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MensSana: Design of a mental well-being self-report interface for shop floor workers

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Abstract

Despite the advancements brought by Industry 4.0 technologies, workers in factory settings often face physical and mental challenges that may adversely affect their overall well-being. Aligned with the Operator 4.0 concept, which emphasises human-centricity, this research focused on developing a self-report interface for shop floor workers that provides real-time health-related metrics and personal data in a readable and understandable format, enabling them to identify trends and make informed decisions to improve their well-being.

This study utilised a user-centred methodology, encompassing the thorough analysis of previous user research data in diaries, interviews, and observation photos. These collected data were carefully analysed to identify user requirements, which were subsequently validated through fieldwork involving interviews and co-design sessions with a diverse group of 10 shop floor workers. The insights gained from this phase informed the design of an interactive prototype, which underwent testing in a focus group with experts and usability sessions with representative users. The results demonstrated the potential of the self-report interface in enhancing worker well-being, with the human-centred design approach and co-creation process ensuring alignment with the specific needs and preferences of the workers. Proto-design guidelines were derived, serving as a valuable resource for future interface development. Future studies should explore additional aspects and possible improvements in the interface, incorporating feedback from a diverse audience, evaluating and enhancing the existing design proto-guidelines, and considering the integration of emerging technologies to enrich the interface's functionality and effectiveness.

Keywords: Human-centred design, Operator 4.0, Healthy operator, Shop floor workers, Health, Well-being, field study, self-report interface;

Resumo

Apesar dos avanços trazidos pelas tecnologias da Indústria 4.0, os trabalhadores em ambientes de fábrica frequentemente enfrentam desafios físicos e mentais que podem afetar negativamente o seu bem-estar geral. Alinhada ao conceito de Operador 4.0, que enfatiza a centralidade do ser humano, esta pesquisa concentrou-se no desenvolvimento de uma interface de autoavaliação para trabalhadores do chão de fábrica que fornece métricas de saúde em tempo real e dados pessoais de forma legível e compreensível, permitindo-lhes identificar tendências e tomar decisões informadas para melhorar o seu bem-estar.

Este estudo utilizou uma metodologia centrada no usuário, abrangendo a análise detalhada de dados de pesquisas anteriores com usuários, incluindo diários, entrevistas e fotos de observação. Esses dados coletados foram cuidadosamente analisados para identificar requisitos dos usuários, que posteriormente foram validados por meio de trabalho de campo envolvendo entrevistas e sessões de co-design com um grupo diversificado de 10 trabalhadores do chão de fábrica. Os insights obtidos nesta fase orientaram o design de um protótipo interativo, que foi testado em um grupo focal com especialistas e em sessões de usabilidade com usuários representativos. Os resultados demonstraram o potencial da interface de autoavaliação em melhorar o bem-estar dos trabalhadores, com a abordagem de design centrada no ser humano e o processo de co-criação garantindo a adequação às necessidades e preferências específicas dos trabalhadores. Diretrizes de proto-design foram derivadas, servindo como um recurso valioso para o desenvolvimento futuro da interface. Estudos futuros devem explorar aspectos adicionais e possíveis melhorias na interface, incorporando feedback de um público diversificado, avaliando e aprimorando as diretrizes de proto-design existentes e considerando a integração de tecnologias emergentes para enriquecer a funcionalidade e eficácia da interface.

Palavras-chave: Design centrado no humano, Operador 4.0, Operador saudável, Trabalhadores do chão de fábrica, Saúde, Bem-estar, Estudo de campo, Interface de auto-relato;

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List of Abbreviations

I4.0	Industry 4.0
HO4.0	Healthy Operator
UCD	User-centred Design
UEQ	User Experience Questionnaire

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1. Introduction

1.1 Research Motivation

The Fourth Industrial Revolution, also known as Industry 4.0, has already arrived in factories, bringing a higher level of digitalisation and automation. As a result, the work on the factory floor is expected to shift towards more cognitive work that requires problem-solving skills and the ability to manage complicated processes. The work in the factory has the potential to be both challenging and fulfilling due to the increasing automation and digitalisation brought by Industry 4.0. However, this complexity may also put an extra mental strain on workers. So, beyond the struggles those workers already face due to their profession, now they might also feel pressure to work at the speed of automation, more isolated, their privacy at risk and fear of being substituted (Leso et al., 2018).

To effectively address this issue the definition of smart operator profiles appear as defined by Romero, such as the healthy operator (Romero et al., 2016), and are expected to play a pivotal role in facilitating access to mental health services and enhancing worker well-being.

By acknowledging the potential challenges posed by Industry 4.0, this thesis aimed to design and validate an interface for the self-report and management of the mental well-being of shop floor workers, self-assessing personal and workplace metrics, based on a healthy operator 4.0 approach. Through user research and participatory methods, this research defined the interaction models for creating this self-report tool and aimed to identify proto-guiding principles for designing interfaces for self-report of mental well-being for shop floor workers.

1.2 The Augmented Humanity Project

This dissertation emerges in the context of the Augmented Humanity project (Augmanity), a project led by BOSCH in partnership with Fraunhofer Portugal Center for Assistive Information and Communication Solutions (AICOS). The Augmanity project aims to adapt companies to the new paradigms of industrial digitisation inherent to Industry 4.0, with a specific focus on placing workers at the centre of this technological transformation.

Aligning with this goal, in this thesis, we designed and validated an interface for the self-reporting and management of data concerning the worker and the workplace towards a healthy operator 4.0 approach. The work developed in the context of this dissertation is a direct contribution to the Augmanity project, focusing on the design and implementation of a self-report interface for workers. This interface directly contributes to the project's goal of adapting companies to the new paradigms of industrial digitisation, with workers at the centre of this technological transformation.

1.3 Objectives and Contribution

The main goals of this dissertation are to:

- Understand, from the perspective of shop floor workers, what metrics are relevant to self-assess their well-being.
- Define the key principles and proto-guidelines that should be considered when designing a self-report mental well-being interface for shop floor workers.

To address these objectives, this dissertation adopted a user-centred design approach, in conjunction with the healthy operator framework, for the development of a self-report interface that facilitates the reporting of shop floor worker's mental health and wellness state, aiming to enhance their well-being. The design of this interface was based on implemented methods such as data from previous user research, field observation, interviews and co-design sessions with shop floor workers conducted in the context of Augmanity.

The dissertation made a significant and direct contribution to both the Augmanity project and the field of interactive technologies. This was achieved by developing a prototype that was co-created and validated, integrating user-centred design principles and drawing upon the insights from shop floor workers. The research identified design proto-guidelines for self-reporting interfaces aimed at enhancing the mental well-being of shop floor workers. The findings of this study aspire to inform and inspire designers and researchers working in this area.

1.4 Dissertation Outline

This dissertation is organised into eight chapters. The current Chapter 1 has the objective of introducing the theme of the work, mentioning the research motivation, objectives, the research scope in which this dissertation is inserted, and the contributions of the dissertation. This chapter also includes a section where the structure of the dissertation is presented.

Chapter 2 presents the literature review. It explores the impact of Industry 4.0 on work and workers, specifically focusing on the well-being and mental health of the shop floor workers. It also focuses on the Operator 4.0 definition, which encompasses the healthy operator concept, highlighting the importance of maintaining worker's well-being and mental health in the Industry 4.0 era. Additionally, the chapter explores the increasing popularity of mental health monitoring at work and analyse existing related studies found in the literature review. Furthermore, a detailed analysis of the related existing solutions was done. Finally, it outlines constraints to this kind of interface for workers.

Chapter 3 outlines the aims of the thesis, explaining the research questions that guided this study and linking them to the design and methodology process.

Chapter 4 introduces the methodology followed in this dissertation, justifying the user-centred design approach and the methods chosen based on the research questions. It defines user requirements that led to the creation of user personas and scenarios and details the work plan for each method used during fieldwork.

Chapter 5, introduces a detailed description of the user research findings, based on the analysis of collected data and completed fieldwork. The results of the user research were then translated into requirements, reflecting the actionable insights obtained.

Chapter 6 presents the design steps taken for creating this interface based on the insights obtained in Chapter 5. It is divided into two parts, with the first part focused on the design process leading to the final prototype, and the second part focused on the evaluations conducted on the interface, including a focus group and usability testing.

Chapter 7 explained the main findings of the study, along with the results obtained in response to the research objectives of the thesis.

Chapter 8 delves into the discussion of the key outcomes of this research and outlines the study's strengths and limitations.

Chapter 9 draws the conclusions of this research and suggests avenues for future research.

2. State of Art

This section aims to provide a comprehensive overview of the literature surrounding the impact of Industry 4.0 on work and worker's well-being, explicitly with a specific focus on mental health. It also analysed proposals found in the literature for monitoring mental well-being in the workplace and addressed the challenges encountered. It set the stage for the subsequent chapters, which delved deeper into the methodology used in this dissertation and the development of the prototype.

2.1 Industry 4.0

Industry 4.0 (I4.0), was introduced in Germany (Rojko, 2017) and refers to the trend towards automation and data exchange in manufacturing technologies through recent advances in information technology, artificial intelligence, the Internet of things, and cyber-physical systems. The goal is to create efficient, flexible "factories of the future" with a focus on human-centred solutions (EFFRA, 2016). This includes real-time measurement of operator capacity and physical strain, automatic adaptation, and worker involvement with the aim to increase productivity, safety, and well-being.

As I4.0 technologies transform the factory floor, the nature of work undergoes significant changes, introducing new implications for workers. Extreme situations which offer severe risks of illness and accidents to workers can now be minimised or avoided (Dornelles et al., 2022). Workers may now work more with automated systems or be asked to interpret and act on data from sensors and other sources, increasing the use and adoption of automation and emerging technologies. Ejsmont (2021) emphasises that these industry changes have profound implications for the skills and competencies required in the workforce, encompassing technical, personal, and social proficiencies at both macro and micro levels. These changes not only involve technical aspects but also require shifts in corporate culture, particularly regarding safety and values, as highlighted by Digmayer & Jakobs (2019). Consequently, new communication channels and health and safety procedures need to be developed to adapt to the I4.0 idea (Lazzerini & Pistolesi, 2018).

However, the automation of the workplace raises concerns among shop floor workers (IPSOS, 2019). This automation usually requires workers to have higher technical skills and knowledge and sometimes to be monitored. Consequently, this has caused increased stress and anxiety among workers, especially those unfamiliar with these new technologies (Ruppert et al., 2018). Despite the advancements and efficiencies brought about by I4.0, it remains imperative to address worker's emotional and psychological well-being within the workplace. To this end, it is then crucial to implement measures that improve worker's mental health, thus creating a better work environment that prioritises and centres around the worker's emotional stability and comfort.

2.1.1 Operator 4.0: Healthy Operator

In the context of I4.0, human-centricity is a fundamental principle that places humans at the forefront of technological advancements and design considerations. It recognises the importance of considering the human factor in developing and implementing technologies, ensuring that they are designed to support and empower workers. Directly from this human-centric approach emerged the Operator 4.0 (Romero, Bernus, et al., 2016). Operator 4.0 technologies, as described by Romero, Stahre, et al. (2016), aim to enhance the interaction between humans and intelligent technologies in the workplace to improve efficiency and effectiveness and establish a relationship based on interaction and trust between humans and machines.

These operators embrace technologies like virtual and augmented reality, robotics, wearables and advanced sensors that allow real-time monitoring and control of various aspects of the manufacturing process (Ruppert et al., 2018). Although these operators are explained by Romero separately, some case studies demonstrate the implementation of different operational typologies of Operator 4.0 joined in real-world solutions (Zolotová et al., 2018).

The author proposed a typology of 8 different types of Operator 4.0 to help in many functions, including the Super-Strength Operator, which enhances human strength through exoskeletons; the Augmented Operator, which uses AR technology for real-time visual access to information; the Virtual Operator, which utilises VR technology for immersive experience and training; the Smarter Operator, which accesses information through smartphones, personal assistants, and computers; the Collaborative Operator, which involves human-robot collaboration; the Social Operator, which utilises industrial social networks for collaboration and knowledge sharing; the Analytical Operator, which leverages big data analytics for decision-making and improved performance visibility; and the Healthy Operator, which uses wearable devices and bio-signal trackers for worker well-being monitoring.

The Healthy operator (HO4.0) emerged in response to growing concerns about increased levels of stress in the workforce and the health status of employees (Romero, Stahre, et al.,

2016; Sun et al., 2020). Therefore, it aims to drive positive changes in productivity, well-being and proactiveness in safety measures in smart workplaces. According to the authors, it combines an operator with a wearable tracker designed to measure health-related metrics and personal data in real time. They can be used to predict potentially problematic situations before they arise and can also be used to monitor and improve overall health and well-being (Ruppert et al., 2018). According to Sun et al. (2020), this operator can also alert operators about possible exposure to hazardous environments, avoid collisions with heavy-moving equipment, and prevent anti-ergonomic body movements and postures. This kind of operator already exists and may use technologies such as Android Wear and the Apple Watch.

The widespread use of wearable self-monitoring devices in the health domain has increased self-awareness, helping individuals identify patterns or trends over time and change problematic behaviours. In addition, they can help identify early warning signs of changes in the mental health when pattern/frequency changes significantly of shop floor workers.

2.2 Well-being and Mental Health of Shop Floor Workers

The pursuit of happiness, well-being, and positive emotions is a universal aspiration shared by many, as it is a fundamental part of being human. WHO (2022) defines mental health as an individual's overall psychological state of well-being, enabling them to cope with life stressors, learn, perform skills, and contribute to their community. Therefore, maintaining good mental health is crucial for leading a fulfilling life. However, according to the World Health Organization (2022b), in 2019, one in eight individuals, around 970 million people worldwide, lived with a mental disorder. Despite the fact that mental illnesses are treatable and their impact can be minimised, a significant number of individuals do not have access to adequate treatment, and even when treatment is available, it is frequently of poor quality (Dattani et al., 2021).

Mental health disorders are an increasingly important issue in the workplace, contributing to problems that are the primary cause of worldwide illness and incapacity, affecting individuals across ages, gender, and socioeconomic status (Harnois & Gabriel, 2000). Shop floor workers are no exception. A shop floor worker is an employee who works in a manufacturing facility, usually where production takes place. These workers assemble products, operate machines, and perform quality checks on finished products. These factories usually contain chemicals, heavy machines, and/or sharp tools for production (Indeed, 2022). According to Statista (Aaron O'Neil, 2023), Portugal's industrial and service sector employs 25% of active workers, an enormous mass of the population.

Due to their work's physically demanding and potentially dangerous nature, many factory workers have measurable mental health problems like anxiety, sleep disturbance, depression, somatic complaints and other clinical conditions (Serrano, 2019; Shankar & Famuyiwa, 1991).

Several studies have identified factors related to the workplace contributing to mental issues among shop floor workers. Some of the common causes include working in rotational shifts, poor social support, high job demands, low job control, role ambiguity and conflict, physical and ergonomic problems, job insecurity, hazardous environment, and difficulties in understanding tasks (Belete et al., 2020; Kvarnström, 1997; Serrano, 2019; Shankar & Famuyiwa, 1991). Stress can also lead to various physical, psychological, and behavioural changes in workers, including insomnia, headaches, stomach upset, depression, reduced concentration ability, frequent absenteeism, mood swings, and irritability (Serrano, 2019). House (1980) says these contributors threaten the worker's health and can lead to many health problems, not just psychological or psychosomatic.

While there are several ongoing efforts to address the health concerns of factory workers (Bernal et al., 2017) and the implementation of I4.0 has the potential to make worker's activities safer and inclusive (Lazzerini & Pistolesi, 2018), the increased digital interconnectedness creates more opportunities for highly skilled workers and the emergence of new professions (Ejsmont, 2021), which may lead to an overestimation of the number of manual workers being substituted (Ejsmont, 2021; Shuttleworth et al., 2022). According to EFFRA (2016), workers will no longer perform their tasks routinely and will have to undertake varied and mostly unstructured tasks, depending on the needs of the dynamically changing production process.

This can lead to higher levels of psychosocial stress and expose workers to health and safety risks related to automated tools (Mendes & Chaves, 2019). In fact, psychological risks are expected to become more evident than physical ones in the workplace due to mental overload and work density induced by even more flexible and dynamic smart manufacturing activities (Leso et al., 2018).

The incorporation of new technologies into industrial processes will lead to the emergence of new occupational risks, but there is a lack of information on how to identify, quantify, and propose solutions to prevent and address such risks (Issamar & Roberto, 2019). Also, according to Issamar & Roberto (2019), the use of new technologies brings risks related to data security. According to Kvarnström (1997), Serrano (2019) and EU-OSHA (2013), the health status of workers is a cardinal factor in organisational growth, therefore, companies should take the necessary steps toward creating solutions to ensure their employee's well-being. Addressing mental health in the workplace can benefit both workers and employers. However, how different industry's view and prioritise mental health can vary. As I4.0 technologies revolutionise the way shopfloor workers live and work, the integration of self-assessment and monitoring tools is posed to play a vital role in facilitating access to mental health services and reduce the suffering experienced by those in need (Harnois & Gabriel, 2000; Mendes & Chaves, 2019). It is crucial to bridge the gap in effectively monitoring and promoting mental health in the workplace, going beyond the identification and addressing of risks perceived by employees (Digmayer & Jakobs, 2019). This entails defining the specific metrics to be collected, the

elements that integrate the interface, and determining the most suitable representation methods. By doing so, we can create a comprehensive system that captures and visualizes relevant mental health data. While wearable devices have been highlighted as valuable tools in an I4.0 work environment for supporting occupational health, safety, and productivity (Romero et al.,2018), it is important to recognise that they are just one component of a broader approach. To gain a holistic understanding of workers' mental well-being, it is necessary to employ multiple data collection methods and consider different tools (Mishra & Rasool, 2019).

2.3 Mental Health Tracking

With the continual evolution of technology, numerous solutions have entered the HO4.0 philosophy. Currently, many tools exist to provide social support and expand the network beyond traditional mental health care (Coyle et al., 2012), including while the person is in motion (Moshe et al., 2021). These tools have the potential to improve access, engagement, effectiveness and accessibility of examining an individual's mental health (Doherty et al., 2008). Additionally, these new tools have created a new method for monitoring health and collecting data capable of evaluating it on a population level (Tal & Torous, 2017).

These digital technologies such as wearables, smartphones, and network sensors are potential technological approaches for managing mental health via sensors and self-reports. Each has its own strengths and weaknesses depending on the specific use case and can connect users, health services and data in new ways (Hollis et al., 2015). It is possible to use sensors to detect information, but also allow self-reports from the worker. This self-report is usually done through brief questions about themselves daily. Later, all the data is transformed into features that define behavioural markers, often through machine learning techniques (Sheikh et al., 2021) or just mirroring the inputs given for reflection. This way, it is possible to track trends (good or bad) in the workplace, predict an individual's mental health status, and intervene on time (Makhmutova et al., 2021).

According to Carneiro et al. (2015), smartphone-based approaches in the workplace are the best option for workers due to their diversity of features, availability, privacy, and richness of information. Although they are less accurate than wearable devices and network sensors, they excel in providing information on behavioural and performance modalities, including application usage patterns, user location, accuracy measures, response times, and some physical features such as touchscreen intensity and acceleration.

2.4 Related Cases

With the advancement of new technologies, non-intrusive methods that connect people and data are now better suited for measuring a person's mental health (Hollis et al., 2015). They can improve access, engagement, effectiveness, and affordability of mental health treatment (Doherty et al., 2008; Murnane et al., 2016), and let the data collected to be employed to identify potential health issues in real-time by tracking trends over time and identifying deviations in patterns (Huynh et al., 2017; Murnane et al., 2016).

The following Table 1 presents workplace solutions found in the literature that feature graphical user interfaces with interactive elements that incorporate the HO4.0 approach to enhancing the well-being of factory workers. We searched the literature for examples of proposed solutions specifically designed for the industrial factory environment. However, due to limited availability, we expanded our analysis to include workplace solutions in general.

