenon.

Notwithstanding the study contributions, several key limitations merit consideration. First, the study involved a student population in South Africa. While the media behaviour of such a sample is comparable to Western norms among students (le Roux et al., 2021; Panova et al., 2020; Chokalingam et al., 2019), it is unknown how the results would generalise to a non-student population or to students in other countries. For this, investigations among either general or specific populations are needed. Second, the study was conducted during the early stages of the Covid-19 pandemic in 2020. The effects of this pandemic on media use have yet to be established, however, it is expected that behaviour during this period may differ from other periods. Third, a key limitation of the present study relates to the measurement instruments used to assess integration and use-motivations. As with previous studies concerning behaviour tracking (Lee and Cho, 2017; Oeldorf-Hirsch and Chen,

2020) survey-items were produced based on existing literature. While the measures used were internally consistent, demonstrated the expected internal structure and face validity, more work is needed to further verify the construct validity of the measures used. Furthermore, while self-report measures may be appropriate for assessing motivations, measures based on digital-trace data may present a more accurate (Parry et al., 2021) and nuanced representation of application usage than the binary measure used in the present study.

Acknowledgements

Conflict of interest: The authors declare no competing financial interests.

Funding sources: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics approval: The ethics committee of the University approved the study.

Appendix

5.1. Appendix A: Survey items

References

- Ajzen, I., 2011. The theory of planned behaviour: Reactions and reflections. *Psychology & Health* 26, 1113–1127.
- Apple Newsroom, 2018. iOS introduces new features to reduce interruptions and manage Screen Time. <https://www.apple.com/za/newsroom/2018/06/ios-12-introduces-new-features-to-reduce-interruptions-and-manage-screen-time/>. Online; accessed 01-April-2020.
- Blumler, J.G., Katz, E., 1974. The uses of mass communications: Current perspectives on gratifications research. Sage Publications.
- Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. *Qualitative research in psychology* 3, 77–101.

Table 3: Questionnaire part 1 (completed by all participants).

Item	%
Please indicate your consent by selecting the appropriate option	
I confirm that I have read and understood the information provided for the current study ^d	99.15
I agree to take part in this survey and that the data may be used in future research projects ^d	99.15
Please select the year in which you were born^{a, b}	20.52 (1.87)
What year of study are you currently in?	
First year	43.16
Second year	25.20
Third year	20.50
Fourth year	8.43
Other (please specify)	11.14
Please select the gender you identify with:	
Female	62.47
Male	36.88
Not listed (please specify)	0.65
Do you own a smartphone?	
Yes, I own an Android smartphone (e.g., Samsung, Huawei, LG etc.)	58.30
Yes, I own an Apple smartphone (iPhone)	41.70
No, I own a feature phone (e.g., not a smartphone)	0
No, I do not own a phone	0
Please estimate the amount of hours and minutes you spend on your phone during an average day.^{a, c}	335.07 (185.24)
I regularly use smartphone applications for health and fitness (e.g., Strava, MyFitnessPal, iOS Health, Runtastic)	
Yes	49.11
No	50.89
I regularly use smartphone applications for mental health (e.g., Headspace, Calm)	
Yes	23.90
No	76.10
Are you aware of smartphone applications or features that enable you to monitor or restrict how much you use your device?	
Yes	80.48
No	19.52
How would you characterise your use of smartphone applications or features for monitoring and restricting device use:	
I have never used such applications or services	46.94
I used to use such applications or services but have now stopped	16.12
I occasionally use such applications or services	27.80
I am a regular user of such applications or services	9.14

Note.

^a Mean (standard deviation) reported.

^b Age computed from this item.

^c Responses provided through a slider ranging from 0 to 960 minutes.

^d Those indicating ‘no’ were removed from the study.

Table 4: Questionnaire part 2 (only completed by app users).

