DAN & Danny: Combining Analog and Digital Self-Tracking Data to Manage Wellbeing

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***Abstract*—An uprising trend of Personal Informatics has leveraged mobile applications to help users track their wellbeing; however, these digital solutions focus on quantitative data, lacking the insights provided by qualitative data in paper notebooks. We propose to digitally augment a paper diary to allow both analogue and digital data, bridging the gap between qualitative and quantitative data tracking practices to support better awareness and reflection on health data. As a first case-study, we designed a self-tracking tool to help college students manage their wellbeing by increasing self-awareness and easing help-seeking behaviours. Next, we conducted a longitudinal study to validate the tool's effectiveness and analyse its acceptability. Results show that our approach helped students by allowing moments of self-reflection and self-awareness. Additionally, our findings suggest that qualitative data is most useful when important events and abrupt changes to wellbeing occur. Preference for paper or digital diaries is highly user-dependent; however, most participants favoured a digital-only tool with notetaking capabilities.**

I. Introduction

The transition from high school to university is often overlooked, but students who enter a college setting face new challenges that might negatively influence their wellbeing. Indeed, students' mental health and wellbeing are an international concern [1], widely recognized as a college mental health crisis [1], [2], [3], [4]. Among the most common causes, the academic workload, peer pressure, and graduation pressure are all factors that can induce instabilities to the students' wellbeing [1], [2], [3], [4]. Although a portion of the students can cope with these challenges on their own, some of them may feel overwhelmed and face additional challenges to their mental health. Moreover, these factors have significant implications in academic success, productivity, substance use, and social relationships [2]. The variety of problems these students face is further exacerbated by their poor help-seeking behaviours [2], [5], [6]. Therefore, they often have to manage their wellbeing by themselves; not only is this prejudicial for them – as they may not realize the full extent of the issues their are experiencing – but also for other stakeholders who are not aware of the students' wellbeing.

Prior research focused on leveraging user-generated data to gain insights into the wellbeing of students [3], [7], [8]. However, these digital solutions are often limited to quantitative data (e.g., sleeping time and the number of steps), which lack the context and meaningfulness provided by qualitative data. Indeed, digital tools have advantages regarding data treatment [9] and signalling [10]; yet, users often abandon these technologies due to lack of meaningful insights, switching to paper notebooks as they support more flexible notetaking practices [11]. In contrast, paper diaries are easy to start and use, cheap, portable, robust [12], and more appropriate for qualitative input as users write faster on paper [9]. Additionally, they have the advantage of allowing for a more mindful self-tracking as it helps users distance themselves from potential distractions [13].

In this paper, we propose Dan & Danny, a tool that allows both analogue and digital input while leveraging the advantages from both digital and analogue approaches. Dan is a digitally augmented paper notebook that supports user quantitative and qualitative data tracking practices. Danny is a companion mobile application that serves as a data visualization medium. We describe the design of Dan & Danny and how it supports college students' self-tracking practices and eases help-seeking behaviours while preserving data privacy.

We evaluated Dan & Danny in a qualitative longitudinal study with college students to assess its acceptability and effectiveness. Participants were asked to use the tool in their everyday lives for six weeks. We then interviewed students to gather feedback about the use of Dan & Danny and their experiences as college students. The study aimed to address questions such as: Are Dan & Danny accepted by college students as self-tracking tools? Do the tools increase self-awareness and self-reflection? Do the tool facilitate data-sharing and help-seeking behaviours? What factors most impact college students' wellbeing, and what are their implications?

This paper contributes with: first, an approach for self-tracking data that bridges quantitative and qualitative data; second, two formative user studies that informed the design of the self-tracking tool; third, Dan & Danny, a novel prototype that supports flexible qualitative notetaking practices through a digitally augmented notebook; fourth, an analysis of themes that emerged from interviews with college students about their experiences with Dan & Danny over a six-week period. These contributions are relevant to personal informatics researchers and designers of technologies for college students, particularly when promoting better wellbeing. They provide knowledge for designing systems to support self-tracking practices to support wellbeing in college settings.