Solutions found in the literature were related to mood recognition, well-being, performance and behaviour change. While many of these applications utilised wearable devices to collect various metrics related to the environment or the worker, the graphical user interfaces in the identified examples were predominantly in the form of web or mobile applications. In the next section, it is analysed the collected examples in more detail, specifically examining the metrics collected by the studies, the types of inputs available to self-report their well-being and the feedback provided based on the collected data from the user. By exploring these examples, we aim to gain insights into the range of input methods, measured data and output or feedback provided.

Table 1 Mental health monitoring solutions at work

Reference	Application	Interactive Platform	nteractions	Metrics collected	Input Method	Interface Output
(Zenonos et al., 2016)	Mood Recognition	Mobile application	Touch	Emotions; Notes	Rating scales (emotions), free-text entry	Charts; Graphs; Short messages
(Heikkilä et al., 2021)	Well-being and performance	Mobile application	Touch	Mood; Sleep; Activity	Predefined options (emojis); sleep and activity tracking	Sensors feedback; Graphs
(Wellspace, 2022)	Well-being	Mobile application	Touch	Mood; Sleep; Activity	Predefined options (emojis); Activity and sleep tracking; Chat rooms	Sensors feedback; Rewards; Calendar
(Trolle Elmholdt et al., 2021)	Sleep well-being	Mobile application	Touch	Sleep	Report sleep manually (optional)	Sensors feedback; Graphs
(Kocielnik et al., 2018)	Behaviour change and well-being	Web application	Mouse; Keyboard; Voice	Notes	Journaling	Reflection questions
(Rivera-Pelayo et al., 2017)	Mood Recognition	Web application	Mouse; Keyboard	Mood; Notes;	Colour map; Predefined options (questions)	graph
(Tani et al.,	Mental	Mobile	Touch	Environmental	Questionnaires	Sensors feedback

2020)	Healthcare	application		and physical sensing data		
(Mathur et al.,2015)	well-being	Mobile application	Touch	Indoor location, Mood, Physical activity and environment sensing data;	Predefined options (mood and activity)	Graphs; Maps ;
(Barenghi et al., 2021)	Behaviour change	Mobile application	Touch	Environmental and physical sensing data	Questionnaires	reminders; recommendations
(Sun et al., 2020)	Well-being and performance	Mobile application	Touch	Environmental, ergonomic and biometric sensing data	Predefined options (what to see)	Sensors feedback

2.4.1 Metrics Collected

Based on our analysis, the most prevalent method of data acquisition in this workplace solutions was passive collection through sensors (Wellspace, 2022), (Heikkilä et al., 2021), (Trolle Elmholdt et al., 2021), (Tani et al., 2020), (Mathur et al.,2015), (Barenghi et al., 2021), (Sun et al., 2020). These sensors not only collect data about the workers themselves but also capture information about the surrounding environment. The primary metrics gathered were related to activity and physical parameters, such as steps taken, heart rate, and body temperature. Additionally, some cases also included the collection of sleep-related data and environmental factors like noise levels and air quality.

While the focus of data collection in these applications was predominantly on objective metrics, there was also a notable emphasis on gathering user input regarding subjective measures, specifically emotions, mood and additional contextual information (Zenonos et al., 2016), (Wellspace, 2022), (Heikkilä et al., 2021), (Kocielnik et al., 2018), (Rivera-Pelayo, Fessl, et al., 2017), (Tani et al., 2020), (Mathur et al.,2015). This allowed workers to provide their own assessments and self-reports, contributing to a more comprehensive understanding of their mental well-being.

In summary, while the reviewed workplace solutions varied in their emphasis on either user input or wearable data, most of them incorporated both types of metrics to assess well-being in the workplace (Wellspace, 2022), (Tani et al., 2020), (Mathur et al.,2015), (Heikkilä et al., 2021). There was even a case that showed flexibility for the user to choose their preferred reporting method (Trolle Elmholdt et al., 2021), providing a more comprehensive understanding of worker's mental well-being and highlighting the importance of personalised approaches in supporting employee mental health.

2.4.2 Input Method

The cases examined incorporated diverse input methods to capture information about worker's state as is shown in Figure 1. These input methods displayed distinct patterns in their nature and utilisation across the various cases.

One found pattern involved the use of rating scales (Figure 1 (b)), (Zenonos et al., 2016), allowing users to express their emotions and moods through ratings. Free-text entry was another frequently observed input method, enabling users to provide detailed descriptions and narratives about their mental state or experiences (Zenonos et al., 2016), (Kocielnik et al., 2018). In some instances, pre-defined options in the form of images, emojis and text were employed as shown for example in Figure 1 (e) (Heikkilä et al., 2021), (Wellspace, 2022), (Mathur et al.,2015), (Sun et al., 2020). Also, the use of colour mapping to choose their mood based on colour was also present (Figure 1 (a)), (Rivera-Pelayo, Fessl, et al., 2017). Additionally, it was also avaliable chat rooms and journaling input methods (Figure 1 (d)), (Wellspace, 2022), (Kocielnik et al., 2018), allowing the user to express via text, granting users a platform to document their thoughts, reflections, and experiences related to their mental health. Questionnaires (Figure 1 (c)), (Tani et al., 2020) were also avaliable to gather structured information on aspects related to the worker's mental well-being,

In addition to the active input methods mentioned above, several workplace solutions also incorporated passive tracking mechanisms that did not require direct interaction from users (Sun et al., 2020), (Tani et al., 2020), (Trolle Elmholdt et al., 2021), (Heikkilä et al., 2021). These passive tracking methods involved the use of sensors to collect feedback from the worker and the surrounding environment.

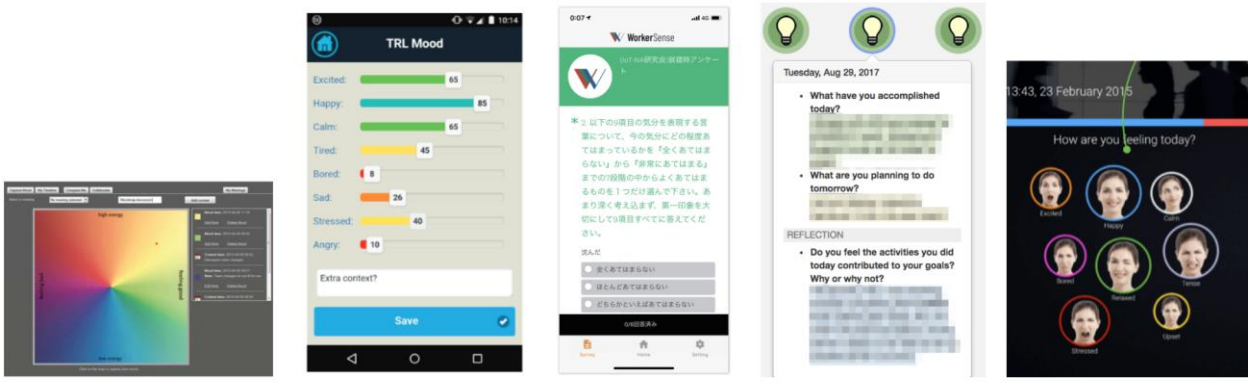

Figure 1 Example of input methods in (a) (Rivera-Pelayo, Fessl, et al., 2017), (b) (Zenonos et al., 2016), (c) (Tani et al., 2020), (d) (Kocielnik et al., 2018), (e) (Mathur et al.,2015)

2.4.3 Interface Output

The workplace solutions examined in our study encompassed a range of device outputs designed to facilitate feedback provision and support for monitoring and enhancing individual's mental well-being. These outputs, are shown in Figure 2, exhibited discernible patterns in their functionality and usage. One notable pattern involved the utilisation of this interface in showing data collected from sensors (Figure 2 (a)) (Mathur et al., 2015), (Sun et al., 2020), (Tani et al., 2020), (Trolle Elmholdt et al., 2021), (Heikkilä et al., 2021), encompassing biometric, ergonomic and environmental data. Additionally, we could in some cases see feedback based on the user's input information in the form of reminders, rewards or recommendations, as shown in Figure 2 (b) (Barenghi et al., 2021), (Wellspace, 2022).

Visual representations in the form of graphs, maps and calendar-based interfaces were commonly employed (Figure 2 (c),(d)), (Zenonos et al., 2016), (Heikkilä et al., 2021), (Wellspace, 2022), (Trolle Elmholdt et al., 2021), (Rivera-Pelayo, Fessl, et al., 2017), allowing users to track and analyse various self-reports, which include information such as mood, emotions, location history, activity levels and environmental metrics. Certain case studies also aimed to establish correlations between variables such as location, social interactions, and contextual factors with mood or emotions experienced by the worker (Mathur et al., 2015).

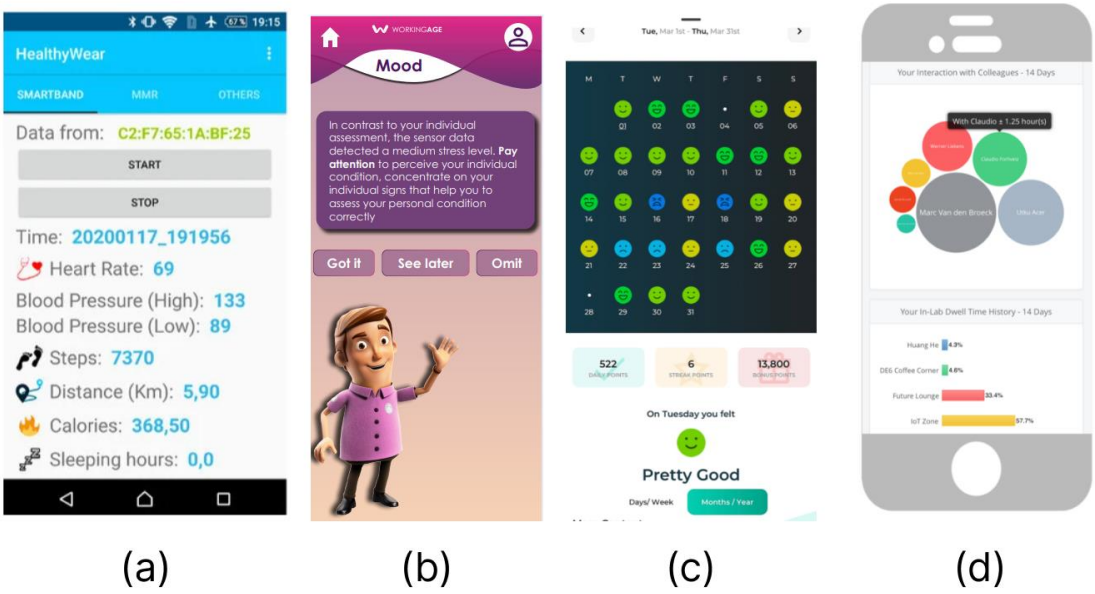

Figure 2 Example of interface outputs in (a) (Sun et al., 2020), (b) (Barenghi et al., 2021), (c) (Wellspace, 2022), (d) (Mathur et al.,2015)

2.5 Constraints

The monitoring of mental health in the workplace remains largely unexplored, particularly within the specific context of a factory setting. The scarcity of relevant proposed interface solutions to follow adds to the novelty of this topic, necessitating its discussion, investigation, and testing. Consequently, there is ample scope for exploration and experimentation in this field. These endeavours, however, face constraints and challenges, as highlighted by Teck et al. (2016). Some of the challenges identified include long-term adherence, addressing manufacturing, data accuracy, privacy, perceived lack of value and limitations in feedback delivery (Hickey et al., 2021; Meyer et al., 2017; Munten et al., 2021; Oesterle et al., 2018; Sheikh et al., 2021).

People's willingness to share data with the workplace also varies (PWC, 2016). According to the analysis of (Teck et al., 2016), 33% of workers want to keep data private from their employers. Moreover, 80% of all respondents show some degree of concern over their private data being misused against them, suggesting that this would be a significant sign to overcome for firms looking to gain access to employee data (Krzywdzinski & Pfeiffer, 2022). There is also a concern for elderly workers who may not be as comfortable or familiar with technology to be engaged in this change (Chapman, 2019). Because of that, it is essential to allow users to report and interact with data, validating it. According to Koch (2022) it is crucial to rely on human input rather than solely on the collected data, which can sometimes be corrupted and distort the truth to the extent that the user is misled (Munzner, 2014).

According to Heikkilä et al. (2018), another important factor to consider is the importance for the device to be unobtrusive during wear, ensuring it does not distract from work tasks or compromise personal safety measures. According to the author’s evaluation, most wearables were not suitable for work tasks or the workplace environment and the best approach had not yet been determined, emphasising the importance of co-designing solutions with factory workers to achieve optimal results. In a study by Hernandez et al. (2016) comparing different devices (phone, watch, and glass) for collecting information about stress and mood, smartphones were found to be familiar and easily accessible. However, their use can be disruptive and may even alter physiological readings if they try to catch the user’s attention with warnings and vibrations.

Considering these findings and the conducted literature review, it appears that a smartphone-based interface would be the most favourable approach for this work because of its familiarity and accessibility. By leveraging the existing ubiquity and user comfort with smartphones, a mobile interface can facilitate integration into daily routines and provide an effective means of self-report in factory environments. Nonetheless, in order to effectively

address the specific needs and constraints of the factory setting, it is crucial to conduct further user research with shop floor workers. This research will gather valuable insights and feedback directly from the target users, enabling us to refine and optimise the design of the interface, establishing the metrics that are most relevant for the self-assessment of well-being and the key principles for the design of a self-report mental well-being interface.

3. Aim of the thesis

Two research questions guide this study:

RQ1: What metrics are relevant to self-assess the well-being of shop floor workers?

RQ2: What key principles and guidelines should be considered when designing a self-report mental well-being interface for shop floor workers?

To answer these questions, the study used a user-centred design approach to identify challenges experienced by shop floor workers, including their causes and their impacts on worker's health and well-being. It is important to also understand what types of metrics are relevant for shop floor workers to be monitored, self-reported and followed on an interface in this context. Through the user research it was also important to identify potential barriers and challenges that would affect the adoption and design of the interface among shop floor workers and develop alternatives for addressing these challenges. This led to the creation of an interactive prototype and the identification of fundamental design proto-guidelines that should be considered when developing a self-report mental health interface for shop floor workers.

4. Methodology

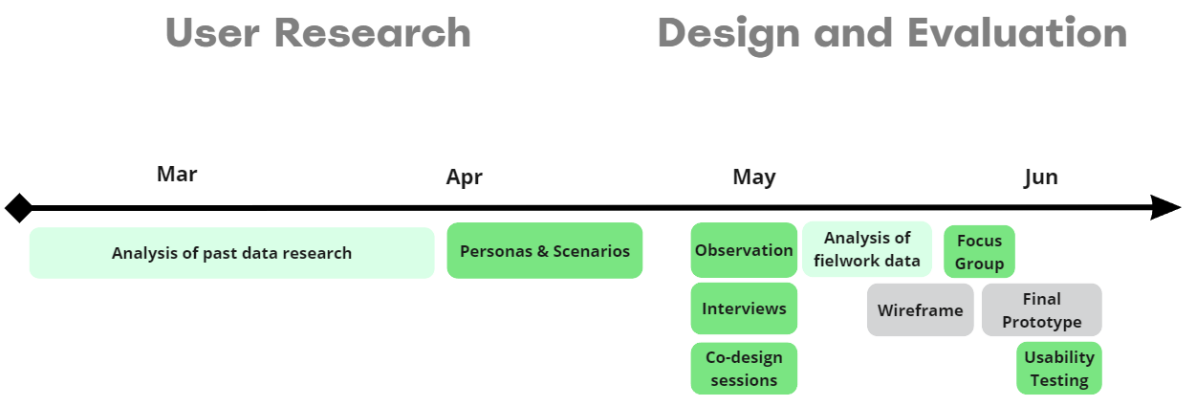

Figure 3 Methodology timeline

In this chapter, the methodology used in this dissertation is outlined. Initially the human-centred design approach used to develop the proposed interface is described in detail. The methods used, such as analysis of data from previous user research, observation, interviews, co-design procedures, focus group and usability testing are subsequently elaborated, explaining how they would be applied.

The following Figure 3 shows the methodology timeline. This timeline visually represents the different phases of the methodology employed in this research, outlining the sequence of activities and their respective durations. During user research phase, the methodology used in the research was decided and prepared. Prior to commencing the fieldwork, an analysis of data collected from past research within this thematic area was conducted and served as a foundation for deriving user requirements, which were further refined through the development of scenarios and personas. Subsequently, the fieldwork methodologies were defined and prepared, consisting of observations, interviews (Appendix 2), and co-design workshop (Appendix 4). The design

and evaluation phase involved the application of the derived user requirements and user research findings, leading to the development of a wireframe and then a final prototype. In this phase, evaluations in the form of a focus group and usability tests were done in different stages of the prototype.

4.1 User-centred Design

Standard interfaces are not always easy to use, and sometimes they can be confusing and frustrating for the user, leading to difficulties in completing even simple tasks. In order to create a better interactive interface proposal, we draw on a user-centred design approach in this dissertation.

According to Abras et al. (2004), user-centred design, or UCD, is a design approach that involves end-users in the design process to influence how a design takes shape. It encompasses a broad philosophy and a variety of methods that seek to improve the usability and user experience of products and systems. According to Abras et al. (2004), the degree of user involvement can vary along a spectrum, ranging from simply consulting users about their needs to partnering with them throughout the design process. The essential concept of UCD is that users are involved in some way during the design process.

By considering the principles outlined by De et al. (2009) such as incorporating user feedback, involving users in the design process, and prioritising user needs, the dissertation seeks to enhance the effectiveness and relevance of the mental well-being interface for shop floor workers. This approach acknowledges the importance of putting the needs and experiences of the workers at the forefront, leading to a more meaningful and impactful solution for promoting their mental well-being in the workplace:

Focus on Users and Tasks involves assembling the development team, assessing intended users, recruiting representative people, identifying intended tasks, assessing how users currently perform their self-monitoring tasks, and selecting the appropriate platform.

Measure Usability Empirically emphasises the importance of measuring usability factors empirically throughout the development process. Usability factors and testing methods should be established a priori and applied uniformly. Self-report measures can be used to assess user's satisfaction, ease, and efficiency over time. Usability assessment reports should be generated for all testing sessions, and problems should be quantified to prioritise improvements.

Design and Test Usability Iteratively is about designing and testing usability iteratively. This means constantly looping back to earlier stages of development to assess, design, test,

analyse, refine, and repeat until the system is deemed usable and functional. The goal is to identify the real needs, reactions, and behaviours of users over the course of design iterations.

4.2 Methods

This section outlines the methods used in the study. For the UCD approach to be successful (Maguire, 2001), it must be carefully planned and managed throughout all parts of the development process of the interface. This study used two types of data: The initial phase of the study involved utilising existing research data obtained from interviews, diaries, and co-creation sessions conducted as part of the Augmanity and Operator projects. These data sources offered valuable insights into the shop floor worker's characteristics, requirements, and general data reporting practices. The analysis of this data facilitated the development of personas and scenarios, which aided in defining the user pre-requisites for the study.

In the subsequent phase, distinct from the first, fieldwork observation, interviews, and co-design sessions were carried out. This phase focused on assessing and refining the user pre-requisites, particularly concerning the interface for self-reporting mental health. Unlike the first phase, which provided a broader understanding of worker profiles and general data reporting practices, the second phase concentrated specifically on aspects related to mental health. By conducting the second phase, the study aimed to acquire comprehensive insights into the worker's mental health-related needs and preferences. The feedback gathered during this phase facilitated analysing and evaluating the user prerequisites established in the first phase, explicitly focusing on design solutions for self-reporting mental health. A focus group and usability tests were also done on the fieldwork, making this an iterative process and ensuring the design of a targeted and efficient interface for reporting mental health data.