Item	%
Which of the following applications do you use? (select all that apply)	
Android Digital Wellbeing	13.03
Huawei Digital Balance	13.62
iOS Screen Time	51.54
Forest	18.30
Cold Turkey	0.73
Focus Lock	2.49
AppBlock	5.56
Unplugged	1.61
AntiSocial	1.02
Moment	0.88
Flipd	2.20
Other (please specify)	5.70
Which of the following features do you use? (select all that apply)	
Weekly report on overall device usage	65.74
Weekly report on application categories (e.g., social media, productivity, etc.)	43.63
Weekly report on specific application usage	28.84
Setting timers to restrict access to my device	26.35
Setting timers to restrict access to specific apps	36.02
Blocking specific apps	18.30
Checking my daily overall usage	41.00
Checking my daily usage of specific apps	25.48
Disabling notifications	43.63
Other (please specify)	0.88

Table 5: Questionnaire part 3 (only completed by app users).

Item	Mean (SD)
Please answer each statement below by selecting the number that best reflects your degree of agreement or disagreement with that statement.	
I frequently use digital wellbeing applications and services	3.84 (1.67)
I have integrated digital wellbeing applications and services into my day to day habits	3.50 (1.82)
I rely on digital wellbeing applications and services to manage my time effectively	3.07 (1.76)
I Intend to continue using digital wellbeing applications and services in the future	4.47 (1.80)
Please answer each statement below by selecting the number that best reflects your degree of agreement or disagreement with that statement	
I use digital wellbeing apps/services because I am curious and want to learn about my smartphone use.	3.92 (1.83)
Digital wellbeing apps/services help me to quantify my overall device usage	4.51 (1.72)
Digital wellbeing apps/services help me to quantify my usage of particular categories of apps	4.34 (1.73)
Digital wellbeing apps/services help me to quantify my usage of specific apps	4.49 (1.75)
I am frustrated by the amount of time that I spend on my phone	4.94 (1.84)
My phone use disrupts my focus in lectures (or class videos	4.57 (1.92)
My phone use disrupts my focus when studying.	5.03 (1.77)
I use my phone when I should be doing other things.	5.20 (1.67)
Digital wellbeing apps/services help with time management	4.34 (1.65)
digital wellbeing apps/services support productivity	4.53 (1.66)
digital wellbeing apps/services help with contration on studies/work	4.31 (1.67)
digital wellbeing apps/services help with the achievement of goals	4.26 (1.60)
Digital wellbeing apps/services are useful for helping me to change my behaviour.	4.32 (1.65)
Digital wellbeing apps/services help to reduce excessive smartphone use.	4.61 (1.65)
Digital wellbeing apps/services help me to not use my phone when I should be doing something else.	4.19 (1.67)
Digital wellbeing apps/services help me to become the person I want to be	3.61 (1.69)
Please answer each statement below by selecting the number that best reflects your degree of agreement or disagreement with that statement.	
I find the data provided by these applications to be interesting and useful	4.98 (1.4)
I find these applications to be useful for helping me change my behaviour	4.41 (1.5)
I find these applications to be useful for helping me remain on task and focus on my work	4.41 (1.6)

Table 6: Questionnaire part 4 (only completed by non-app users).

Item	Mean (SD)
I intend to use digital wellbeing applications or services in the future.	
Yes	60.72
No	39.28
Please answer each statement below by selecting the number that best reflects your degree of agreement or disagreement with that statement.	
I intend to use digital wellbeing apps/services because I am curious and want to learn about my smartphone use.	3.84 (1.76)
Digital wellbeing apps/services can help me to quantify my overall device usage	3.77 (1.69)
Digital wellbeing apps/services can help me to quantify my usage of particular categories of apps	3.90 (1.75)
Digital wellbeing apps/services can help me to quantify my usage of specific apps	4.02 (1.77)
I am frustrated by the amount of time that I spend on my phone	4.30 (2.02)
My phone use can disrupt my focus in lectures (or class videos).	4.79 (2.03)
My phone use can disrupt my focus when studying.	5.29 (1.81)
I use my phone when I should be doing other things.	5.09 (1.72)
Digital wellbeing apps/services can help with time management	4.76 (1.60)
digital wellbeing apps/services can support productivity	4.82 (1.56)
digital wellbeing apps/services can help with concentration on studies/work	4.60 (1.68)
digital wellbeing apps/services can help with the achievement of goals	4.67 (1.59)
Digital wellbeing apps/services can be useful for helping me to change my behaviour	4.38 (1.63)
Digital wellbeing apps/services can help to reduce excessive smartphone use.	4.75 (1.62)
Digital wellbeing apps/services can help me to not use my phone when I should be doing something else.	4.54 (1.65)
Digital wellbeing apps/services can help me to become the person I want to be	3.67 (1.79)