II. Related Work

There has been an uprising trend to use Personal Informatics [14] as well as Digital Phenotyping [15] to help increase self-reflection and self-knowledge. In particular, Kelley et al. [3] has shown how both college students and health professionals value self-tracking tools. Self-tracking data can be either actively or passively captured, or even a combination of both [16], [17]. On the one hand, passive sensors allow to reduce capture burden as well as to track data which would not be possible manually. The major drawback is that people might be less engaged and aware of the collected data [18]. On the other hand, manual tracking raises the users' awareness [18], which is one objective of self-tracking approaches. This comes at the cost of more motivation needed and a higher capture burden. Semi-automated tracking [17] balances the advantages and drawbacks of both types of data-sensing with light quantitative data [13] such as ratings, and descriptive qualitative data.

Another topic of discussion is the nature of the apparatus. Electronic approaches allow a better experience with data treatment and analysis [9], they can offer more contextual data such as time-stamps and location [12], and can increase compliance through signalling [10]. Nonetheless, there are drawbacks of digital solutions and possible improvements for analogue approaches. Users might avoid mobile phones since they are often associated with stressful activities [13]. Mobile apps for self-tracking remind people that they are being monitored and therefore change how they interact with those solutions [19]. Moreover, devices that are dedicated for self-tracking have the advantage of reminding the user to self-track and requiring less preparation time [13]. For instance, Ayobi et al. [11] leverages bullet journaling to counter the lack of personally meaningful insights from digital only approaches as well as to overcome technological boundaries. In addition, Vega et al. [20] eases data treatment by giving a specific structure to notebooks to allow their translation into digital data, yet it does not support descriptive data.

Regarding captured data, quantitative data is the most common and easily tracked data as it can be tracked passively, although it often requires context. As that context is provided by descriptive data, a combination of quantitative and qualitative data might be the best solution. Although, digital phenotyping approaches with raw sensor data have been used in past research [7], [21], users do not find this data relevant [1]. As such, data treatment is required to make information be presentable to individuals so they can act upon it [7]. Nevertheless, most solutions are designed only for stakeholders [1], [8] and not for students to reflect on the data. We found this flexibility to support different data to be an important requirement [11], [16], as there is a clear need for it in a solution dedicated for students in a college setting.

Sharing data with therapists, health professionals, family and peers can also improve the feedback and motivation Some authors [3], [11] reference social sharing as a way to support and connect with others in similar situations. However, sharing personal data raises concerns related with privacy and ethics. Social media and raw sensor data are examples of delicate data that users prefer not to share [1], [7], [8]. Although students are open to share their information [3], solutions should offer full control to the user, so they choose what to share and knows how the data is being used. In this work, we contribute to prior literature on systems to support wellbeing through self-tracking practices by designing a tool that promotes help-seeking behaviors while protecting data privacy.

III. Formative Studies

We conducted two formative user studies to inform the design of self-tracking tools for college students.

A. Cultural Probes

We first designed a cultural probe [22] to leverage self-tracking in a college setting while eliciting opinions and reflections from students. The cultural probe (Figure 1) consisted of: (i) a map and calendar to self-track wellbeing by placing coloured stickers, (ii) a paper diary to complement the assessments, and (iii) eight envelopes with questions and challenges to be opened weekly. After two months with the cultural probe, we conducted semi-structured interviews with each participant ($N = 4$) and proceeded with a thematic analysis [23].

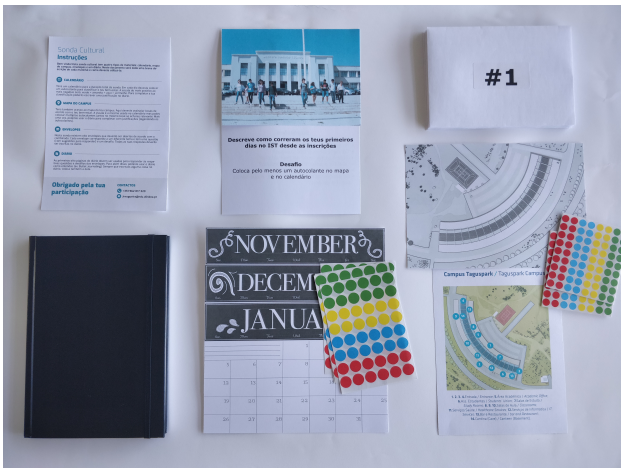

Fig. 1. Cultural probe materials used for user research.