4.2.1 Previous User Research Data

In the context of the Augmanity and the Operator projects, Fraunhofer Portugal AICOS conducted extensive user research utilising various methods including diaries, interviews, co-design sessions, and observation photos (Fraunhofer Portugal AICOS, 2023). The primary objective of this study was to gain in-depth insights into the experiences and needs of shop floor workers from different factories and functions. Despite scheduling delays in our methodology timeline due to the arrangement of fieldwork sessions, the analysis of this diverse data collection yielded valuable qualitative data explained in Chapter 5.1. This data subsequently served as essential insights for initiating our design investigation in the fieldwork program.

4.2.2 Observation

Observation is a crucial tool that can provide valuable insights into human behaviour and social phenomena (Ciesielska et al., 2017). According to Baker (2006), this method offers the advantage of allowing researchers to conduct their study in the subject's natural environment, providing a more realistic understanding of their perspective.

In this study, non-participant observation was conducted at one factory in one session. This method was used to understand the following aspects:

Environment to understand how the space is utilised, it's characteristics and how individuals interact within it.

Possessions to understand more about the tools or artefacts that workers use in their jobs, such as equipment or personal items, and how they carry and access them throughout the day.

Demography to understand the characteristics of the people who work in a factory, including their dress, interactions with one another, relation to technology and behaviour.

Communication to understand the communication channels and technology preferences of the group being studied. We are also trying to see their insights into their communication habits, behaviours and potential barriers to communication or areas for improvement in communication technology.

Type of work to understand the worker in the work environment and to have insights into potential factors that impact their job satisfaction and overall well-being, which could, in turn, impact their well-being.

4.2.3 Interviews

Semi-structured interviews have the power to generate important insights from the participant's experiences, perceptions and opinions (Peters & Halcomb, 2015), because they are able to express their voice about a topic (Berg & Lune, 2007).

This study used semi-structured singular interviews (Appendix 2) with ten participants for around 45 minutes with written consent (Appendix 3). A sample of participants with different ages, gender, digital literacy, and roles were gathered to have a big heterogeneous group. These Interview sessions were recorded and transcribed for further analysis.

The main objective of the semi-structured interview was to learn about the participant's experiences and perceptions related to the social environment and their well-being in the factory, including their challenges, coping mechanisms, and solutions for improving well-being at work. The interview also aimed to explore their attitudes towards data privacy and the

implications of sharing personal health information with different stakeholders in the workplace.

4.2.4 Co-design

Community participation is essential to ensure the optimal design, implementation and evaluation of resulting initiatives (Vargas et al., 2022). So, it is essential to understand who uses this daily, making them part of the creation.

According to Sanders & Stappers (2008), co-design refers to the creative process of designers and non-designers working together to develop a project. The choice of co-design depends on many elements. Sanders et al. (2010) proposed a framework, which is a base structure to organise a repertoire of co-design techniques and tools. This framework has three dimensions: form, purpose, and context:

The **form dimension** is divided into three types of actions: storytelling, creating tangible objects, and improvisation/acting.

The **purpose dimension** is divided into four categories: exploring, preparing for immersion, understanding experiences, and generating design ideas.

The **context dimension** is classified according to four parameters: group size and composition, in-person or online, location, and relationship with participants.

A co-design session with ten participants was planned. Based on Sanders et al. (2010) framework, we defined the workshop session to be in-person but also explored some of these dimensions online with the purpose of creating a tangible/digital artefact. This choice intended to understand participant experiences and generate design ideas using collage because of the flexibility of this tool (Sanders et al.,2010) .

This co-design session aimed to actively involve the participants in the creation of their idea of a self-reporting mental health interface for the workplace. During the session, participants could select and arrange images, symbols, and other materials provided, along with suggested topics that the application could have derived from the analysis of past research data. By engaging in this creative process, we sought to understand the worker's perspectives, needs, and preferences, as well as gain insights into what is important and relevant to them. The session provided an opportunity for participants to express their feelings, visions, and ideas, allowing us to gather valuable input and ensure that their voices were heard and considered.

4.2.5 Focus Group

A focus group allows a group dynamic to start stimulating discussions, generating new ideas and encouraging a group to share insights they may not have thought of in an individual interview setting (Baxter et al., 2015). This method aimed to engage in targeted discussions about the wireframe developed with design experts to gain insights into their needs, challenges, reactions, and feedback on features and components (Lazar et al., 2017). By involving multiple experts, the focus group allowed for a comprehensive understanding of various perspectives, starting topics with the experts that may have yet to be considered otherwise (Lazar et al., 2017).

4.2.6 Usability Testing

Usability testing involves the systematic observation of end users as they attempt to complete a set of tasks using the interface based on representative scenarios (Baxter et al., 2015). This method was chosen to test user satisfaction and task completion of the designed prototype (Baxter et al., 2015). By tracking their ability to successfully complete the assigned tasks and measuring participant's satisfaction with the interface, we aimed to assess the overall usability and user experience of our interface. This way, we could identify and address any flaws or shortcomings in the interface (Lazar et al., 2017) by actively involving users in the testing process and gaining valuable feedback and insights to improve the quality of our self-report mental well-being interface.

4.3 Data Analysis

The data analysis conducted on the developed methods was almost exclusively qualitative, encompassing a comprehensive examination of the available data sources. The previous research data, consisting of interviews, diaries, observation photos, and co-design sessions, along with the fieldwork data, including observation notes, interviews, and co-design sessions, formed the basis for our analysis.

To analyse the previous research data, we employed an affinity mapping technique (Appendix 1), which facilitated the identification of prominent trends, feelings, frustrations, and perspectives. This in-depth exploration of the data allowed us to generate personas, which served as representations of the target user groups.

Furthermore, the fieldwork data underwent a similar affinity mapping process (Appendix 1). By carefully examining the notes, pictures, and quotes collected from the fieldwork methods, we were able to identify groups and commonalities among the participant's opinions.

Subsequently, the information was summarised into overarching themes which were then translated to requirements according to Goodwin (2009). These requirements were classified into three main categories that provide valuable insights into different aspects of the interface, contributing to its overall effectiveness and usability:

Data requirements: to define the specific types of data that the system must be able to handle. These requirements provide guidance on how the product should collect, store, analyse, and present data.

User requirements: encompass the actions and functionalities that users must be able to perform with the interface. It will note users' behaviours, preferences, and pain points. These requirements guide us in designing intuitive user-friendly interfaces that align with users' expectations.

Functional and contextual requirements: In addition to data and user considerations, the overall qualities and constraints of the product are part of the functional requirements. They outline the desired characteristics and features that the product or service must possess and take into account any limitations, regulations, standards, or environmental factors that may impact the product's design and implementation.

Furthermore, the prototype designed during the process underwent two evaluations at both the wireframe and final prototype stages. In the wireframe phase, a focus group was conducted, where concise and objective feedback was gathered from experts regarding potential enhancements or modifications. Additionally, usability testing was performed on the final prototype, and a comprehensive analysis was conducted by combining qualitative insights provided by the participants with quantitative data derived from user experience questionnaire (UEQ) (Mochammad Aldi Kushendriawan et al., 2021). The questionnaire metrics, such as mean and variance, were used to assess various aspects of user experience.

5. User Research Findings

In this section, we presented and discussed the results obtained from the analysis of past user research data and the conducted fieldwork. By examining the insights gathered from the user research data and the outcomes of our fieldwork, we aimed to present a detailed analysis that contributed to a deeper comprehension of the user's requirements and informed the subsequent stages of this thesis.

5.1 Data Analysis Findings

Findings of the user research data in the form of diaries, interviews, co-design sessions and observation photos were subsequently analysed and structured to inform this thesis, using an affinity mapping approach as is shown in Appendix 1. This approach facilitated the categorisation and grouping of diverse data points resulting in key concepts and connections. It was then possible to define personas and scenarios based on Nielsen's model (Nielsen, 2004) to better understand the experiences and lives of these workers and to define user requirements based on these personas and scenarios.

5.1.1 Personas and Scenarios

Three personas (Figure 4, 5 and 6) were developed because it was essential to consider the diverse range of individuals within the workplace. Each persona focuses on their own goals, frustrations, and motivations and is distinguished through their hobbies, personal history and personality traits.

Ana, the Young Line Manager (Figure 4): Ana seeks to prioritise her mental health, develop better emotional intelligence, and improve communication within her team. Her frustrations lie in time management and work-related stress.

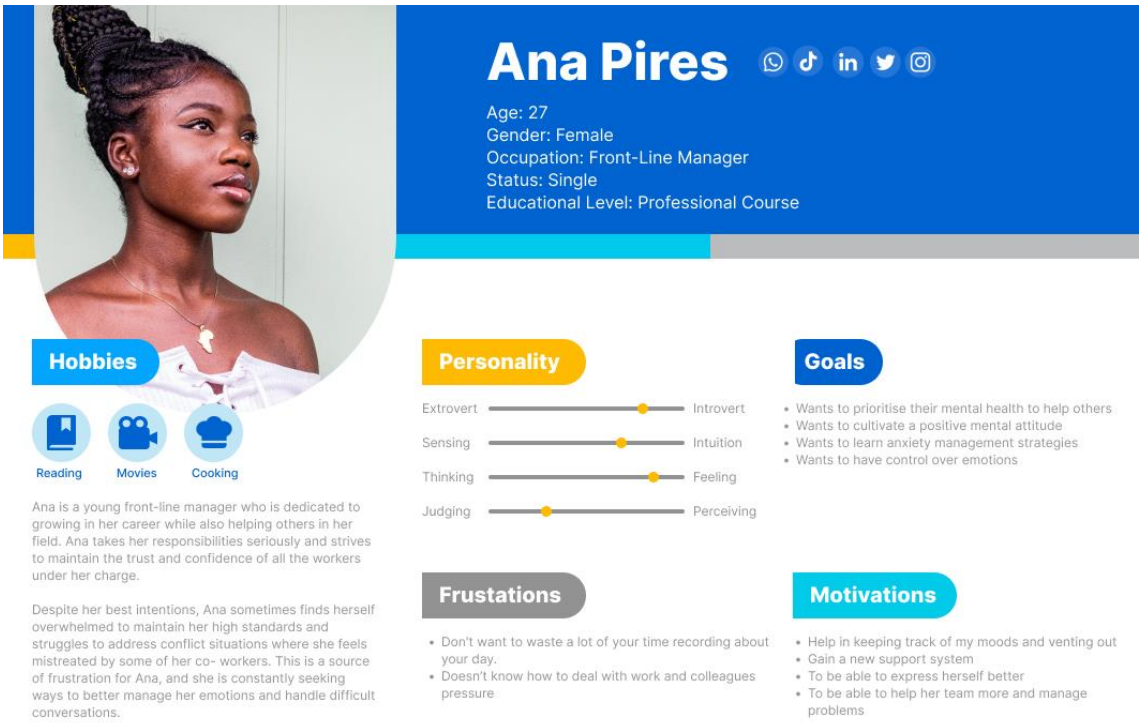

Figure 4 Persona 1 - Ana

Luísa, the Single Mother (Figure 5): Luísa strives to balance her work responsibilities with her personal life. Her challenges include managing her physical condition and finding a safe space for personal expression.

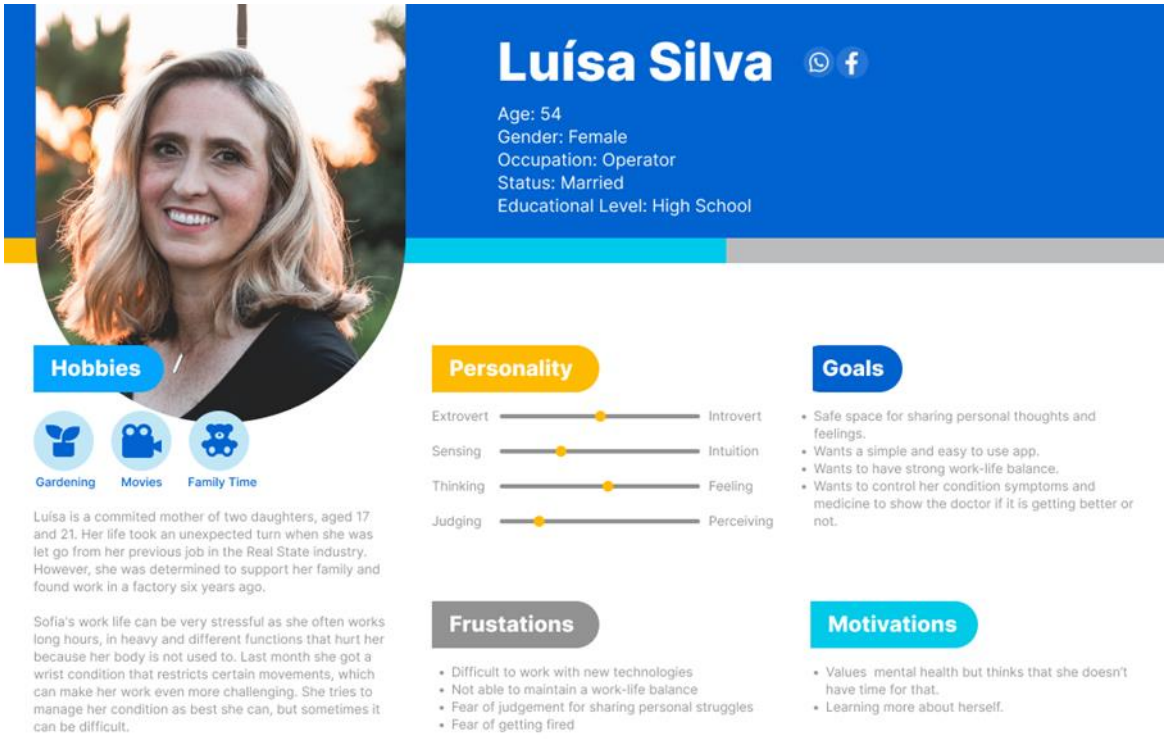

Figure 5 Persona 2 - Luísa

Guilherme, the Perfectionist Worker (Figure 6): Guilherme is driven to excel in his work, but he experiences frustration and stress when facing challenges. He seeks better work conditions, personal growth, and improved relationships with his colleagues.

Figure 6 Persona 3 - Guilherme

It was also developed two scenarios for each persona as you can see in Table 2, to illustrate how the well-being application can address the specific needs of each persona, providing them with personalised solutions and support.

Table 2 Scenarios

Scenario 1	Ana struggles to communicate her feelings and thoughts to her colleagues at work and her team, which causes misunderstandings and tension. She wishes to improve her emotional intelligence and communication skills. The app could help by offering a mood tracking feature to help Ana understand her emotions and thoughts better. Additionally, a journaling feature could assist her in processing her thoughts and feelings, leading to more effective communication with her colleagues.
Scenario 2	Ana cares about her mental health and wants to prioritise it so that she can better support and help her family and colleagues. During her breaks Ana uses the well-being app to calm her down. By using such app, Ana can take small breaks during the workday to focus on her well-being and recharge, helping her to be more productive and effective at work while also improving her overall quality of life. Ana feels more in control of her life and can find the perfect balance between her work and personal commitments.
Scenario 3	Luísa is feeling increasingly overwhelmed with work pressure, causing her to struggle to maintain a work-life balance. She often finds herself working long hours leaving little time for her family and hobbies. Luísa wants to take control of her schedule and prioritise her personal life without compromising her work commitments. She opens the well-being app, which offers customised task management features to help her manage her time better, prioritise tasks, and set realistic goals. Through the app personalised dashboard that tracks her daily activities, Luísa can stay on top of her schedule and allocate time for personal and professional tasks and define personal goals that she wants to that day like having dinner with her kids as a goal. With this, Luísa feels more in control of her life and can find the perfect balance between her work and personal commitments.
Scenario 4	Luísa has been diagnosed with a wrist condition that requires her to be careful when working. However, Luísa often tries to ignore that which makes it difficult for her to perform her job effectively, and sometimes the pain gets worse. To help Luísa manage her wrist condition, she can use the well-being app for shop floor workers. The app can provide her with warnings and contacts of professionals, helping her and others to keep track of her symptoms over time. Additionally, the app can

	recommend the best type of work to do in the company that may be more suitable for her wrist condition, for her to show to her superior and make the environment safer for her. With these features, Luísa can better manage her condition, feel secure and focus on her work with greater ease.
Scenario 5	Guilherme has been feeling isolated from his colleagues since the company started a lonelier work progress due to automation. He misses the social interactions and team-building activities that he used to have in person. Guilherme wants to build better relationships with his coworkers and find ways to feel more connected to the team. He goes to the app and sees many group chats. joins the football chat and asks if anyone wants to go with him work out later. With these features, Guilherme hopes to feel more engaged with his coworkers and create a sense of community within the company.
Scenario 6	Guilherme has been doing the same function in his job for months and is feeling depressed and frustrated with his work routine. He heard about the well-being app for shop floor workers that offers a learning experience for new positions. With this app, he can acquire new skills and step out of his comfort zone while making learning more engaging and fun. In the app he gets upgrades for how much of an expert he is becoming on a new function. He hopes that by using this app, he can find new ways to make his work more interesting, meaningful and fulfilling.

5.1.2 User Requirements

Based on the goals, frustrations, motivations of the personas and the scenarios, as well as the findings from a thorough literature review, user's requirements have been identified and guided the development of the well-being interface and the fieldwork developed. These requirements highlighted several keywords that encapsulate the core needs and expectations of the users, such as:

Personal Development: Personal development is important for many workers to feel more valuable in the company and increase their esteem. Suggesting training and development opportunities aligned with their interests and career goals can also improve their sense of job satisfaction.

Community: Feeling connected to a group is essential for everyone. Creating features that allow operators to connect with each other, celebrate successes, and offer support can boost morale and create a sense of belonging within the workplace. Group chats can also facilitate knowledge sharing, problem-solving, and collaboration.

Humour Report: Humour reports can be a powerful coping mechanism in the workplace. Giving operators a way to report their mood, even if it is just a simple emoji or a rating system, creates a sense of how workers feel and potentially identifies patterns that create those states of mind.

Health Report: Monitoring health is crucial for overall quality of life. By allowing operators to report physical symptoms and track their symptoms, this can help them take better care of their health. This can also help identify potential health issues early on, allowing for early intervention and prevention.

Self-care Tools: Encouraging operators to engage in self-care practices can improve their mental and emotional well-being. Self-reflection exercises, gratitude journaling, mindfulness practices, guided meditation, and other types of relaxation exercises can all help reduce stress, increase resilience, and improve overall mental health.

Daily routine: Setting goals and reminders can help operators stay on track, prioritise tasks and be alerted about what they want in their daily life, promoting their good practices.

These findings informed the development of a well-being interface tailored to the needs and interests of shop floor workers and were used in the interviews and co-design session explained in Chapter 5.2.2 to better understand these requirements around participants.

5.2 Fieldwork Findings

The fieldwork has been conducted in IKEA Industry Portugal Lda, in Penamaior. IKEA is part of the retail industry and produces a wide range of home products, including furniture, decor, household items, and accessories. The production team in the factory comprises production managers, supervisors, team leaders, and operators. The operators are divided into two groups - those who work with more automated processes and those who work with more manual processes. The team leaders oversee a maximum of 15 operators and they are more than 1000 operators in total, working in three shifts.

To involve workers as active participants and guide the design of the prototype, in this section, we utilised several research and design methods such as observation, interviews, and collaborative design sessions with various types of shop floor workers. This approach was employed to gather valuable insights in the form of requirements to inform the development of the interface.

5.2.1 Observation

One factory was visited for the context of this user research method and was done observation with contextual interview. Some photos from the observation can be seen in Figure 7. The observation was only for one day, and an attempt was made to gather data on the objectives determined in the methodology Chapter 4, focusing on the topics: environment, personal possessions, demographics, communication and type of work.

Environment: In this work environment exist two large factories that are home to a vast number of operators. These two differ in their degree of automation, changing the nature of the work, as one has a more cognitive approach, and another still maintains a more manual process of production. Both are very spacious and don't have natural light. Most areas require ear protection due to the numerous machines being used. There is almost no corner of the factories where a machine is not in operation. Safety regulations are expressed around the space via posts. People must stay within designated areas marked with yellow lines for safety purposes and must be careful with forklifts driving around. Throughout the factories, posters extol the virtues of quality and safety, emphasising the operator's commitment to delivering high-quality products while ensuring a safe working environment and promoting the practice of exercise, underscoring the importance of physical well-being.