- Broughton, A., Daly, M., Marx, N.J., Nieuwoudt, M., le Roux, D.B., Parry, D.A., 2019. An exploratory investigation of online and offline social behaviour among digital natives, in: Proceedings of the South African Institute of Computer Scientists and Information Technologists 2019. Association for Computing Machinery. SAICSIT '19.
- Büchi, M., 2020. A proto-theory of digital well-being. URL: osf.io/k3e2j, doi:10.31219/osf.io/k3e2j.
- Chokalingam, L., Matthee, M., Hattingh, M.J., 2019. It seems to have a hold on us: Social media self-regulation of students, in: Kabanda, S., Suleman, H., Gruner, S. (Eds.), ICT Education, Springer International Publishing. pp. 78–92.
- Creswell, J.W., 2013. Qualitative inquiry and research design: Choosing among five approaches. Sage publications.
- David, M.E., Roberts, J.A., Christenson, B., 2018. Too much of a good thing: Investigating the association between actual smartphone use and individual well-being. *International Journal of Human–Computer Interaction* 34, 265–275.
- Davis, F.D., Bagozzi, R.P., Warshaw, P.R., 1989. User acceptance of computer technology: a comparison of two theoretical models. *Management science* 35, 982–1003.
- Dienlin, T., Johannes, N., Bowman, N.D., Masur, P.K., Engesser, S., Kümpel, A.S., Lukito, J., Bier, L.M., Zhang, R., Johnson, B.K., Huskey, R., Schneider, F.M., Breuer, J., Parry, D.A., Vermeulen, I., Fisher, J.T., Banks, J., Weber, R., Ellis, D.A., Smits, T., Ivory, J.D., Trepte, S., McEwan, B., Rinke, E.M., Neubaum, G., Winter, S., Carpenter, C.J., Krämer, N., Utz, S., Unkel, J., Wang, X., Davidson, B.I., Kim, N., Won, A.S., Domahidi, E., Lewis, N.A., de Vreese, C., 2020. An Agenda for Open Science in Communication. *Journal of Communication* .
- Faul, F., Erdfelder, E., Buchner, A., Lang, A.G., 2009. Statistical power analyses using G*

- Power 3.1: Tests for correlation and regression analyses. *Behavior research methods* 41, 1149–1160.
- Fitzgerald, M., McClelland, T., 2017. What makes a mobile app successful in supporting health behaviour change? *Health education journal* 76, 373–381.
- Gazzaley, A., Rosen, L.D., 2016. *The Distracted Mind: Ancient brains in a high-tech world*. MIT Press, Cambridge, USA.
- Google, 2018. Our Commitment to Digital Wellbeing. <https://wellbeing.google/our-commitment/>. Online; accessed 01-April-2020.
- Haven, T., Van Grootel, L., 2019. Preregistering qualitative research. *Accountability in Research* 26, 229–244.
- Humphreys, L., Karnowski, V., Von Pape, T., 2018. Smartphones as metamedia: A framework for identifying the niches structuring smartphone use. *International Journal of Communication* 12, 17.
- Junco, R., 2012. In-class multitasking and academic performance. *Computers in Human Behavior* 28, 2236–2243. doi:10.1016/j.chb.2012.06.031.
- Lee, H.E., Cho, J., 2017. What motivates users to continue using diet and fitness apps? application of the uses and gratifications approach. *Health communication* 32, 1445–1453.
- Mason, B., 2018. Digital wellbeing in the twenty-first century. https://digitalsocial.eu/images/upload/42-D3.4\%20Trend\%20-\%20Digital\%20Wellbeing_p002-018_split.pdf. Online; Accessed 20-Jan-2020.
- Monge Roffarello, A., De Russis, L., 2019. The race towards digital wellbeing: Issues and opportunities, in: *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, Association for Computing Machinery. p. 1–14.