Overall, participants enjoyed the activities as they helped them to reflect on different subjects and increase their wellbeing awareness. Self-tracking was well accepted and exposed the value of leveraging such approaches in a college setting. Although some students shared past failed experiences with other tools, it helped us elicit and confirm some design guidelines, such as the value of a dedicated tool and active self-tracking. One participant also referenced the importance of adding justifications to light-data, such as the stickers. While the calendar helped them be more aware of their wellbeing and highlight patterns, participants did not value the spatial data (i.e., campus map). This information might be useful to aggregate the data of multiple students, but it does not

Fig. 2. Participatory toolkit overview: (Left) Main board: stakeholders (lines), data types (columns), share method (last column). Participants were asked to chose 10 data types and fill the columns. Data type cards based on wellbeing dimensions (e.g., productivity, stress). Next, they were asked to use a Yes, No or Maybe token that indicated their willingness to share data to a particular stakeholder. Moreover, they were asked to indicate how they would share the data: periodically, in real-time, or on user demand. (Right) Emotion chart and numbered tokens that represent the users' emotion if sharing policy for each stakeholder was defrauded.

seem worth tracking for individual use. The acceptability of a physical diary proved to be a matter of preference; participants found it useful, but the capture burden was a concern for some. Finally, while participants were open to share their data, it was evident that reducing privacy concerns should be a design goal. Thus, we organized a follow-up workshop to understand privacy concerns regarding wellbeing data.

B. Participatory Activities Toolkit

Collecting and sharing sensitive user-generated data raises privacy concerns. To understand students' expectations, we built a participatory toolkit to elicit views concerning the most valued types of wellbeing data (e.g., hours of productivity or sleep quality), their perceived usefulness, their willingness to share with various stakeholders (e.g. family or psychologists), and their preferences about the sharing process (e.g., real-time sharing or weekly reports). We used the toolkit in a remote study through a tabletop simulator. Digital materials included cards with types of data, a board with stakeholders with whom participants could share data, cards representing different sharing processes, and a valence-arousal chart to point out emotions [24] when their sharing expectations were (not) met (see Figure 2). Finally, we conducted individual sessions $(N = 8)$ where we asked participants to populate the board while talking aloud, and then performed a thematic analysis [23] of recorded conversations.

Findings indicate that although participants agreed on which wellbeing dimensions should be tracked, their preferences regarding data types are diverse. There was no clear preference between quantitative and qualitative measures, and combining data types was appreciated as they offer distinct insights. Indeed, while quantitative metrics are often not enough to evaluate aspects of wellbeing (i.e., a higher number of working hours might not mean higher productivity), personal ratings offer more accurate information but even less detail. Furthermore, both these types of quantitative data often lack relevant context, which can be supported by descriptive qualitative data. This point is in line with previous research [16], [25] on self-tracking tools where it was reported that these tools need to be flexible enough to support diverse configurations and data inputs.

Results also show that students perceive data-sharing as a useful feature to gain feedback from stakeholders or inform third parties such as government and college administration entities, but feel threatened by the option of their data being used for different purposes (e.g., advertising). Furthermore, the willingness to share information is related to data types since they are more likely to share information that offers less detail (i.e., quantitative). This finding confirms that there is an opportunity to pair quantitative with qualitative data, leveraging how the former is more likely to be shared, and the latter complements it by offering the needed context in control of the user. Participants' expectations regarding what and how data should be shared vary according to their end-goal and with whom they are sharing. Nevertheless, findings indicate a preference for having more control over how data is shared to reduce the feeling of being monitored.

Lastly, students said they would feel disturbed if they lost control over what and how data is shared and disappointed if they could not share their data when it would be helpful. If self-tracking tools are designed according to these findings, they will fulfil students' expectations with a higher chance of acceptance and long-term engagement. Moreover, tools should be flexible to support different data types and offer a customizable sharing experience to reduce privacy concerns and meet users' demands.