Possessions: In the workplace, the use of personal mobile phones is permitted, although it is not recommended. In addition, the company provides operators with a pair of headsets to protect their hearing and enable communication with their colleagues in the factory. This equipment is a necessary measure to ensure a safe and efficient working environment. However, it is important to note that the use of personal mobile phones during work hours can be a distraction and may compromise the quality of work. Therefore, it is advisable to minimise their use and prioritise communication through the provided equipment.

Demographics: In the factory, there is a diverse group of workers spanning all age ranges, from young to seniors, with an average age of 35. Each worker owns a uniform consisting of a t-shirt and loose-fitting pants. The uniform's colour denotes the worker's role within the company, allowing for easy distinction between functions. For instance, green signifies maintenance personnel, orange designates team leaders, and red identifies emergency personnel. Each uniform also bears the operator's name. All workers are required to wear the same shoes, which serve to protect their feet while on the job. Women must tie up their hair to avoid accidents. Despite these safety protocols, some workers tend to overlook minor safety

regulations, such as walking on the designated yellow path. The machines have alleviated the burden of laborious tasks, allowing workers to undertake lighter functions.

Communication: Different teams have varying ways of communicating with each other. Some prefer to have face-to-face conversations at the end of their shifts, while others maintain communication through WhatsApp groups. However, relying on informal methods of communication can sometimes result in misinterpretation or incomplete information transfer, which can be detrimental to the overall productivity of the factory. To supplement extra information, the factory has installed screens at each machine and workstation that display production criteria and references, allowing operators to monitor their work status. Additionally, some workstations have computers that enable communication with the machines in operation.

Furthermore, there are team boards where operators can see the activity plan and fill out parameters such as behaviour and team well-being, among other factors allowing transparency and a culture of collaboration and shared responsibility. Some workers with less literary skills sometimes find themselves struggling when the communication is via text and need help from others.

Type of Work: The general work objectives are defined at the beginning of the day and correspond to the production plan. Therefore, the number of pieces produced, and the time taken to produce them are manually entered into a platform. Workers perform a range of tasks that fall into two categories: manual and cognitive. The cognitive work involves machine control and sometimes requires specialised knowledge and is often held by men. Conversely, some positions are more physically demanding, such as assembly, glueing, and packaging, and sometimes need the workers to keep pace with incessant machines. Women are typically more visible in these demanding roles. When operators transition from one position to another, they may struggle if they are not accustomed to the physical demands, leading to discomfort and pain. Many employees find it challenging to leave their comfort zone and experience stress

Figure 7 Field Observation Photos

when they are unsure about their daily tasks, while others start feeling depressed for doing the same thing every day and enjoy changing roles.

5.2.2 Interviews and Co-design Session

One individual interview and co-design session were conducted with shop floor workers. Participants were recruited through the company, where a responsible person reached out to a diverse group of individuals in terms of education, gender, age, job role, and digital literacy. The participants were informed about the study and invited to take part in the research activities.

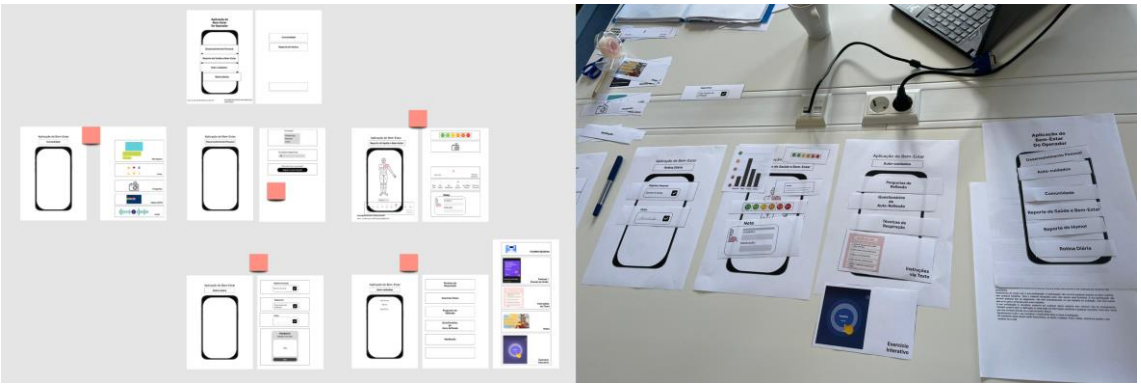

Figure 8 Remote vs presential co-creation sessions

This approach aimed to ensure a representative sample of shop floor workers and gather insights from a range of perspectives and experiences within the workplace. All participants provided written informed consent (Appendix 3) when participating in the study.

A total sample of 10 participants was included in the study as is shown in Table 3. Six of these meetings took place in the fabric accommodations, and the other four in an online setting, using Teams for the call and Figma for prototyping, as is shown in Figure 8. These sessions took around 45 minutes each and were audio-recorded for posterior review.

Table 3 Participant data from interview and co-design sessions

Participant	Gender	Age	Function
PA	Male	59	Operator
PB	Male	30	Operator
PC	Female	48	Operator
PD	Male	49	Team Leader

PE	Female	50	Operator
PF	Female	57	Operator
PG	Female	35	Team Leader
PH	Female	35	Warehouse Management Assistant
PI	Male	30	Operator
PJ	Male	33	Operator

During the interview, the overall theme was the participant's perspective and expectations of the invention of the self-report interface to promote their well-being and health. For the co-design part, participants were to create an interface themselves for what they wanted this self reported mental well-being application to be. This was facilitated by the use of generative tools such as images, types of interaction, media, graphics, words and post-its for them (Appendix 4) inspired by the analysed cases from the state of the art. The participants were then to create their future app to use daily to express their expectations, ideas and vision. Activities included: Phase (1) construction of the main page where they would tell what they wanted for this interface to have, including options defined in Chapter 5.1.2: (A) Personal Development, (B) Community, (C) Humour Report, (D) Health Report, (E) Self-care Tools and (F) Daily Routine. Phase (2) definition and creation of each module they integrate into phase (1) using the generative tools and giving some context of use.

By this session, it was identified that participants experience several challenges in the workplace setting that this interface could act on, and all suggested options defined in the past research section were all key factors.

5.2.2.1 Interview Results

During the interviews conducted, valuable insights were gathered regarding the user's goals, pain points, and necessities. These findings shed light on the needs and expectations of the workforce, allowing for a deeper understanding of their experiences within the workplace.

It was evident that the users faced several pain points that hindered their well-being and overall job satisfaction. Competing with younger individuals and keeping up with the rapid pace of technological advancements emerged as a significant concern for the users: "we are competing with young people, they absorb information more quickly" (PF), "I have to keep up with the machine's pace, not my own" (PE). They also expressed discomfort resulting from

physical strains associated with work tasks that their bodies were not accustomed to as Participant PE told: “Heavy work that I do routinely, my body is already accustomed to it… when they make me do the work that others who are there every day are accustomed to, and I have to keep up with their pace on my own I get a lot of pain, it’s like first day of gym”, leaving some participants feeling that their safety was not a priority as “Reporting no pain is impossible”(PA). Furthermore, a lack of communication between operators, management, and teams was highlighted, leading to feelings of “undervalued” (PE), “injustice” (PC), and “abandonment” (PC). The fear of asking for help (“Many people agree, but don't speak up” (PE)) and the stress arising from the daily routine's instability (“We used to want to work and enjoy it, but not anymore” (PF)) were additional sources of frustration.

To address these challenges and improve the work environment, certain necessities were identified by the users. Firstly, the participants expressed a need for a self-report tool to be implemented, making the concerns and spirit of workers supported by professionals "Psychologist and nurse should accompany us” (PI). Additionally, they emphasised the importance of personal contact, “we want to interact” (PB), over excessive reliance on technology, highlighting the value of face-to-face communication. Improved organisational measures at workstations, increased recognition and value placed on the workers, and the provision of answers to create a sense of reassurance and support were also identified as crucial necessities. Finally, the users stressed the importance of ongoing follow-up and support to address their concerns effectively.

Beyond understanding the pain points and necessities, it was also important to consider the users' goals with the creation of this self-report interface. It became apparent that users aspire to foster a sense of unity within their team. They expressed a desire for increased engagement and responsiveness from management and health responsible. Additionally, they emphasised the importance of encountering new challenges to “further grow” (PJ) and having a well-defined routine in their professional lives as “If you know what you're going to, the day goes smoother and easier” (PJ).

These findings underscore the significance of enhancing communication channels, promoting a more supportive and organised work environment, and recognizing the value of the employee's contributions. The findings of these interviews provide a solid foundation for the development and implementation of the self-report interface, ultimately contributing to the improvement of shop floor worker’s experiences.

5.2.2.2 Co-Design Results

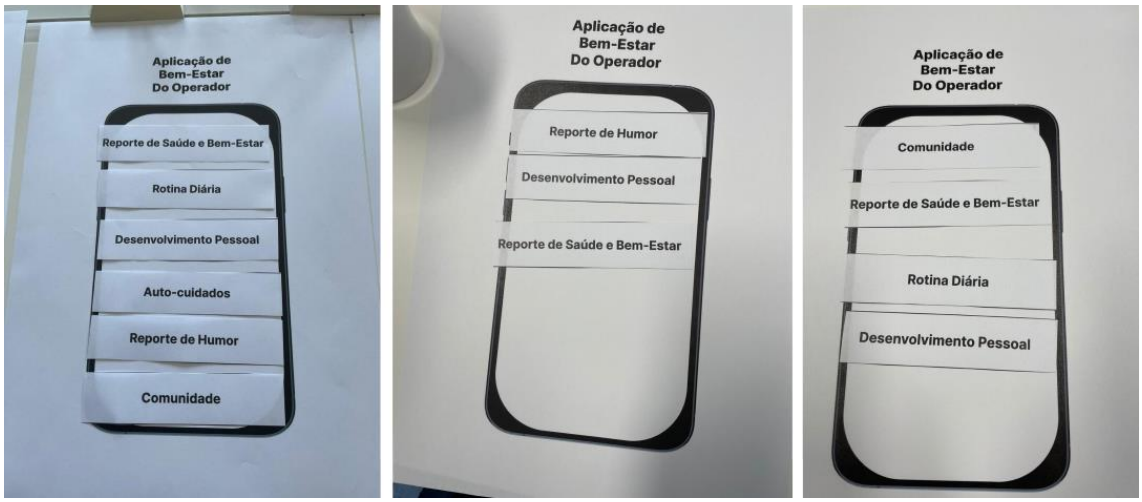

Figure 9 Some co-design topic results for the interface from the workshop

An individual workshop was conducted where 10 shop floor workers collaborated on creating a well-being interface for their workplace. Participants told several key points about the application. They emphasised the need for quick access and highlighted that sound-based features and features requiring space and time such as physical exercises or interactive activities are not practical. They also did not show interest in interacting through audio or photographs on the interface, being more engaged with the text, pre-define options, images and videos. It is also considered important by them for the application to separate personal issues from work-related matters, focusing solely on work-related aspects as mandatory.

The workshop incorporated the topics identified in the previous research section (Chapter 5.1.2) such as: community, self-care tools, health report, humour report, daily routine and personal development. Every topic suggested for the interface was at least chosen 4 times by the participants and according to them "If we look at all of them [suggested themes], they all fit into the interface" (PA), "It's all important." (PE).

Appendix 5 and Figure 9 shows the participant's responses and choices, ordering the most essential chosen category at the top to the less important at the bottom. The humour report was mentioned 4 times, the health report 10 times, personal development 9 times and daily routine, community and self-care tools were each mentioned 7 times. No one suggested any other topic apart from these available options. Many participants often believed that the Health Report already included elements related to humour and did not consider it as a separate category. In terms of priority, the most selected topics were the health report, personal development and community which were also often chosen as the number one priority.

By conducting an examination of each mentioned theme and the artefact developed by the participants and their feedback, we could learn the participant's expectations, ideas and how they see themselves represented in these themes.

Community:

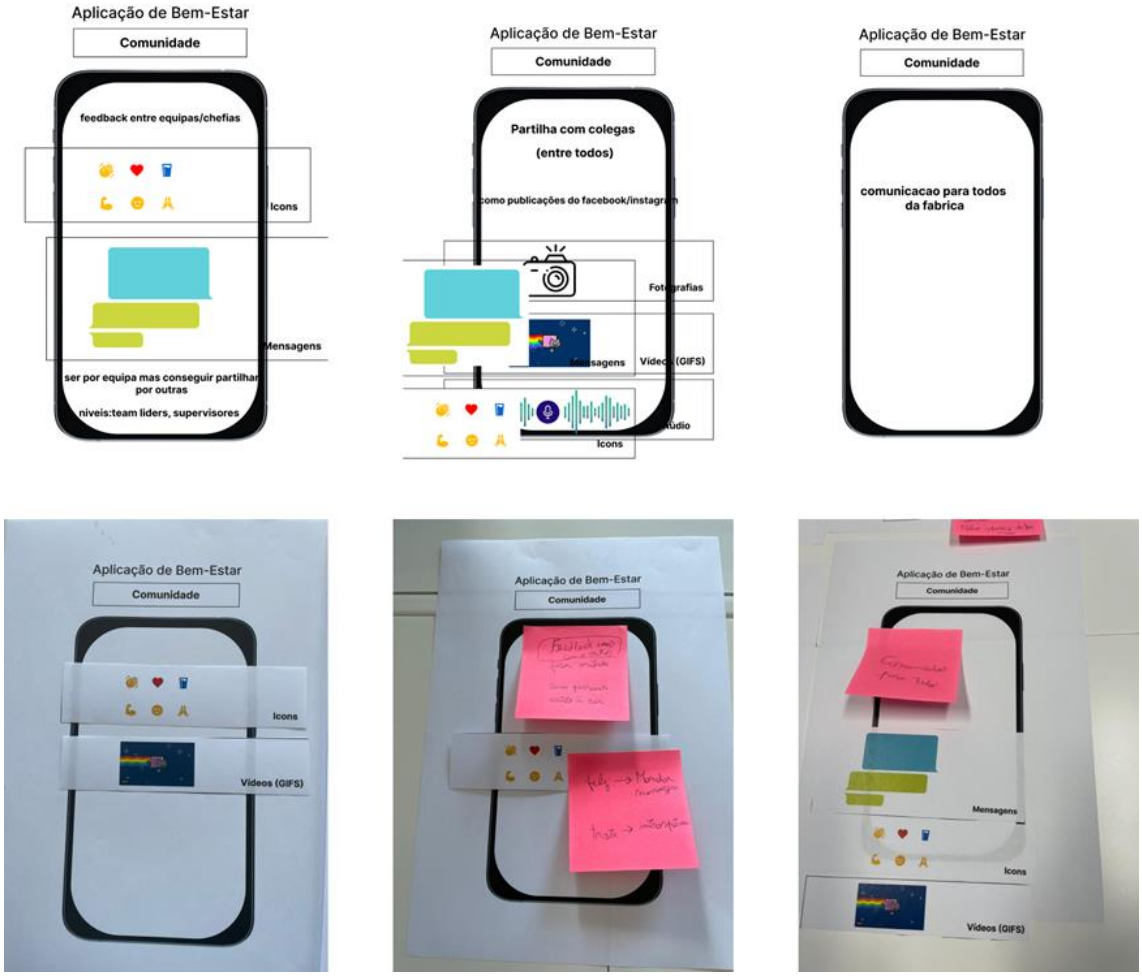

Figure 10 Community page from some participants

The participants drew several ideas regarding what the Community feature in the interface should be (Appendix 6) (Figure 10). It was emphasised that "Community is important for us all to know how the factory is doing overall" (PB) and "I don't want to feel alone in my work state of mind." (PG), proposing announcement posts for everyone made to inform and gather feedback from employees regarding any changes or updates. Participants wanted to engage through text, emojis, and GIFs in this area, providing a platform for open and interactive communication for the community, “Should be like Facebook posts” (PG). Others also recommended the inclusion of separate chat channels for leaders, supervisors, teams and individuals to facilitate “more effective communication” (PG) and “get direct answers." (PC).

Furthermore, participants acknowledged the importance of fostering positive feedback among colleagues to "work on the lack of communication." (PC). They emphasised the value of

constructive feedback, reflecting on personal growth rather than solely focusing on negative aspects. Additionally, participants recognised the role of humour in enhancing understanding and fostering a positive work environment. They suggested the incorporation of mechanisms to reward or acknowledge positive events using emojis and GIFS for "People who have difficulty conveying what they are thinking, they need something that motivates them to be more dynamic." (PI).

Overall, the insights gathered from the participants underscored the significance of the Community feature to foster effective communication, facilitate emotional well-being, and promote positive interactions among colleagues.

Personal Development:

Figure 11 Personal development page from some participants

Participants as shown in (Appendix 7) (Figure 11), emphasised the importance of including personal data about individuals, such as their background and journey within the company, to “know who to call when a problem occurs." (PB) and feel “valuable” (PC). They agreed that personal development should be available to all employees, emphasising the inclusive nature of this feature. Some participants expressed a desire for the application to showcase available training programs and courses. They also suggested a feature that allows users to track and provide feedback on the training they have completed, along with the option to leave notes or reflections. Participants expressed the need for both professional and personal development opportunities to be accessible through the application “If they see a bird hurt around, they will know that they can call me to help” (PB).

Furthermore, other participants expressed a preference for not having an excessive focus on past completed training as they “Don’t see the point of that” (PA). Instead, they highlighted the importance of encouraging individuals to think of the future, step out of their comfort zones and learn different areas of work as "Some people get too comfortable with what they have, and then they don't develop further" (PI). Although this sounds like a positive thing, some other participants said that they feel very stressed and uncomfortable when put in other work positions, especially in physically demanding ones “it’s like first day of gym” (PE).

In summary, the insights gathered from the participants highlighted the importance of including personal growth and ensuring that personal development opportunities are accessible to all employees through the application's Personal Development feature but are not mandatory.

Daily Routine

Figure 12 Daily routine page from some participants

Participants were divided into two types of routines for this interface to follow (Appendix 8) (Figure 12): 1) Personal Health Metrics and Daily routine in the company. Participants who talked about daily routines in the workplace suggested incorporating a display of the employee’s “work schedule” (PH) for their employers, allowing for a daily report on their activities and mood during the shift because some workers associate their mood with where they are working. At the same time, others expressed interest in 2) Personal tracked metrics related to nutrition, sleep and activity. Participants highlighted the importance of providing information on the benefits and risks associated with these metrics, along with health tips as "People behave here, but if they don't care about their safety outside, they will end up getting hurt anyway" (PF). They also emphasised the need for themselves to define their own well-being goals and the

option to set personal reminders for specific objectives. However, the participants acknowledged that incorporating personal routines can be challenging to encourage everyone in the workplace as "It's challenging to make someone want to share their routine in this context." (PB), not only because of privacy concerns but also "Many people already have wearables or smartphones that give these sleep and step metrics, so they would not be very interested in seeing in this interface that. Those who want to know that type of stuff already knows" (PI).