- Oeldorf-Hirsch, A., Chen, Y., 2020. Who Cares about Screen Time? Predicting the use of Mobile Phone Tracking Features.
- Pai, P., Arnott, D.C., 2013. User adoption of social networking sites: Eliciting uses and gratifications through a means-end approach. *Computers in Human Behavior* 29, 1039–1053.
- Panova, T., Carbonell, X., Chamarro, A., Puerta-Cortés, D.X., 2020. Specific smartphone uses and how they relate to anxiety and depression in university students: a cross-cultural perspective. *Behaviour & Information Technology* 39, 944–956. doi:10.1080/0144929X.2019.1633405.
- Parry, D.A., 2017. The Digitally-Mediated Study Experiences of Undergraduate Students in South Africa. Master’s thesis. Stellenbosch University.
- Parry, D.A., Davidson, B.I., Sewall, C.J., Fisher, J.T., Mieczkowski, H., Quintana, D.S., 2021. A systematic review and meta-analysis of discrepancies between logged and self-reported digital media use. *Nature Human Behaviour* 5, 1535–1547.
- Parry, D.A., le Roux, D.B., Bantjes, J.R., 2020. Testing the feasibility of a media multitasking self-regulation intervention for students: Behaviour change, attention, and self-perception. *Computers in Human Behavior* 104, 106182.
- Putri, M.F., Harahap, N.C., Pramudiawardani, S., Sensuse, D.I., Sutoyo, M.A.H., 2019. Usage intention model for mobile health application: Uses and gratification perspective, in: *International Conference on Electrical Engineering and Informatics (ICEEI)*, IEEE. pp. 500–505.
- R Core Team, 2013. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing. Vienna, Austria. URL: <http://www.R-project.org/>.

- Rooksby, J., Asadzadeh, P., Rost, M., Morrison, A., Chalmers, M., 2016. Personal tracking of screen time on digital devices, in: Proceedings of the 2016 CHI conference on human factors in computing systems, pp. 284–296.
- le Roux, D.B., Parry, D.A., Totolo, A., Iyawa, G., Holloway, J., Prenter, A., Botha, L., 2021. Media multitasking, online vigilance and academic performance among students in three Southern African countries. *Computers & Education* 160, 104056. doi:10.1016/j.compedu.2020.104056.
- Rubin, A.M., 2009. Uses -and-gratifications perspective on media effects, in: Bryant, J., Oliver, M. (Eds.), *Media effects: Advances in theory and research*. Taylor & Francis, New Jersey, pp. 165–184.
- Rubin, A.M., Rubin, R.B., 1985. Interface of personal and mediated communication: A research agenda. *Critical Studies in Media Communication* 2, 36–53.
- Saariketo, M., 2019. Encounters with self-monitoring data on ict use. *Nordicom Review* 40, 125–140.
- Schmuck, D., 2020. Does digital detox work? exploring the role of digital detox applications for problematic smartphone use and well-being of young adults using multigroup analysis. *Cyberpsychology, Behavior, and Social Networking* 23, 526–532.
- Silver, L., 2019. Smartphone Ownership Is Growing Rapidly Around the World, but Not Always Equally. <https://www.pewresearch.org/global/2019/02/05/smartphone-ownership-is-growing-rapidly-around-the-world-but-not-always-equally/>. Online; accessed 03-April-2020.
- Tarafdar, M., Gupta, A., Turel, O., 2013. The dark side of information technology use. *Information Systems Journal* 23, 269–275.

- Vanden Abeele, M., 2020. Digital wellbeing as a dynamic construct. *Communication Theory* , 1–24.
- Vanden Abeele, M., De Wolf, R., Ling, R., 2018. Mobile media and social space: How anytime, anyplace connectivity structures everyday life. *Media and Communication* 6, 5–14.
- Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D., 2003. User acceptance of information technology: Toward a unified view. *MIS Quarterly* , 425–478.
- Whelan, E., Islam, A.N., Brooks, S., 2020. Applying the sobc paradigm to explain how social media overload affects academic performance. *Computers & Education* 143, 103692.
- Zhang, Y., Tang, L.S.T., Leung, L., 2011. Gratifications, collective self-esteem, online emotional openness, and traitlike communication apprehension as predictors of facebook uses. *Cyberpsychology, Behavior, and Social Networking* 14, 733–739.