IV. DAN & DANNY

Based on previous findings, we propose a two-component tool (Figure 3) composed of (i) a digitally augmented notebook (DAN) and (ii) a companion mobile application (Danny). DAN is a **flexible** notetaking tool with **balanced capture burden**

that relies on **active rating assessments**. The goal is to enable both types of input, allowing users to input descriptive data coupled with ratings, building a bridge between qualitative and quantitative data. Additionally, we propose Danny, a mobile application connected to the notebook that provides **meaningful insights** through **easily perceived visualizations** while also allowing users to share their data to gain further support and without raising privacy concerns.

A. DAN: Digitally Augmented Notebook

DAN allows both digital and analogue data collection, leveraging the advantages of both approaches and thus offering a balanced capture burden. While ratings can be easily captured and analysed, they might provide insufficient insights. Analogue data addresses this limitation by offering context at the cost of a higher capture burden. Moreover, we choose to focus on active data collection because it enables users to bridge the gap between quantitative (ratings) and qualitative (personal notes) data while promoting more self-reflection and self-awareness.

The augmentation is Arduino-based and comprises an LCD, a button to scroll through rating types, five buttons representing a rating scale, a real-time clock to save timestamps, a battery to power the system, and a wireless charging circuit. DAN allows users to select a specific aspect of their wellbeing and rate it accordingly. All components are contained in a 3D printed box placed on the top of the notebook, leaving it with squared pages. Therefore, we preserve the original form of a notebook, thus allowing DAN to be easily carried. Furthermore, this means that DAN is a tool dedicated solely to self-tracking, helping users focus and distance themselves from distractions while they reflect and input their data.

B. Danny: Mobile Companion App

Danny communicates with DAN and serves as a medium to visualize the user-generated data and configure DAN. Users can set up custom trackers or chose recommend trackers for college students, such as anxiety or sleep. The application generates visualizations based on self-track data to provide meaningful insights, promoting self-awareness and -reflection. Users can leverage these charts to pinpoint changes and their causes, find possible correlations, and track the evolution of their wellbeing. Moreover, users can share their visualizations with other stakeholders to gain further feedback. To provide a sense of privacy, users have control over the sharing process by choosing which visualizations they want to include in a static snapshot, which is shareable through a PDF file. Finally, we promote user engagement through gamification components, including unlockable achievements and *Weeklies* - weekly notifications with questions, challenges, and recommendations.

V. Longitudinal User Study

We conducted a longitudinal user study that ran through the course of six weeks. Our goal was two-fold: first, understand whether the tool is **accepted by students** and, if so, whether it helps students to be **more self-aware and reflect on their wellbeing**. Second, we intend to validate whether our tool **eases data-sharing and help-seeking behaviours**.

A. Methodology

Even though Dan & Danny are targeted at all college students, we invited participants that often face additional challenges adapting to college. We recruited five participants who either have the status of SSED (Students with Special Educational Needs) or are being supported by student support services. All participants ($N = 5$) were male with ages between 18 and 28 ($\overline{x} = 21.8, \sigma_x = 3.54$). They were compensated with a 35€ voucher.

Each participant received a DAN with a wireless charger and was asked to install Danny on an Android 8.0+ smartphone that supports BLE. When the students confirmed they had the notebook and application installed, we scheduled an initial meeting with each of them. In this meeting, we started by introducing the study and the tools. Afterwards, we gave them instructions for what they could to do for the following weeks, which included: (i) choose three to five trackers; (ii) rate each tracker on a daily basis; (iii) write contextual information regarding these ratings; (iv) engage with Weeklies; (v) gain insights from the visualizations; and (vi) share their data to get further feedback. At the end of the study, we scheduled a semi-structured interview with each participant.

B. Data Collection & Analysis

Acceptability was evaluated through the Technology Acceptance Model (TAM) [26], which assesses how users accept and use technology by analysing their **perceived usefulness (PU)** and **perceived ease of use (PEOU)**. Regarding the interviews, we first collected information on past experiences with self-tracking and help-seeking behaviours to understand whether it affects the PU, the PEOU, and the **intent to use** our tools. Afterwards, we discussed each of the features of Dan & Danny, namely their usefulness, usability, and participants' intent to use them. To conclude our analysis of acceptability, we leveraged interaction logs to analysed participants' **use behaviours**. To evaluate **effectiveness**, we complemented our acceptability findings with questions that included exploring changes in self-awareness and -reflection, and analysing improvements regarding help-seeking through data-sharing. Finally, with the participant's consent, we audio-recorded and transcribed each session, and proceeded with an iterative thematic analysis [23].