Self-Care tools

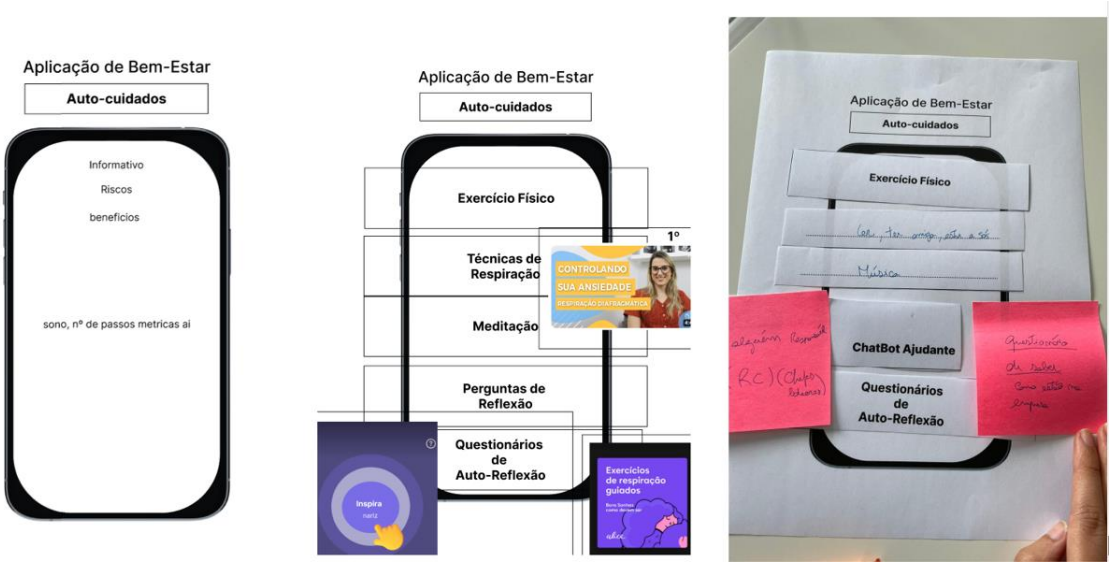

Figure 13 Self-care tools page from some participants

"Self-care is something we should do for our well-being." (PG). For most of the participants, engaging in physical exercise helps "relieve stress from day-to-day life." (PA) and benefits workers to prevent injuries in physical workstations before they start their shift. It was also highlighted the positive effect of combining this with "music" (PC) and also engage in "conversations" (PC) are tools to help them feel better.

Regarding what the results of the co-design session show (Appendix 9) (Figure 13), participants expressed the need for a chat with responsible individuals allowing for direct communication and prompt responses. They suggested the inclusion of a page explaining health risks individuals may face and providing quick self-care tips, "It could suggest recommendations for common injuries." (PF), through text, video, or interactive formats. Participants acknowledged that self-care practices requiring specific spaces, long time or sound conditions might not be practical in the workplace setting. They emphasised the importance of

the application granting access to contact medical professionals such as nurses, psychologists, and psychiatrists as "More personal contact instead of using technology" (PH) is important.

Furthermore, participants emphasised the importance of personal safety beyond workplace-related measures. They expressed a desire for increased knowledge about safety consequences, and they suggested incorporating pop-up reminders and reflection prompts.

Self-Report: mood and health

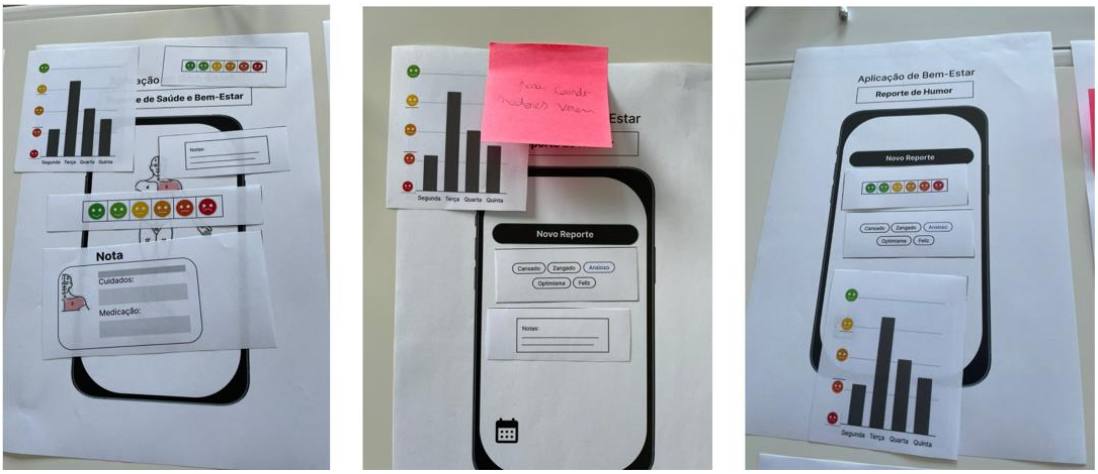

Figure 14 Self-report page - well-being and mood - from some participants

Most participants thought it made more scene that the health report included not only physical well-being but also mood and mental state of mind. It was identified by participants various factors that can influence mood, including shift changes, inconsistency in job roles, pain, isolation, personal routine, social environment, and personal issues.

According to the co-design results (Appendix 10) (Figure 14), as opposed to using illustrations, photographs, audio, temperature degrees, or emotions scales, most of the participants expressed a greater level of comfort and preference for using emojis and words to describe their pain and mood as "It's the most direct way to express myself" (PD). They were deemed the most intuitive, fast, and direct way for most participants. It was suggested that a free-text space should appear when emotions or pain are particularly intense in the self-report, making the application interact with their report "Moderate pain backward, the application should ask if everything is okay if a person reports severe pain forward, contact the infirmary" (PB). The interface was also recommended to inquire about task completion or to check on the participant's condition regarding injury or mood to see how the person is doing.

In terms of what others can see, participants stressed the importance of ensuring the individual's privacy while allowing a collective sharing of reports among operators. They

recommended providing an overview of how operators are doing and sharing monthly and weekly reports with production managers and supervisors, so they are alert when problems are present or everything is fine as "mood is important to understand each other" (PE). It was also suggested making reporting mandatory “once a week to understand how the operator is doing." (PB).

Regarding handling the reports, participants proposed the interface to have the ability to interact with them "The application should send alerts or questions about injuries detected and interact with the injury to make sure we are ok." (PB). It was suggested that injury reports should be forwarded to "professionals, such as the infirmary, psychologist, manager" (PB) allowing "professional support" (PH).

5.3 Design Requirements

To define these requirements, we draw on multiple types of data collected, such as personas and scenarios requirements, observation data and interviews and co-design results. With all this data collected, an affinity mapping was made to analyse the results (Appendix 11).

According to Goodwin (2009). Fundamental requirements encompass a preliminary understanding of the data that the system must manage, the actions users should be able to perform with that data, the desired attributes and characteristics of the product or service, and any limitations or constraints that need to be considered for the solution. In Table 4 are shown the data, user, functional and contextual requirements collected from the findings of the affinity mapping done according to Goodwin (2009) fundamental requirements.

Table 4 Collected design requirements

Interface Feature	Data Requirements	User Requirements	Functional and Contextual Requirements
Self-Report	• Gathering data on reported pain, where the pain is, the level of it, mood, and emotions via emojis and text. • Storing and organising user data for future reference and analysis.	• Participants did not show a preference for audio or photograph-based interaction and reporting. • Participants found reporting pain and mood through text and emojis to be the most intuitive, direct, and easiest way to	• Weekly/monthly reports can be analysed individually to detect patterns. • A team Weekly report anonymous can be viewed by superiors and the team. • The use of emojis is the best

	• Ensuring the privacy and confidentiality of user data.	understand. • Notes or health professionals support should appear depending on the emotions or pain levels.	option to report the general mood of employees. • In the same report, shall be included both humour and physical health with features such as notes, wide choice of words.
Personal Development	• Include a profile section for each employee with their photo, years in the company, skills emblem, and current role.	• Employees want to feel valued for their job and experience personal growth.	• Enable possibility employees to explore and venture into new work areas outside their comfort zone.
Daily Routine	• Record data related to sleep, activity, and nutrition. • Show progress and achievements.	• Participants recommended interaction with a bot for task completion inquiries or checking the participant's condition.	• Reminders for employee protection measures should be provided. • Include an option for personal goals related to nutrition, sleep, and activity to be available on the interface. • Informative content on risks and benefits associated with the personal goals chosen and security should be provided.
Self Care tools	• Interactive exercises to make workers feel better should be available. • Securely store emergency contact information associated with employees having responsible access.	• Videos, interactive activities, and text were found to be the most engaging options for users to learn new skills.	• Features requiring space and time are not suitable for this application. • A section for employees to associate emergency health contacts should be provided. • Incorporate interactive exercises that are chosen collectively, require no sound, and are quick to complete.
Community	• Capture and store data related to posts and interactions between employees, including text, emojis, gifs, and	• Participants want to feel more connected to others and give an example of social media features to claim that.	• Section where employees can share posts with text, emojis, gifs, and photos and interact with each other.

	photos.		• Interaction between workers should be non-anonymous.
Application	**Data Requirements**	**User Requirements**	**Functional and Contextual Requirements**
Overall application		• The application should focus solely on work-related aspects and separate personal issues.	• The application should provide quick access to its features. • Sound-based and photography features are not practical in the workplace environment, and users are not very comfortable expressing that way. • The interface should be accessible to all operators, including those with poor literature skills.

6. Prototype

This section explains the design process and features based on insights from requirements acquired in Chapter 5.3. Additionally, the prototype evaluation applied to the prototype and their results are presented.

6.1 Prototype Design

This section of the report focuses on the design of the prototype interface optimised for mobile devices. The decision to prioritise mobile devices was based on their widespread availability among the workers and their demonstrated accessibility, ease of use, and popularity, as discussed in the state of art chapter (Chapter 2) and observed in Chapter 5.2.1. The proposed interface focused on providing personal feedback to individual workers, and it is not meant for sharing self-reporting data with other stakeholders like management or other employees in this phase.

6.1.1 Translation of requirements into the interface

For the design process of the interface, we prioritised the requirements based on the preferences expressed by most of the participants during the user research phase and the theme of this thesis which is the use of self-report to increase the well-being of the worker.

While all the features were deemed important by more than half of the participants, we chose to empower the features often chosen by the participants in the co-design session. This includes: mental and physical self-report feature, community feature, and personal development emphasis. For these features, all requirements defined in Chapter 5.3 were important to be in the interface. The main emphasis was placed on designing and evaluating the self-reporting features, the main theme of the dissertation. As such, the implementation of self-care tools and features revolving work organisation was excluded from this phase, as it falls outside the scope of the thesis. However, requirements related to these topics, such as contact emergency information and feedback on user conditions, would be incorporated to ensure their well-being and safety. So, the interface was designed to fulfil the following user requirements:

- The interface should enable users to easily report on their mental and physical well-being, providing the option to express themselves using emojis. However, as emojis can sometimes lead to ambiguous interpretations, users should also have the ability to provide additional details through text if they desire to do so.
- Enable analysis of the gathered reports to detect behavioural patterns, empowering users to gain insights into their own mental and physical well-being.
- Maintain individual privacy by ensuring that the interface remains personal and confidential during this phase of the prototype, without sharing reports with anyone else.
- Provide informative notes and support tailored to the user's emotional state, offering education and assistance based on their reported feelings.

- Incorporate a profile section for each employee, highlighting their years of experience, thereby recognising and valuing their contributions. Additionally, include a section where employees can view and interact with each other's profiles, fostering a sense of community.
- Allow users to report data related to sleep, activity, nutrition, and other important aspects that are relevant to them, promoting a holistic approach to well-being.
- Include a designated zone within the application where users can make posts and engage in interactions, ensuring that they feel heard and safe expressing themselves.
- Design a simplistic interface that provides quick access to its features, ensuring ease of use and efficiency in navigating the application.
- Offer the choice for users to focus solely on work-related aspects within the application while also accommodating personal elements if desired.
- Create an interface that incorporates images and colours, ensuring a visually appealing and simplistic design that remains accessible to individuals with poor literacy skills.

By adhering to these requirements, the interface aims to provide a user-centric and comprehensive experience that promotes mental and physical well-being while offering a sense of community and individual value based on the participant’s insides.

6.1.2 Information Architecture

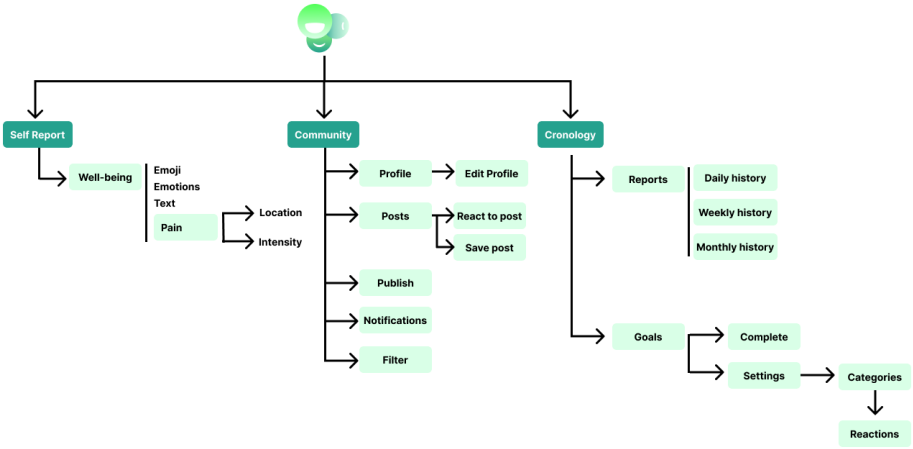

Figure 15 Information Architecture

Based on the aforementioned requirements, the objectives, structure, and functionalities of the application were determined. In this phase, the interface tools and navigation were defined, establishing the interface flow via an information architecture (Dillon & Turnbull, 2005). The interface consists of three main views as is shown in Figure 15: Self-Report, Community, and Chronology:

The Self-Report view allows users to evaluate their well-being using emojis and provides the option to add words and text as well. If the user selects the word "pain," they are directed to a subsequent page that inquires about the location and intensity of their pain.

The Community view grants access to the user's profile, which can be edited, and provides access to posts made by others. Users can react to these posts using emojis and save them for later reference. The posts can be filtered by recency, popularity, saved posts, and user-specific posts. Additionally, users can receive notifications when someone reacts to their own posts. This page also enables users to publish their own posts, displaying information such as the author, date, intended audience (team or all), title, text, and optional images.

The Chronology view offers two types of information. Firstly, it allows users to view their reports on a daily, weekly, or monthly basis. In the monthly view, users can apply filters to observe reports related to overall mood, emotions, goals, or pain. Secondly, this page features a goal-tracking functionality. Users can react to goals, marking them as completed or editing them by selecting pre-defined options and removing or creating custom goals. The pre-defined goal categories include Mental Health, Physical Health, Nutrition, Fun, and Work Security.

6.1.3 Wireframe

Having defined the platform requirements and the information architecture of the interface, a wireframe was then developed in Figma as is shown in Appendix 12 and Figure 16. The wireframe serves as a proposed solution, incorporating important metrics and addressing the identified needs and objectives of this study. This low-fidelity, non-functional yet interactive prototype establishes connections between various system views triggered by user interaction with interface elements. Additionally, this prototype allows for a closer approximation of element positioning and sizing within the interface.

The wireframe underwent a focus group evaluation, explained in Chapter 6.2.1, where the results were applied to the development of the prototype in subsequent stages.

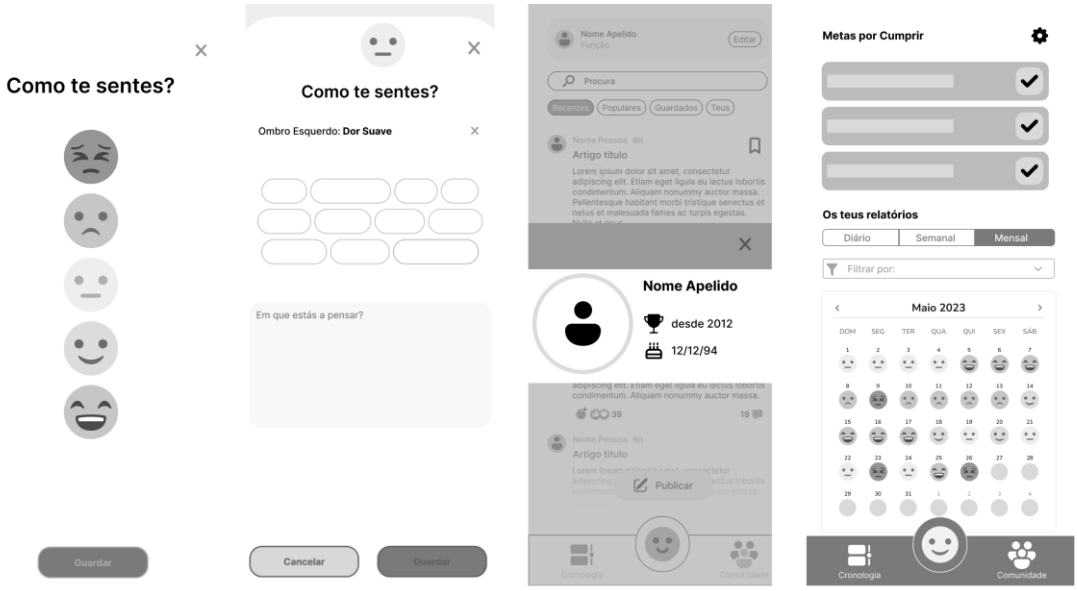

Figure 16 Wireframe

6.1.4 Visual Identity

The visual identity of the interface endeavours to exude a contemporary aesthetic while fostering a friendly and soothing environment for the user. This is achieved through careful attention to typography, colour schemes, and icons employed within the application.

Regarding the chosen colour palette (Figure 17) for our prototype, it is justified based on the principles of colour theory. According to Decker (2022) colour theory explains how humans perceive and interpret colours, as well as the visual effects of how colours interact, blend, or contrast with each other. It also encompasses the understanding of how colours communicate messages and evoke specific emotions or associations. According to American Addiction Centers (2022), the combination of earthy green shades and blues can promote relaxation, reduce stress, and alleviate anxiety, fostering a sense of peace and tranquillity. It was chosen the predominance of green tones for this interface, which signifies harmony, balance, and nature, that can contribute to a calming effect.

The colours depicted in Figure 18 were also used in the interface to moods and ranks inside the app. The use of bright red to green colours can be justified based on colour psychology, cultural associations, and visual impact, as red is often associated with intensity and urgency, while green represents calmness and balance (Chapman, 2021). Additionally, the contrast between these colours creates a visual impact and draws attention.

Another consideration for the selection of the colour palette was accessibility. It was taken into account the Web Content Accessibility Guidelines (WCAG, 2023) for low vision and created the colour palette using the colour scheme generator Coolors, which is designed to meet the WCAG level AA guidelines.

Figure 17 Interface colour palette

By adhering to these guidelines, we aim to ensure that the colours used in the prototype provide sufficient contrast and readability for individuals with visual impairments. This approach enhances the inclusivity and usability of our project, allowing a wider range of users to engage effectively with the content.

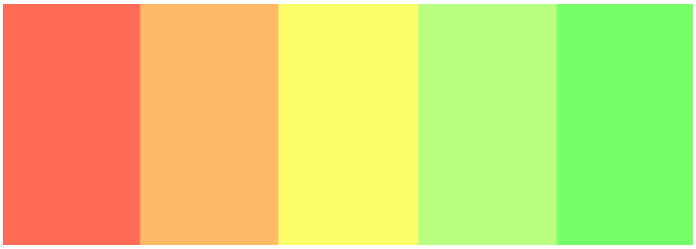

Figure 18 Mood's colour palette

The Inter font was chosen for its combination of legibility and visual appeal (Figure 13). This font family exhibits clean and modern characteristics, ensuring easy readability while maintaining a harmonious visual balance throughout the interface. The range of weights, from extra bold to medium, has been strategically utilised to accommodate users with various visual conditions, enhancing legibility and accessibility. Icons play a pivotal role in the application's visual language, serving as intuitive visual cues to enhance user understanding and interaction and help people who have difficulty reading and understanding through them some context. The iconography employed (Figure 19) follows a modern and minimalistic design approach. The icons are clean, simplified, and meticulously crafted to maintain consistency and clarity across the application. With round, filled designs, these purposefully chosen icons not only capture visual appeal but also prioritise functionality as was seen in the co-deisgn session about the materials brought. They aid users in effortlessly identifying and navigating different features and functionalities, contributing to an intuitive and user-friendly experience.

By combining carefully selected typography, a calming colour palette, and intuitive icons, the visual identity of the interface successfully creates a modern and inviting atmosphere that promotes a positive and serene experience for users.

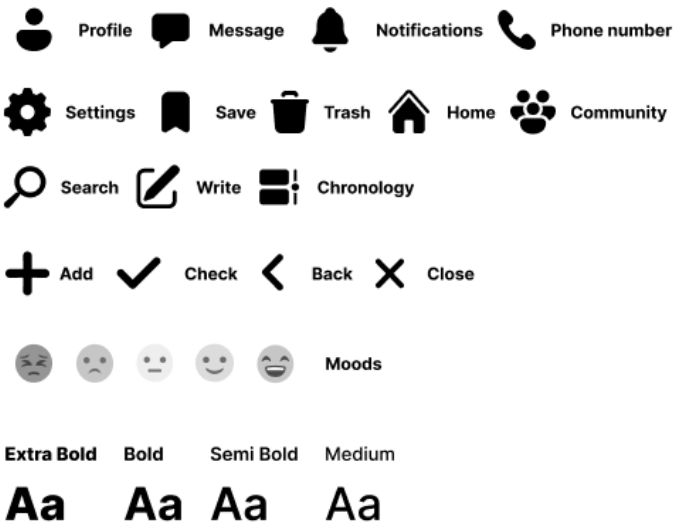

Figure 19 Icons and typography used in the interface

6.1.5 Prototype Views and Content

This phase of the dissertation focused on the implementation of the final prototype with the recommendations given in the focus group on Chapter 6.2.1. The interactive prototype is possible to see on the video https://youtu.be/oI-yZixuqP4.

The following section delves into the various views incorporated within the interface, providing a comprehensive exploration of their features and functionalities. Each view is discussed in detail, highlighting the key components and their role in enhancing the user experience.

6.1.5.1 Bottom Navigation Bar

This bottom navigation bar (Figure 20) is fixed at the bottom of the application and provides access to three main sections. The "Chronology" section contains the goals yet to be accomplished and the past reports made by the user. The "Self-Report" section allows users to submit and save their own reports within the application. And lastly, the "Community" page enables users to engage with content from others through posts and reactions. In the next sections of this report, each page will be further described, providing a detailed overview of their features, functionalities, and user interactions.

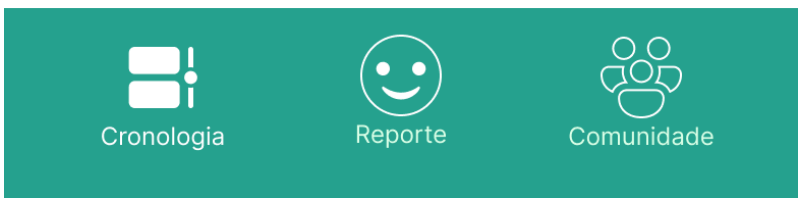

Figure 20 Bottom navigation bar

6.1.5.2 Login View

The login view (Figure 21) is responsible for user registration and authentication. Users can register and authenticate through their company email account. To access the application's system, users will need to give their username and password and then click on the "Login" button.

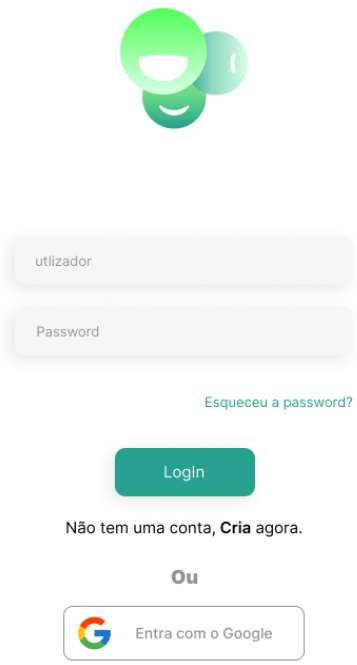

Figure 21 Login View

6.1.5.3 Self-report View

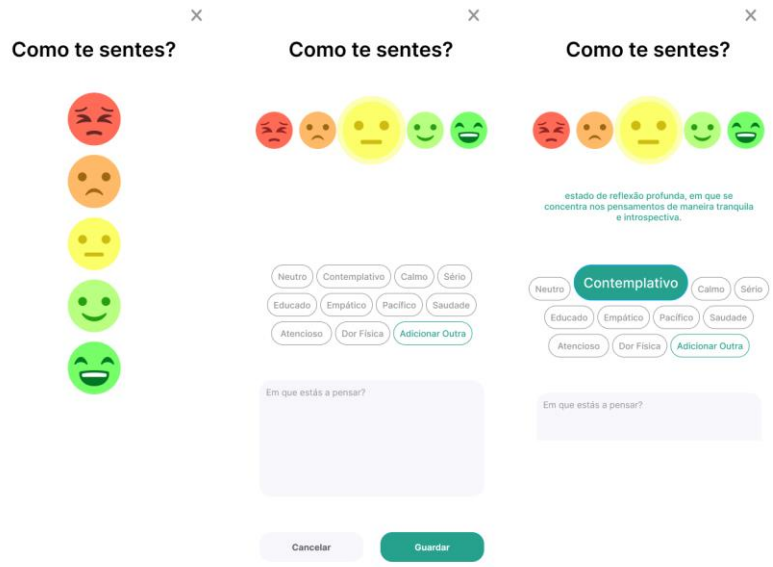

Figure 22 Self-report Views

Upon logging in, the self-report view prompts the user to indicate their current emotional state as is shown in Figure 22. This can be accomplished by selecting an emoji that best represents their mood. After selecting, the user has the option to add additional emotional words and notes to their self-report. These words are responsive to the chosen emoji and are based of the Scherer's model adaptation from (Mano et al., 2019) (Annex 1) and Russell's Circle cumplex model on affect (Russell, 1980), where he defined an emotion circle based on valence (feeling good to feeling bad) and arousal (high energy to low energy).

When an emotion is chosen, the application provides feedback by offering a definition that explains the meaning of the selected emotion (Figure 12). This feature aims to facilitate the user's learning and comprehension, equipping them with a broader emotional vocabulary for effective communication and self-understanding. Additionally, users can add their own personalised emotion words, going beyond the predefined options provided by the application. In the case where the user selects the "pain" emotion, they are redirected to a distinct page that differs from the rest of the emotions.

6.1.5.4 Pain Report View

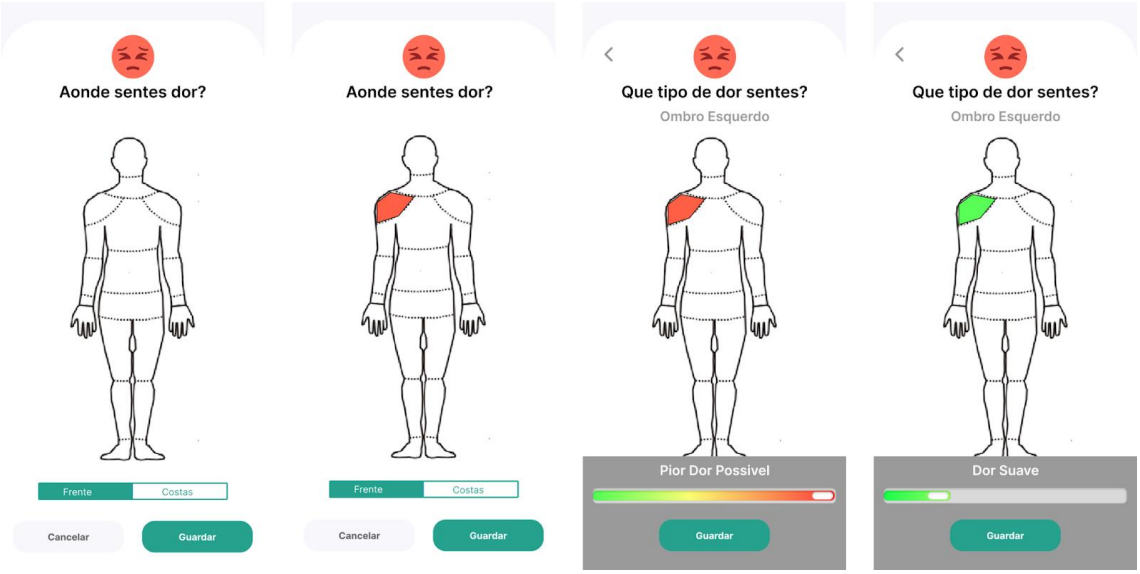

Figure 23 Pain report views

On the pain report page (Figure 23), users can utilise a body diagram (Tirloni et al., 2012) to select multiple areas of the body where they experience discomfort. They can specify different types of pain associated with each selected area. Pain intensity is assessed using the verbal pain intensity scale (Thong et al., 2018) as it was the preferred choice among the majority of participants among the four options available (Appendix 4). This approach provides a more detailed and accurate representation of their pain symptoms and aids in effective communication with healthcare professionals or further analysis within the application.

6.1.5.5 Confirmation and Response Views

In the Confirmation and Response view, once the user completes and submits their self-report, they will always receive a confirmation message indicating that their report has been successfully submitted (Figure 24). As part of the interface concept, the self-report would be analysed in relation to the user's response and in consideration of previous reports. If concerning patterns or indicators are identified, the application would be responsive and prompt the user with a notification, as is also shown in Figure 14, suggesting that they may require assistance. Additionally, the application would provide the option to contact emergency contact information for individuals whom the user should reach out to for help in such situations.

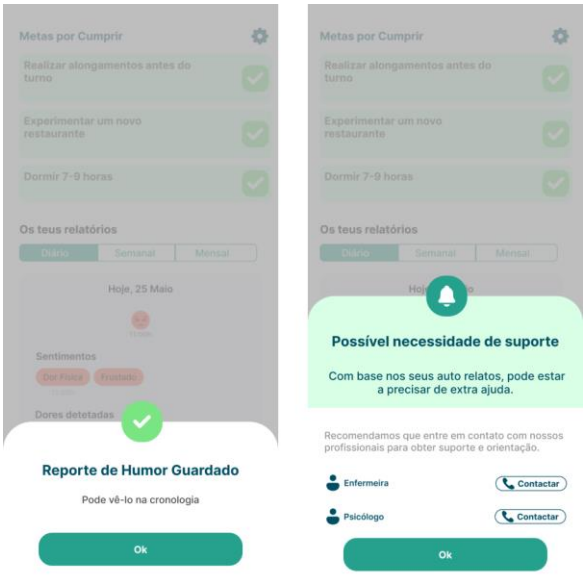

Figure 24 Confirmation and Response Views

6.1.5.6 Chronology View

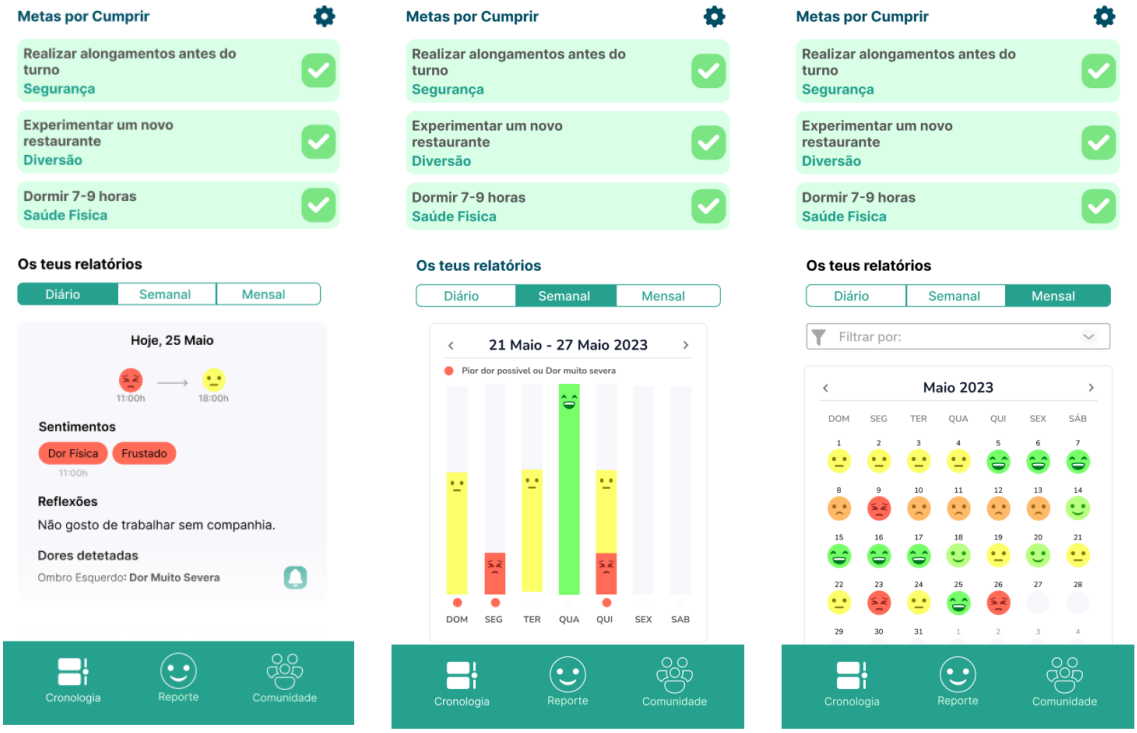

Figure 25 Chronology Views

The Chronology page offers a comprehensive snapshot of the user's daily goals, as well as a detailed view of their reports in different time frames (Figure 25). At the top of the page, users can view their daily goals that they have set for themselves. These goals represent the tasks or objectives that the user aims to accomplish during the day.

Below the goals section, the reports are organised into three different formats: daily, weekly, and monthly. In the daily view, users can see a chronological display of their reports for each day. This includes the changes in mood throughout the day, along with the corresponding timestamps. Users can also view the emotions they experienced, any reflections they wrote, and the goals they achieved on that day. In the weekly view, the user only has a general view of what he is feeling. The monthly view shall be explained in the next view section.

6.1.5.7 Monthly Filter Report View

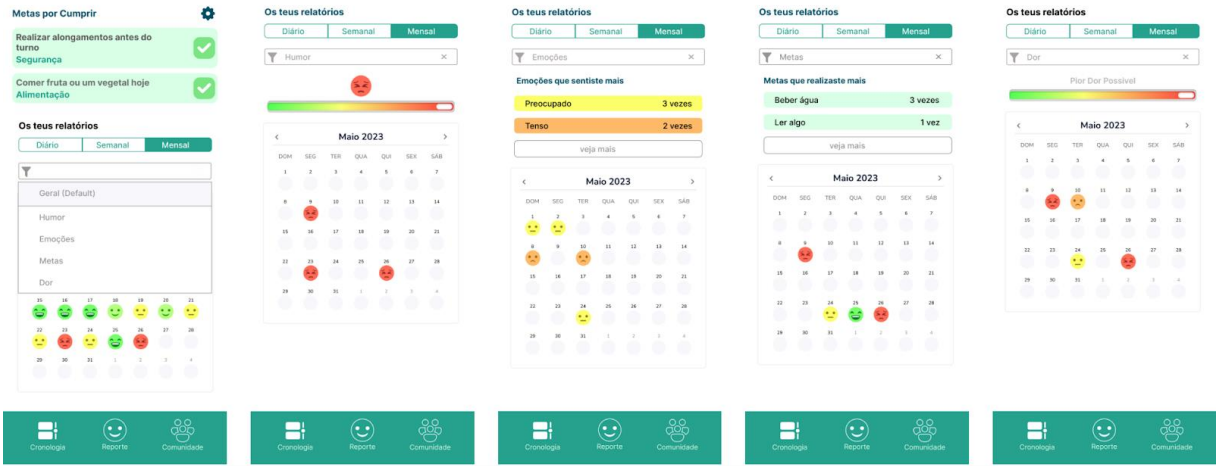

Figure 26 Monthly filter report views

The Monthly Report view offers four unique filtering options besides the general overview (Figure 26). Users can customise their views based on different criteria to analyse and identify patterns in their mood reports.

The first filtering option is based on mood, allowing users to select a specific mood (represented by an emoji) and view the days they felt that particular mood. This provides insights into the frequency and duration of specific moods experienced over the month.

The second filtering option is based on emotions. Users can see the top two most frequently experienced emotions (with the option to view more) and their corresponding days on the calendar. Clicking on a specific emotion narrows the view to only the days when the user felt that specific way.

Similarly, the third filtering option is based on goals. Users can track their progress by selecting specific goals and viewing the days they achieved them. This feature helps users identify the correlation between their emotional state and goal attainment.

The fourth filtering option is based on pain. Users can filter their monthly report view to see how their emotional well-being correlated with different types of pain they experienced. This allows users to explore the relationship between their mood and physical discomfort.

6.1.5.8 Goals Setting View

Upon clicking the tool icon on the top right in the chronology section, users are directed to the initial page, as shown in Figure 27. This page provides an overview of the user's current goals, both completed and pending, allowing them to manage their goal list efficiently. Users have the option to remove a goal from the list by selecting the appropriate action.

In addition to the existing goals, users can explore other thematic categories that offer pre-defined goal suggestions tailored to their needs: security, physical health, mental health, nutrition and fun. These categories provide users with a variety of tasks and goals to choose from, fostering personal growth and development. Users also have the flexibility to create their own custom goals, reflecting their unique aspirations and preferences.

When adding a new goal, users are prompted to specify the desired routine or frequency for the task. This ensures that users can establish recurring goals based on their preferred schedule or frequency. Conversely, if users attempt to delete a task from their goal list, they are prompted to confirm their decision, ensuring they are intentional about removing a goal.