VI. Findings

This section pinpoints our main findings, complementing the quantitative data with the thematic analysis. We also discuss our findings as well as the limitations of this study.

A. Acceptability

a) Use Behaviour: All participants chose five trackers and mostly used the ones recommended by the tool as these trackers cover what they considered the most important dimensions of wellbeing. Additionally, two participants created

Fig. 3. A digitally augmented notebook (DAN) on the left with an LCD and a button to select a wellbeing aspect, and a group of five buttons to rate said measure. On the right, two of Danny's screens, including a visualizations page and a customizable sharing feature.

custom trackers to address more specific issues (i.e. depression and chronic tiredness). Self-tracking was mostly event-based as participants usually assessed their wellbeing before going to sleep, while only one resorted to a daily reminder. Furthermore, all participants had at least one occurrence where they did not rate their wellbeing because they forgot. In the words of P2, *"I only missed a few ratings because I was studying for tests, and I forgot to do them."*. The paper notebook was mostly used to document abrupt changes in students daily lives, which prompted them to write small sentences that justified the discrepancies in their wellbeing. It is noteworthy that none of the participants reported following journaling practices before the study. Regarding the application, participants visited the visualizations periodically or when they felt abrupt changes in their wellbeing. Some features such as sharing were not as popular and were only used when participants wanted to test them to unlock achievements.

b) Perceived Ease of Use: Overall, participants agreed there was a balanced capture burden because, while writing involves more time and motivation, ratings were easier and faster to do. A complaint regarding DAN was its battery life and the charging burden it posed: *"The diary did not have much lifespan. Sometimes I would forget to charge, and it takes too much time to charge." - P2*. Besides this issue, participants stated that Danny was easy to use, the visualizations were easy to interpret, and the sharing feature could be helpful. They only pointed out two usability issues: (i) the colours used on some of the charts were hard to distinguish, and (ii) confusion among ratings of negative factors. The latter happened because one student took into account the amount of stress instead of its impact on wellbeing, giving a 5-point rate (green) when he was more stressed and 1-point (red) when he was not stressed.

c) Perceived Usefulness: Although one participant stated that writing did not help him as it made him remember why he felt so bad, the rest of the participants agreed the that link between the ratings and written notes was very useful. Nevertheless, they state that in most cases, the ratings were enough to assess their wellbeing – *"something can happen that can cause a more drastic change, and in those cases, it might be relevant to know, but besides that..." - P1*. All participants found the information visualizations useful because they offered meaningful insights. They also saw value in sharing their data as it supports their help-seeking and might provide helpful feedback. Lastly, participants found the gamification strategies to be effective in promoting reflection and increase the usage of Danny. P4 stated: *"Although it does not seem like it, these are things that make you hang on to the App [Danny] and use it more frequently."*.

d) Intent to use: Intent to use was mostly impacted by perceived ease of use and perceived usefulness. As stated before, participants' intention to write on DAN was mainly influenced by their perceived usefulness to which P5 added: *"If it is inside the typical values, its just like any other day. I do not think that everything leads me to write."*. Additionally, their intent to write was also affected by their tendency to write on paper. In the words of P4, *"To be honest, I never wrote much because I do not like to write."*. Regarding Danny, participants often tried new features, which was further prompted by the unlockable achievements. Still, sharing was not frequently used given the lack of circumstances that would lead users to do so. Indeed, only one participant shared a PDF because a health professional showed interest. Some users did not use specific features due to a lack of interest, awareness, or time. This theme was recurrent with P3, who said: *"I sometimes did not remember that part, I would just do the ratings... I think*

it is useful. If I had more time, I would have used it more.".

Since we added the possibility of rating directly in Danny, we asked participants whether they would prefer the current approach or a Danny-only solution. As we discussed their preferences, participants suggested two alternatives: (i) Danny should allow note-taking or (ii), for users who like to write, a separate diary to complement Danny. P4 was one of the participants who made these suggestions and said: *"I would only use the application because it was rare to use the notebook. I thought it was important to use it for writing but not much for the ratings ... You could have a separate notebook to complement, but I would mostly use the application. Writing on the phone is not as fluid as writing on paper, but I think it would be cool if I had the option to add notes [in Danny]."*. Lastly, although all participants understood the value of a dedicated tool, most said they were not impacted by distractions either because they are used to them or because the time they took to rate was not enough to have implications.

B. Effectiveness

Participants noticed improvements in their self-awareness due to the moments of reflection that our tool provided. While participants were assessing their wellbeing or visualizing their data, they reflected and detected specific issues, patterns, and correlations. For example, P4 said: *"I was able to detect patterns that I was not aware were related... I had a vague idea, but I did not know. Because this application mixes everything and can connect them, in a way, it helped me guide myself through these last weeks."*. Nevertheless, participants noticed a lack of tools to support their problem-solving and goal-setting techniques. P2 stated that *"If one does not have the resources or ability to change, tracking becomes pointless. At most, it increases one's frustration."*, and P5 said: *"With what we have, we can monitor what is happening. I think what is missing is maybe the solution."*. Participants tried, both successfully and unsuccessfully, to set goals or fix a specific issue. While Danny helps them monitor their progress, they suggested further functionalities to support such practices. These included being able to define goals and personalized recommendations that take into account their ratings.

All participants agreed that the sharing feature was useful to get professional feedback: *"it is the opinion of a professional, things I did not even think about." - P3*; however, participants rarely used this feature. Even though most of them shared at least one PDF, they stated it was only to try out the feature and unlock an achievement. As aforementioned, only one participant actively sent the PDF to his psychologist. The lack of usage was justified by the short period of the study and by the lack of circumstances that would lead them to share their data with someone. P4 added: *"I ended up not sending because I would not just force a PDF and say: here you go."*. This comment highlights the importance of negotiating the use of Dan & Danny in professional practices. Additionally, a participant suggested creating a network to share ratings with friends. On the other hand, P5 pointed out that *"If you start watching ratings of other people, you might want to be better and might not be as honest when you rate."*

While participants stated that the tool helped them better manage their wellbeing, further research should conduct studies for longer periods. Students suggested that the short span of the study was not enough to improve wellbeing. The increased workload that happened throughout the semester had a considerable influence on their ratings. P5 explained the decrease in wellbeing ratings: *"I think it is because of when I started [making assessments]. I started at the beginning of the semester, and then [towards the end] I began having more work and tests."*. These results suggest that the tool was successful in promoting self-awareness and -reflection.

C. Wellbeing in College

Regarding the state of wellbeing in a college setting, everyone agreed that there is a current issue that impacts many students. Nevertheless, two participants stated that the impact of college on students' wellbeing varies, as some are not greatly impacted, mainly because they may not worry as much. In the words of P1, *"there are two types of students: those who have a positive wellbeing because they do not care as much about college and then, there are the others."*

An in-depth analysis of the chosen trackers throughout the user study shows that participants prefer to focus on Stress, Sleep, Productivity, and Exercise. In particular, the interaction effects of Stress, Productivity, and Sleep were a recurring theme in the interviews. P5 stated that *"I think if I am more tired than usual, my productivity is lower. What I would study in half an hour, I might need double the time to study."* Moreover, participants thought that the trigger for these negative loops was mainly caused by the abrupt change in pressure caused by excessive workload and the difficulty of that work. Indeed, P3 confessed that *"I was not expecting so much to do, things on top of the others."* This combination also constrained participants to have less time to perform activities that might improve their wellbeing. The recording hurdle may have also stressed users, thus leading them to give up on it.

Regarding help-seeking behaviours, most of the participants agreed that students tend to avoid it either because of stigma, lack of trust in third-parties, or because *"that means that we are dependent on something, and all we want is independence." - P4.* Furthermore, even though all the participants were currently being "helped" by someone, they agreed that most of the time, that only happens if someone approaches them and suggests some sort of help.

D. Discussion

We leverage our findings to answer the research questions.