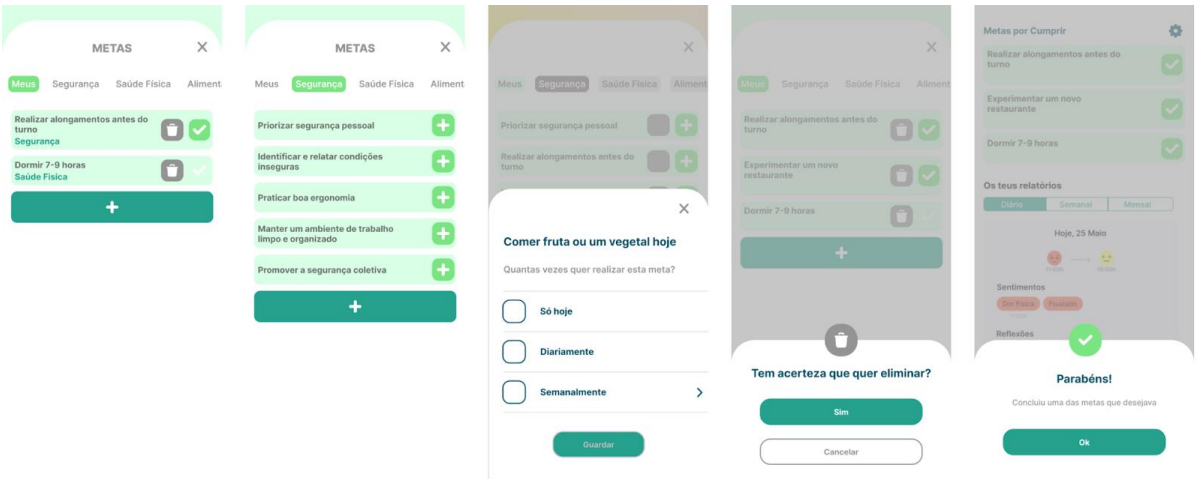

Figure 27 Goals Settings Views

6.1.5.9 Community View

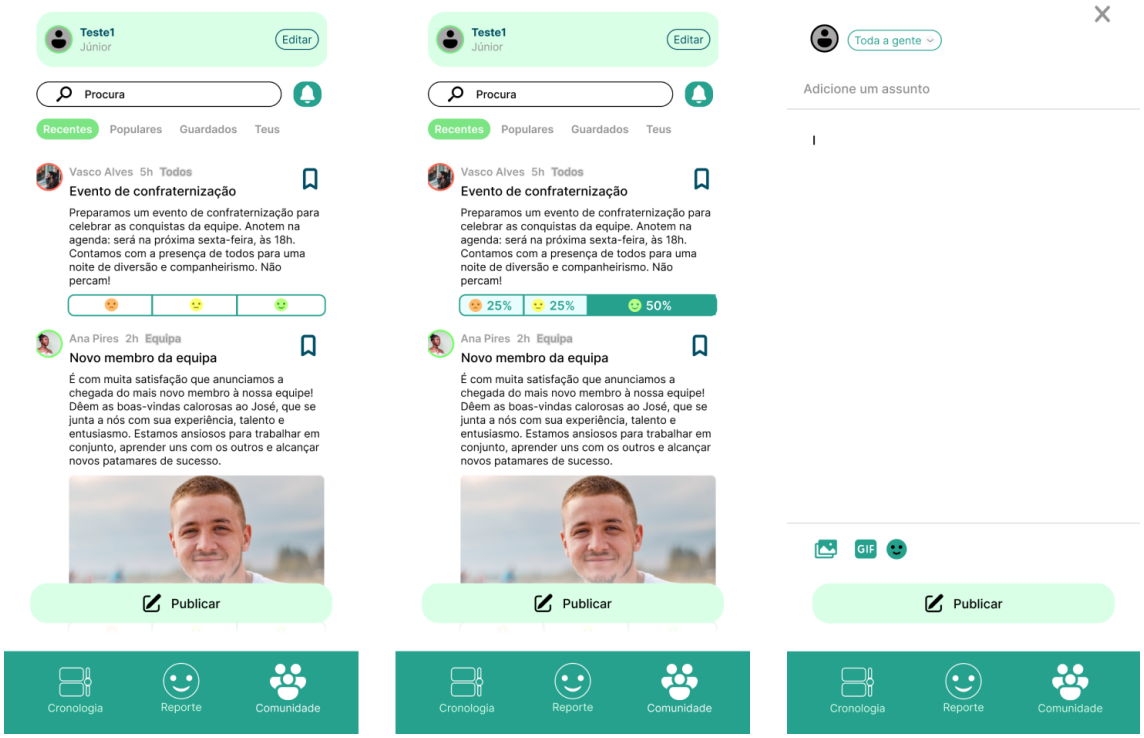

Figure 28 Community views

The community page (Figure 28) features a prominent profile section at the top, displaying the user's name, photograph, and job title based on their years of experience. This profile information can be edited within the page to ensure accuracy and relevance. Below the profile section, a collection of posts is presented, allowing operators and employees within the factory to share their thoughts and updates. These posts can be conveniently filtered by name search or organised according to criteria such as recency, popularity, saved posts, and the user's own contributions. Additionally, a dedicated notifications area is provided to inform users about reactions received on their own posts.

Within each post, a title and descriptive text can be provided, accompanied by optional elements such as photographs, gifs, and emojis. Posts can be shared with a broad audience or targeted specifically to relevant teams. Interactions with posts are facilitated using three emojis (sad, neutral, and happy), enabling users to express their support or dissatisfaction with the shared content. It is important to note that the specific identities of voters or the exact number of votes per category are intentionally withheld. Instead, users are presented with an overall percentage representation based on the collective votes. This approach is designed to streamline feedback within the application, foster discussions beyond the platform, and create a supportive environment that encourages open expression without the risk of undue scrutiny or hesitation.

6.1.5.10 Profile View

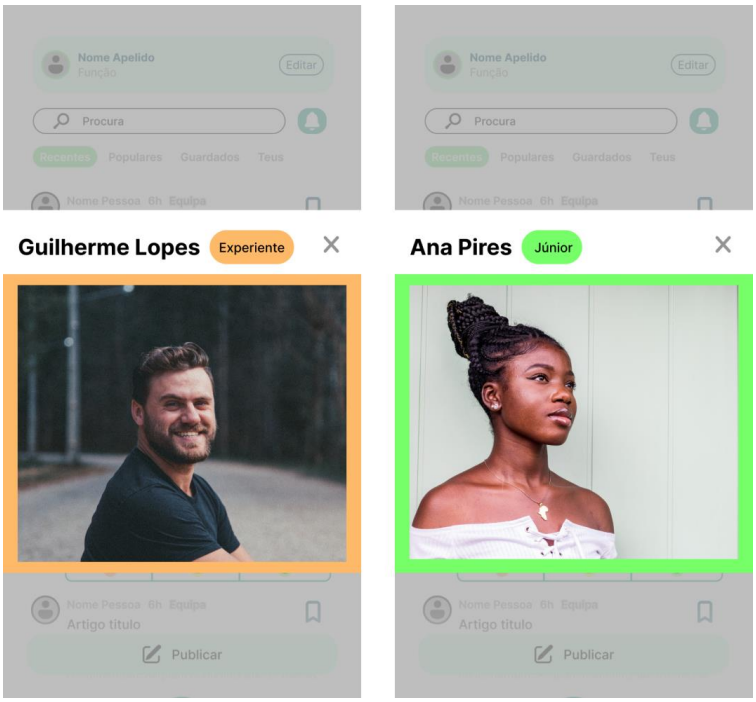

Figure 29 Profile examples view

The profile section of the users is designed with a minimalist approach, as is shown in Figure 29. It consists of essential elements such as the individual's name, profile picture, and a distinctive frame that corresponds to the emblem associated with their tenure in the company. The frame serves as a visual representation of the user's experience and longevity within the organisation. This simplistic profile design prioritises clarity and efficiency, allowing users to quickly identify and recognise their colleagues while maintaining a visually cohesive and professional appearance.

6.2 Prototype Evaluation

This section focuses on the evaluation and validation of the interface developed, incorporating two types of evaluation: a focus group conducted on the wireframe development and usability testing performed on the final prototype. This testing session was carefully scheduled to assess various aspects of the prototype, including its usability and user experience. Within this section, we outline the objectives of these evaluations and present the results obtained.

6.2.1 Focus group Evaluation

A focus group session was conducted with nine experienced designers to participate in a discussion about the wireframe of the self-reporting interface designed. The decision to involve experienced designers in this session aimed to gather expert perspectives and ensure the interface's alignment with design principles and best practices. Their knowledge and understanding of design principles and usability considerations allowed for a thorough evaluation of the wireframe's features and the discover of potential improvements. During the one-hour session, valuable insights were collected regarding each of the three significant sections of the interface: self-report, community and chronology. These findings were instrumental in further refining the wireframe in the next section and are present organised here:

Self-reporting section: The designers, based on the results of their fieldwork, advised against relying solely on emoji-based mood descriptions in the self-reporting section. Drawing from their experiences with factory workers, they observed that some participants hesitated to express their emotions using emojis. Instead, the designers emphasised the importance of using words to describe emotions. By encouraging descriptive language, the interface could potentially enhance participant's emotional vocabulary and improve their ability to express their well-being effectively.

Community section: Regarding the community section, the designers cautioned against creating an interface that closely resembled a social network based on insights gathered from their fieldwork results. Through their expertise and experience, they expressed concerns that such a design approach could potentially devalue real-life conversations and interpersonal interactions. They emphasise balancing digital interactions and face-to-face communication within the self-reporting interface and recommended that the primary objective of the application should be to guide individuals in understanding how most people feel based on the posts. Moreover, the designers promoted conversations outside the application rather than confining them within it. To achieve this, they proposed simplifying user interactions. Using borders on the profiles was also recommended to symbolise an individual's length of time with the company or their position, thus highlighting specific posts accordingly.

Report Timeline Section: In the report timeline section discussion, the designers commented on the need for more precise guidance on setting tasks and goals. They suggested that the interface should provide more intuitive features to help users navigate and utilise this section effectively to understand better how to utilise this feature to track their progress and set achievable goals.

6.2.2 Usability Testing Session

To evaluate the effectiveness of the designed final prototype, we conducted usability testing sessions. The usability testing was conducted in person with a total of five participants (Table 5), as research suggested that this number is often sufficient to identify the majority of usability issues (Baxter et al., 2015). The testing was performed using an iOS mobile phone to assess the functionality of the developed prototype, and the sessions were recorded on video to capture the participant's interactions for analysis (Figure 30).

Prior to the testing session, the participants were provided with an explanation of the context and purpose of the session. They were asked to sign an informed consent form (Appendix 13), which outlined the data that would be collected throughout the testing process. The consent form also included a summary of the project and the procedures involved in the usability testing. It was emphasised that the collected data would be used solely for analysis purposes and would not be disclosed or utilised for any other purposes.

Figure 30 Images from the usability testing recorded sessions

A task list was prepared (Appendix 14) to ensure a structured and goal-directed testing process. The tasks included in the list were designed to be clear, unambiguous, and aligned with the typical goals that users aim to accomplish (Lazar et al., 2017). The selection of tasks took into consideration their frequency of occurrence and relevance to the primary objectives of the users. To accommodate participants who had difficulties with reading, the task list was adapted into another version (Appendix 15), to provide a more comfortable testing experience for them, eliminating some of the tasks on the list that only required reading.

The testing process consisted of two phases. The first phase involved the interaction with the developed prototype, where participants attempted to complete the assigned tasks. The second phase involved the completion of a questionnaire to measure the user experience with the tested prototype.

The initial phase aimed to encourage participants to interact with the prototype and attempt to complete the assigned tasks. These tasks were designed to encompass the four main fundamental functionalities of the application: self-reporting, task list, community, and self-report analysis. By incorporating these tasks, users were able to engage with all the intended

features of the application, enabling a comprehensive evaluation of its functionalities. During the usability testing sessions, the think-aloud protocol was employed (Rubin & Chisnell, 2008).

This approach required participants to verbalise their thoughts and actions while performing the tasks. By doing so, we gained qualitative insights into their cognitive processes and better understood their decision-making throughout the task completion process because it exposed the participant's preconceptions and expectations about how the product works.

After completing the tasks, participants were asked to fill out the UEQ (Annex 2) that assessed their experience with the application and gathered their opinions about it. The UEQ was chosen to gather participants feedback and opinions about the overall user experience across different dimensions, such as usability, aesthetics, efficiency, and satisfaction on their experience with the interface tested. Requesting participants to complete this questionnaire would be a user-centric approach to the interface development. The questionnaire aimed to evaluate usability, satisfaction, and effectiveness. It provided valuable feedback to identify strengths and weaknesses and allowed for objective measurements and comparisons to identify user trends and patterns in their responses. By analysing the questionnaire responses, we gained insights that contributed to enhancing the product's overall user experience.

Participant	**Gender**	**Age**	**Reading Proficiency**	**Function**
PK	Male	59	Difficulty	Operator
PL	Male	30	Fluent	Operator
PM	Female	32	Fluent	Operator
PN	Female	23	Fluent	Operator
PO	Male	49	Fluent	Team Leader

Table 5 Participant data from usability testing

6.2.2.1 Usability Results

During the usability testing, participants engaged with the self-reporting tasks in different ways, specifically in terms of choosing emojis and deciding whether to add words or notes, despite the description of the task. It became evident that users preferred a simpler and quicker method to describe their mood rather than filling in all available fields in the self-report such as

choosing words that described their emotions and writing additional context. It also became evident that the connection between emojis and the participant's emotional state is subjective and consequently not always directly attributed with the same meaning for participants. Furthermore, participants expressed a desire for some of the collected data to be shared with their superiors, beyond being solely a self-reporting tool for themselves.

Additionally, certain elements of the user interface caused confusion for some participants. For instance, the association of temperature bars with emojis on the monthly view of reports and the spacing between community posts led to participants mistakenly reacting to a post based on the reaction of the post above it. Regarding the goal task, it was observed that some participants displayed a preference for writing their own responses rather than searching through the provided predefined list.

During the usability testing, some challenges were encountered. Participants often deviated from the predefined tasks, focusing instead on their personal stories, emotions, and choices to answer tasks. This allowed for the collection of qualitative data to measure the interest and suitability of the solution, which were positive and demonstrated that they had a great deal of interest in expressing themselves as they were through the application. Despite this, interventions were required to redirect their attention back to the assigned tasks due to time-constrains, potentially influencing task completion and error rates. Special assistance was also required to provide to the participant with limited literacy skills to make the testing process more comfortable for him. Based on those interventions, quantitative data about task completion and errors was not taken into consideration and was only considered the qualitative data collected from that phase of the usability testing.

The collected data from the UEQ provided meaningful information regarding the user experience. Each scale in the questionnaire, including attractiveness, perspicuity, efficiency, dependability, stimulation, and novelty, offers a distinct perspective on the participant's evaluation of the application. The Graph presented in Figure 31 shows the data based on the mean and variance for these categories.

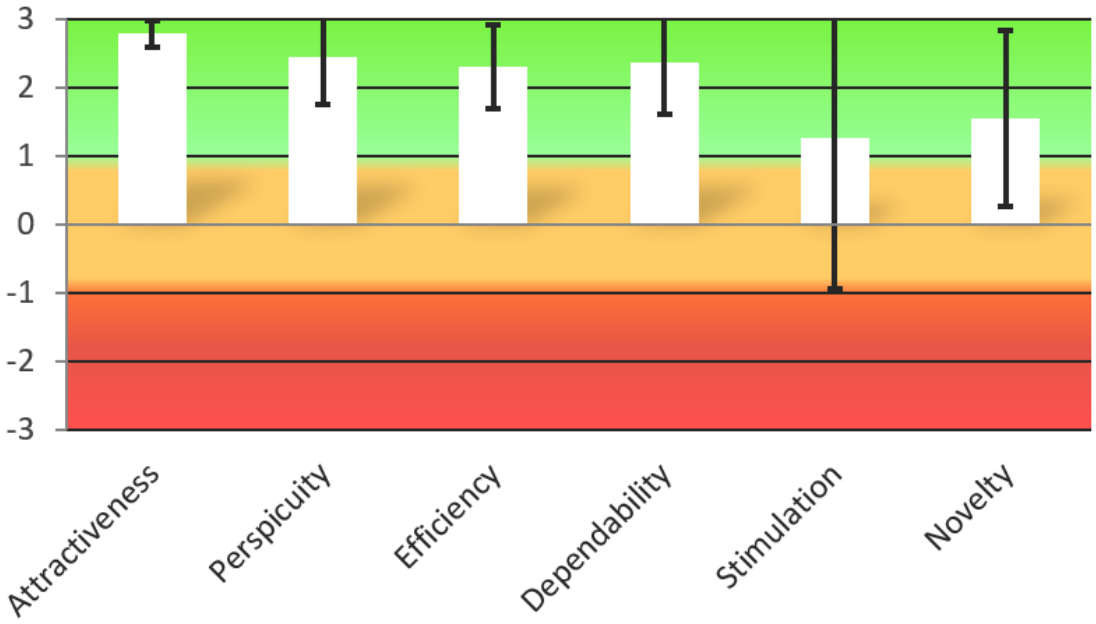

Figure 31 User experience evaluation based on the mean and variance

Upon analysing the data on Figure 31, we observed that participants rated the application positively in terms of attractiveness, perspicuity, efficiency, and dependability, with mean values ranging from 2.300 to 2.780. These results indicate that the application was perceived as visually appealing, clear, efficient, and reliable by the participants. However, the scale of stimulation received a lower mean value of 1.250, suggesting that participants found the application to be less stimulating or engaging. The scale of novelty also received a relatively lower mean value of 1.550, indicating that participants did not perceive the application as particularly novel or innovative.

Additionally, variance values were analysed to understand the level of consensus among participants. The lower variance values for attractiveness, perspicuity, efficiency, and dependability scales (ranging from 0.050 to 0.740) suggest a relatively high level of agreement among participants regarding these aspects of the application. On the other hand, the higher variance values for stimulation and novelty scales (6.310 and 2.140, respectively) indicate a more diverse range of opinions and perceptions among participants.

The obtained results also revealed valuable insights into the application's pragmatic and hedonic quality, which are crucial aspects when evaluating user satisfaction. Where pragmatic quality encompasses aspects related to task-oriented functionality, including perspicuity, efficiency, and dependability and, hedonic quality focuses on non-task-related aspects such as stimulation and novelty. Figure 32 shows the mean of attractiveness, pragmatic and hedonic quality of the interface evaluated.

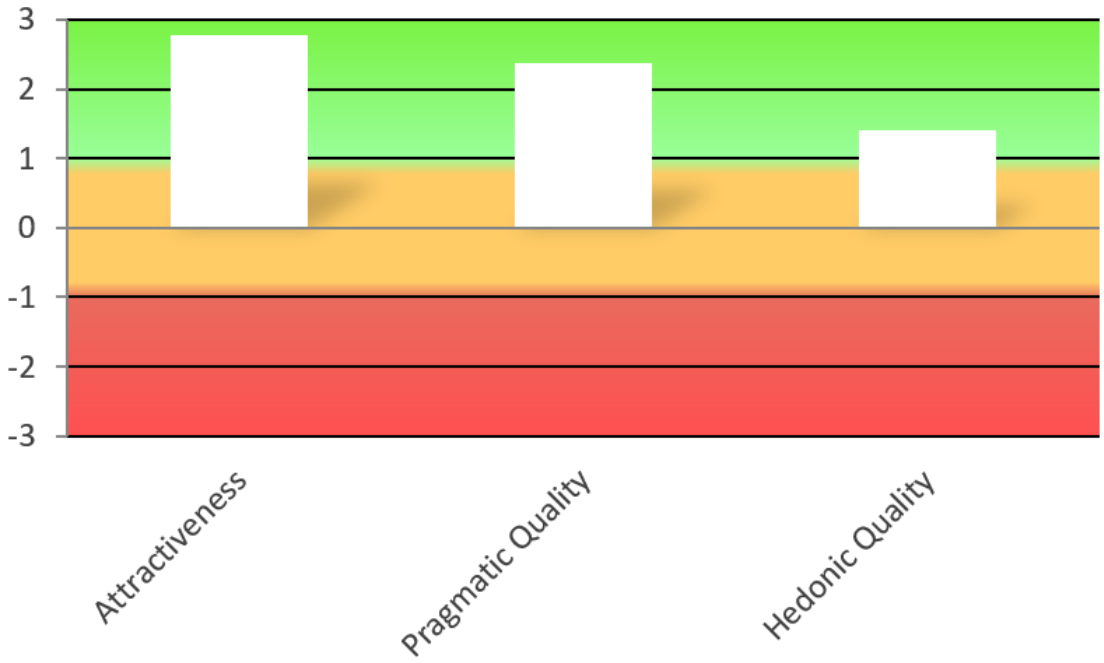

Figure 32 User experience evaluation results based on mean

These findings provide valuable insights into the strengths and weaknesses of the application. Users found the application to be relatively satisfactory in terms of its task-related functionality, including clarity of information (perspicuity), efficiency in use, and dependability. Also suggests that users found the application to have lower satisfaction levels in terms of non-task-related aspects such as stimulation and novelty. It implies that the application might benefit from enhancements to provide a more engaging and enjoyable user experience. Additionally, the overall mean score for attractiveness was reported as 2.78. This indicates that users found the application to be moderately appealing and visually pleasing.

In summary, the usability testing conducted yielded positive outcomes, with valuable insights and data obtained.

7. Results

This chapter presents the outcomes that address the initial research questions posed in this study:

RQ1: What metrics are relevant for self-assessing the well-being of shop floor workers?

RQ2: What key principles and guidelines should be considered when designing a self-report mental well-being interface for shop floor workers?

Based on the analysis of the methods and fieldwork conducted, which led to the development and evaluation of an interface, we were able to provide answers to these two questions.

In response to RQ1, the fundamental aspect that emerged as crucial for self-assessing the well-being of workers is tracking their mood. Within their mood, it is important to delve deeper and explore the emotions they experience and the physical pain they may feel due to their physically demanding job. This way, we can better associate the overall worker state to a given context. Another significant metric that influences an individual's well-being is their routines. By tracking their goals and making sure they are comfortable with their routine the interface can contribute to their well-being by linking these attributes to how the person is feeling. Analysing the collected self-reports over time and identifying patterns and factors related to well-being is another effective way for individuals to self-assess their well-being. By grouping variables such as routines, physical pain, and emotions into a graph/calendar, individuals can gain insights into the interplay of these factors and identify potential reasons for changes in their well-being. Another important metric to assess the well-being of workers is their response to company and work changes or updates. This can help identify any negative impacts on well-being and provide

an opportunity for employers to address concerns and make necessary adjustments to promote a positive work environment.