Are Dan & Danny accepted by college students? Even though we consider that self-tracking as an approach was well accepted among the participants and the engagement strategies were effective, the tools present barriers that reduce their acceptability. We believe that the burden of charging a digitally augmented notebook may have led participants to suggest that the digital and analogue components should be

detached. Weighting how recent research suggests that the use of paper journals remains common practice [11], [27], [28], these findings point us towards improving DAN by improving the battery life and charging experience of DAN. In this case, our next iteration strategies may open our design space towards slow technology by turning the charging of the device as a meaningful experience of self-reflection [29], for example. Regarding the mobile application, participants agreed that Danny was easy to use and found its features useful, although some functionalities could be better promoted to increase their usage. This strong acceptability may be related to the "look and feel" of the application and its visualizations since the visual aesthetics of self-trackers is very important to users [30].

Does the tool increase students' self-awareness and self-reflection? Overall, results are in line with the current state-of-the-art [31], [32]. We found that our tool successfully improved students' self-awareness and self-reflection regarding their wellbeing. DAN & Danny provided moments of reflection either when they were assessing their wellbeing or were visualizing their data. By doing so, we were able to improve their self-awareness as they could detect issues, causes, patterns, and correlations. These abilities may have stemmed from the short study period, since usually people cannot easily find patterns or draw meaningful insights from their long-term data [30]. Nevertheless, participants referenced a lack of support for problem-solving and goal-setting techniques [33], [34]. Therefore, there is an opportunity for features that promote such practices.

Does the tool facilitate data-sharing and help-seeking behaviours? Even though all participants agreed that sharing their data was valuable, this feature was not frequently used because of a lack of circumstances. When the participants shared, they did it to unlock an achievement, or because someone showed interest in their data. These findings indicate that we should focus on better promoting data-sharing behaviours, but that, in most situations, students would not share their data unless they were asked to do so. Although the tool seems to ease the sharing of valuable data, our findings were not conclusive enough to answer this research question. Nevertheless, the state-of-the-art provides examples of novel sharing methods such as physical artifacts [30].

What factors most impact college students' wellbeing and what are their implications? Based on the usage logs and interviews, we highlight some of the recurring wellbeing issues among college students. Our findings indicate that the impact that college has on students' wellbeing varies depending on the person. These issues are mainly due to students not being well prepared for the abrupt change that is the transition from high school to college. Our participants considered that college involves more pressure, increased difficulty, and an excessive workload, which is in line with prior research [4]. Since the college workload occupies a significant period of their days, students are left with a small amount of time to do other things that might improve their wellbeing, such as social and recreational activities. Poor help-seeking behaviours exacerbate these problems as students do not seek help unless it is suggested to them. The wellbeing dimensions that were referenced as the most impacted were sleep, stress, and productivity. These are closely related to one another; they can influence each other resulting in a loop that ends up causing harsher implications. Finally, our findings suggest a lack of preparation for students who enter college and a need to analyze the excessive workload and pressure that these students face. Colleges should also focus on providing and promoting effective help, since mental health issues are currently considered an high-priority institutional responsibility [35].

E. Limitations

The study's main limitation was the small sample size. Nevertheless, results should shed light on opportunities for novel self-tracking tools that combine qualitative and quantitative data. Furthermore, the study's duration also reduced our ability to detect conclusive changes in the participants' wellbeing.

VII. Conclusions & Future Work

In this paper, we present a self-tracking system that supports digital and analogue data, dedicated to helping college students better manage their wellbeing. We contribute with a longitudinal study to evaluate our approach's effectiveness and analyse its acceptability. Results showed that the system promoted moments of reflection, and therefore, increased their self-awareness; however, results were not conclusive regarding the potential of data-sharing features to encourage help-seeking practices. The usefulness of qualitative data was highly dependent on quantitative ratings as participants were most motivated to use the paper notebook when abrupt changes occurred to wellbeing.

Future work includes another iteration of our system leveraging slow technology design practices [29] to elicit college students' preferences regarding analogue and digital approaches. We also aim to increase our tools' flexibility and acceptability among college students by adding more functionalities to support problem-solving and goal-setting techniques. We aim to include mental health professionals in the development process to inform the design of such features. It would also be beneficial to embed the tool in the practices of current student support services.

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