By incorporating these metrics into the prototype, workers can have a holistic view of their well-being and actively engage in self-assessment. Ultimately, this self-assessment process can contribute to the overall well-being and satisfaction of workers in the workplace.

In response to RQ2, through this combined approach of user research and prototype design and feedback, we have derived a set of key principles as design proto-guidelines that provide a comprehensive framework for developing a self-report mental health interface tailored to the unique requirements of shop floor workers: accessibility considerations, design ease of use, comprehensive self-reporting, flexibility for work-related and personal elements and real-time feedback and support.

These proto-guidelines are informed by real-world insights, ensuring that the resulting platform effectively addresses the challenges this specific user group faces and fosters an inclusive and supportive environment for their mental well-being.

Accessibility Considerations: It is crucial to consider the accessibility needs of this specific group. Many shop floor workers may face challenges such as visual impairments, low digital literacy or limited literacy skills. Additionally, it is important to note that interfaces relying heavily on audio cues may not be suitable for the factory floor environment due to the presence of high noise levels. Moreover, the time and space constraints of their work schedules should also be taken into account, as shop floor workers may have limited time or space to interact with the interface. To ensure inclusivity and overcome these potential barriers, the interface should be designed with accessibility in mind. A key aspect of accessibility is the use of visual elements that can effectively communicate information to users. By incorporating images, icons, and colours, the interface can provide visual cues that guide users and enhance their understanding. These visual elements can serve as intuitive and universal symbols, enabling users to navigate and interact with the interface more easily.

Design for Ease of Use: It is essential to design the interface in a way that respects shop floor worker's time and prioritises simplicity. The interface should guide them through the self-reporting process swiftly and effortlessly, allowing them to provide the necessary information without excessive effort or time investment, making extra features for the report non-mandatory. In addition to efficiency, shop floor workers also desire to feel valued, heard, and connected through the interface. Design elements that foster a sense of importance and recognition can enhance user engagement and satisfaction. This could include personalised greetings or acknowledgments, interactive features that encourage communication and collaboration among users, and a user interface that reflects their individual contributions and

experiences. Furthermore, the interface should focus on presenting fresh and relevant data that users can report themselves, rather than relying heavily on wearable device information. Shop floor workers may perceive personal reporting data as more meaningful and reflective of their own well-being. Their interest may lie in sharing their own experiences and observations rather than relying solely on data collected from external devices. Therefore, the interface should prioritize the ability for users to input their own data and provide meaningful insights based on their self-reports.

Comprehensive Self-Reporting: It is important to acknowledge that self-reporting goes beyond simply tracking mood. The interface should provide a range of tools, resources, and support mechanisms to empower individuals in their health reporting journey. It should implement mechanisms to analyse gathered reports and identify patterns to empower users to gain insights into their mental and physical well-being, enabling them to take proactive steps towards self-improvement. It should also incorporate features that enable users to define and track their own health goals, fostering a sense of personal agency and progress. Furthermore, the interface should create an environment where users feel heard, validated, safe and supported.

Flexibility for Work-Related and Personal Elements: The interface should offer users the flexibility to focus on work-related aspects while also accommodating personal elements if desired. By offering the option to focus only on work-related aspects, the interface recognises the specific challenges and stressors that may arise in the workplace. Users can choose to report on factors such as job satisfaction, workload, or interactions with colleagues, enabling them to identify areas for improvement and seek support within their professional environment.

Simultaneously, accommodating personal elements within the interface as an option acknowledges that an individual's mental health is influenced by various factors outside of work. Users may choose to track personal goals, emotions, or activities that contribute to their overall well-being. This flexibility encourages a holistic approach to self-reporting, recognising the interconnectedness of work and personal life.

Real-Time Feedback and Support: The interface should prioritise immediate feedback and support to user inputs. This feedback should go beyond simply acknowledging the reported mood and extend to tracking goals, offering reminders, and addressing pain or discomfort. By actively engaging with users and remembering their previous reports, the interface can create a highly interactive and personalised experience. Additionally, it should offer a range of resources, coping strategies, and pertinent information to empower users in effectively managing their mental health.

8. Discussion

The development of the self-report mental health interface has made significant strides in addressing shop floor workers' specific needs and challenges encountered in user research. In this section, we discuss the contributions of the results and the limitations of the project.

8.1 Contribution

This dissertation aimed to co-design and co-validate a self-report mental well-being interface for shop floor workers. Through fieldwork and various research methods, we could understand what metrics were relevant for self-assessing the well-being of shop floor workers and what key principles, in the form of proto-guidelines, should be considered when designing this interface.

Based on the findings presented in Chapter 2.4, the predominant method of data acquisition in workplace solutions of this nature involved passive collection through sensors. However, when participants were allowed to express their preferences, it became apparent that they were not particularly interested in incorporating such variables into the well-being application. They expressed that individuals interested in such aspects already utilised mobile devices or wearables to access and monitor such results. This aligns with the viewpoint Koch (2022) put forth, highlighting the participant’s strong emphasis on actively contributing their input within the application rather than solely relying on passively viewing outcomes.

The investigation revealed that self-reporting mood emerged as a fundamental aspect of self-assessing the shop floor workers well-being. It was observed that workers felt more comfortable expressing themselves through the use of emojis, an option that has been previously found in the literature (Rivera-Pelayo, Fessl, et al., 2017), (Wellspace, 2022),

(Heikkilä et al., 2021). This connection between emojis and the participant's emotional state is subjective and consequently not always directly attributed to the same meaning for different participants. This potentially allowed a sense of protection for the participants, as it allows for a subjective evaluation of their emotional state without providing mandatory extensive contextual information that could make them feel insecure. By avoiding misleading information and objective information, this approach aligned with the principles of safeguarding participant's well-being (Munzner, 2014). For additional self-report context, participants lacked interest in new input methods such as audio, photography, and illustrations. Instead, they expressed a preference for the ability to choose from pre-defined text options and provide free-text entries, which were also common in other workplace interface solutions described in (Heikkilä et al., 2021), (Zenonos et al., 2016), (Wellspace, 2022), (Rivera-Pelayo, Fessl, et al., 2017), (Mathur et al.,2015). Including daily routines and physical pain measures as metrics for data collection was a novel addition compared to the cases of Chapter 2.4. They are specifically tailored to the shop floor worker's difficulties that potentially could influence the well-being, such as high job demands, low job control, physical and ergonomic potential problems (Belete et al., 2020; Serrano, 2019). Moreover, the collective presentation of these metrics over time proved to be highly valuable, allowing for the identification of potential reasons for changes in worker's well-being, a practice commonly observed in the literature (Zenonos et al., 2016; Heikkilä et al., 2021; Wellspace, 2022; Trolle Elmholdt et al., 2021; Rivera-Pelayo, Fessl, et al., 2017; Mathur et al., 2015).

There were mixed feelings among the participants regarding the issue of sharing data with the workplace, as suggested in the literature (PWC, 2016). While some preferred to keep this data strictly personal, others expressed interest in collectively sharing the self-report information with their superiors in the company if it was done securely and anonymously. They saw this sharing as an opportunity to be heard and to bring about a voice to express and ask for changes that would enhance well-being in the workplace. Furthermore, the fieldwork results also revealed that an important metric for assessing the well-being of shop floor workers relates to their response to company and work changes or updates. This metric can help identify any negative impacts on well-being and allow employers to address concerns and make necessary adjustments to promote a positive work environment. The concept of a more social media-style interface, where workers can connect and share their experiences, was also relatively a new idea not found in the literature.

Despite the absence of significant alarm or concerns raised by the participants regarding the conception of this interface, it was acknowledged that not all workers would be inclined to utilise it. Several reasons were presented to support this perspective, including concerns related to privacy, fear of job insecurity, and a perceived lack of sufficient value to justify the utilisation of the application. Therefore, it was crucial to ascertain the key principles that workers deemed essential to address these challenges effectively. These derived design proto-

guidelines proposed for the design of a self-report mental well-being interface included accessibility considerations, design for ease of use, comprehensive self-reporting, flexibility for work-related and personal elements and real-time feedback and support. These ensure inclusivity, simplicity, personalisation, and empowerment for shop floor workers in this interface. These proto-guidelines may help overcome some barriers found in the fieldwork and state of the art, such as Data accuracy, perceived lack of value and limitations of the feedback returned. (Hickey et al., 2021; Meyer et al., 2017; Munten et al., 2021; Oesterle et al., 2018; Sheikh et al., 2021).

As suggested by Heikkilä et al. (2018), it was evident that the interface for the workplace environment needed to be suitable and tailored accordingly. Therefore, considerations such as ease of use, accessibility, and comprehensive self-reporting were considered. Interfaces relying heavily on audio cues or requiring significant time and space were deemed unsuitable for the factory floor environment due to high noise levels and the demanding work schedules of the workers. Moreover, the application should incorporate mechanisms to analyse the collected reports and identify patterns, empowering users to gain insights into their mental and physical well-being. However, ensuring that these notifications are not distracting and provide real-time feedback only when the individuals are actively engaged in the application is crucial.

Participants expressed a desire for instant feedback and an interactive interface that provides warnings based on their self-reports. They emphasised the importance of the data being derived from their input rather than tracking variables beyond their control, distinguishing their output preferences from those presented (Barenghi et al., 2021). Participants also preferred keeping their personal and working lives separate within the interface. However, they acknowledged that their mood and external issues could occasionally impact their state of mind at work. This interface primarily focused on capturing data about their immediate work-related feelings without extensively addressing external factors. By offering these features, the interface respected the participant's preferences while still acknowledging the potential influence of personal factors on their overall well-being in the workplace.

8.2 Limitations

Some limitations were encountered, which are important to acknowledge and provide context for the findings. Firstly, the adaptation of the methodology calendar to accommodate the participant's availability took longer than anticipated. To overcome this constraint, data from past research was analysed to inform this work. This reliance on previous research could have influenced the direction and scope of the study as the findings and conclusions drawn from past

studies were not perfectly align with the specific context of this study which was the mental well-being of workers.

Another limitation is the fact that all participants were recruited from a single factory. While their insights and experiences provide valuable information, it is crucial to recognise that their perspectives may not fully represent the broader challenges faced by all factory workers. So, these findings should be interpreted within this specific context and not generalised certainly to the entire population of factory employees.

Furthermore, due to time constraints, only one interview and co-design session with each participant was conducted with the participants. This limited engagement may have restricted the depth and breadth of feedback obtained prior to prototype development. A more comprehensive approach involving multiple iterations and a different sample could have provided a more robust understanding of user needs and preferences. Despite this limitation, the analysis of previous user research conducted by other researchers in different factories and with similar research questions were analysed and served as a complementary source of information.

Additionally, the usability session done with the prototype had its own limitations. Firstly, there were limitations with the Figma prototype, leading to participant frustration as they faced difficulties in performing actions making intervention necessary. The think-aloud methodology used in the session also posed challenges, as participants occasionally deviated from the proposed tasks and engaged in exploratory or personal behaviour within the prototype. Consequently, the session primarily relied on the questionnaire data and qualitative data, which provided valuable insights but left for future work data analysis regarding task execution and error analysis.

Finally, it is also important to emphasise that the design proto-guidelines outlined in the results had not been extensively tested, necessitating further effort to validate them. While they provided initial recommendations, their effectiveness and applicability in real-world scenarios required additional validation and refinement. Therefore, more rigorous testing and evaluation are necessary to ensure the reliability and robustness of the design guidelines for the interface.

These limitations are the contextual factors that should be considered when interpreting the study's findings. They provide valuable insights into the constraints and challenges encountered during the research process and offer opportunities for future investigations and improvements in methodology.

9. Conclusions

This dissertation has focused on the development of a self-report mental well-being interface specifically tailored for shop floor workers in industrial settings. By examining the state of the art, conducting user research, and evaluation of the prototype proposed we have gained valuable insights into the design considerations and requirements for such an interface.

In this section, we delve into the conclusions and propose avenues for future work in the field of developing a self-report mental health interface for shop floor workers.

9.1 Conclusions

The field of well-being interfaces for shop floor workers in the context of I4.0 is relatively unexplored, with limited existing literature and examples to follow. Therefore, this project greatly emphasised conducting fieldwork to co-create and validate this interface with workers. The synthesis of the user research findings based on observation, interviews and co-design sessions, combined with analysed insights from previous research, provided a solid foundation for defining the design requirements that led to the design of the prototype, ensuring that it was aligned with the specific needs and expectations of shop floor workers.

The design prototype offered flexibility for work-related or personal focus and gave immediate feedback to workers. They could self-assess and report their well-being via moods and achieving goals in their daily routine. The prototype also fostered community engagement through a dedicated user posts and interactions space. Through usability testing, it was ensured that the interface was user-centred and met the specific needs and expectations of shop floor workers, but still with space for improvement.

The results highlighted five design proto-guidelines: accessibility considerations, design for ease of use, comprehensive self-reporting, flexibility for work-related and personal elements and real-time feedback and support. The results gave valuable insights for developing future self-report mental well-being interfaces for shop floor workers. As a result, this developed interface, characterised by an HO4.0 framework, can serve as a valuable resource in equipping workers with the necessary competencies to thrive in this dynamic environment.

Overall, this project contributes to the mental health support field for shop floor workers by providing insights and proto-guidelines for designing and developing self-report interfaces. It underscores the significance of considering shop floor worker's specific context and needs within the broader framework of HO4.0. With further research and development, such interfaces

can play a vital role in promoting mental well-being and improving the overall quality of work life for shop floor workers in the era of I4.0.

9.2 Future Work

To further enhance the self-report mental health interface designed for shop floor workers, future work can focus on several key areas.

In the future, it is essential to move forward with the prototype development, improving what we learned from the prototype evaluation and results. Future research should explore more than one factory setting for usability testing, with different participants to better understand the impact of the interface developed on shop floor lives. With the implementation of the prototype into a functional solution, these new tests should be without the think-aloud protocol to evaluate and focus on other metrics, especially efficiency, which was not assessed in this research.

Future work can also focus on understanding the disagreements observed between experts, participants and state of the art about this type of interface to reveal the underlying factors that may have contributed to these disagreements, such as implementation, potential generational differences, the context of this study, the limited time available for testing, or other aspects.

Another avenue for future work is developing an interface that complements the self-report interface designed to provide access to reporting data for supervisors or managers. This additional application would enable managers to gain insights into the well-being of their employees while maintaining data privacy and security. By accessing self-reporting reports, managers can provide appropriate support and interventions, fostering a healthier and more supportive work environment for shop floor workers.

It is crucial to also consider inclusivity and accessibility in future work, for those with low literacy in the future design and development of this type of interface. Ensuring these individuals can also benefit from technology could be fundamental in promoting an equitable and just society.

Finally, in future research, the proto-guidelines presented should be tested for the definition of base design guidelines for a self-report mental well-being user interface for shop floor workers. These considerations in future research could only focus on one more specific guideline or subjects such as information architecture, the display of information, navigation mechanisms, general layout considerations, user input, output mechanisms and even ethical aspects.

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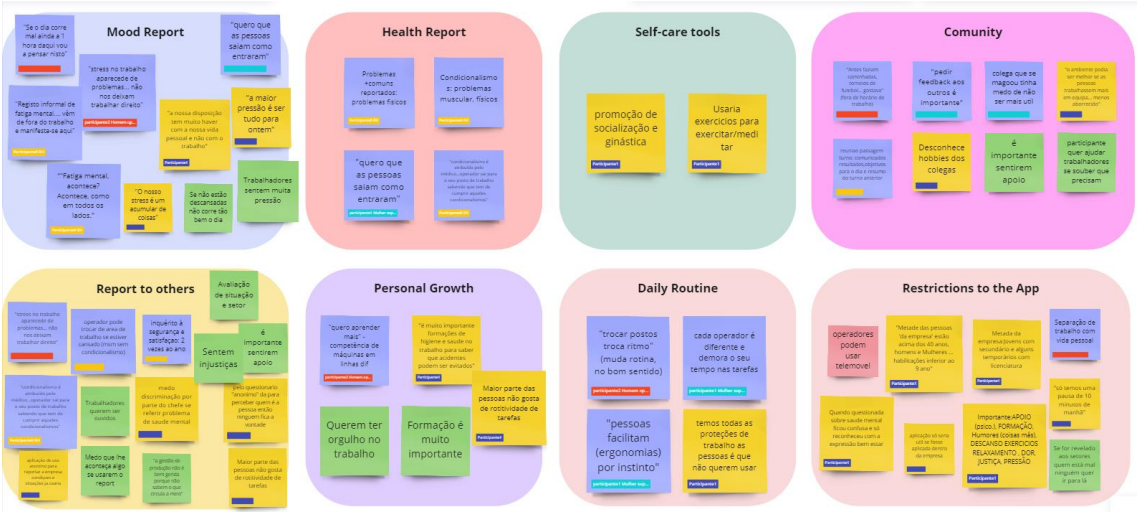
11.Appendices

Appendix 1: Affinity mapping analysis: past research



Appendix 2: Interview Guide

Intro:
Olá, chamo-me Inês.
(Objetivo) Sou da faculdade de engenharia do porto e Estou a trabalhar num projeto que tem como objetivo desenvolver uma aplicação que irá coletar e exibir dados sobre o trabalhador e o local de trabalho com o intuito de melhorar o bem estar, saúde mental e física do mesmo.
(O que vamos fazer) Nesta fase do projeto, estamos a conversar com os trabalhadores para entender os vossos problemas e desafios que vivenciam no decorrer de seu trabalho e queremos também fazer uma sessão de co-criação desta aplicação em conjunto. para entender qual seria a maneira mais útil de construir esta aplicação e onde esta deve atuar.

(saber do participante) Gostava de saber um bocado sobre si, podia-me dizer o seu nome idade e o que faz na empresa?

(pedir para assinar consentimento de entrevista) Leia com calma e se tiver alguma duvida diga

Warm-up

- Pode-me explicar um dia normal no seu trabalho?
- (pergunta relacionada com a observação do espaço)
- Já recorreu ao uso de alguma aplicação ou ferramenta para ajudar a cuidar da sua saúde mental ou física no trabalho ou na vida pessoal?
    - Porque começou a usar?
    - O que achou da mesma
    - Não: Como se sente no uso de uma? Porque?

Co-criação

(explicar co-design) Vamos agora desenhar como esta aplicação seria com base nas suas preferencias e opiniões. Irei mostrar um conjunto de tematicas que esta aplicação poderá ter, onde pode acrescentar mais se sentir que esta a faltar algo importante e deixar de parte
algo que não ache que usaria na aplicação.

- Gostava que os ordenasse por ordem de importância para si.
- Se sentir que gostava de acrescentar alguma coisa mais a aplicação escreva num post it e juntamos a estes temas.
- Se tiver alguma duvida sobre algum tema pergunte.

(pós a ordenação)

- O que esse tema significa para si?
- O que espera encontrar no mesmo?
- Como gostava de interagir com o mesmo? (pode se inspirar com ideias de interaçao apresentadas aqui)

Comunidade

- Como descreveria o clima social aqui na fábrica?
    - Como se relaciona com os seus colegas e superiores?
- Já assistiu a algum tipo de conflito aqui na fábrica?
    - Como isso o/a fez sentir?

Auto-cuidados e Exercícios

- Quando está um bocado em baixo que estratégias costuma adotar para se fazer sentir melhor?
- Se quisesse fazer um exercicio de respiração para acalmar a sua ansiedade qual destas opções ia achar mais interessante de usar?

Reporte de Humor | Reporte de Saúde e Bem-Estar

- Para reportar se está ansioso destas opções o que usaria?
- Para reportar uma dor que sente no ombro de que maneira gostaria de descreve-la?

Sessão D- Fim da entrevista
Estamos a chegar ao fim do nosso tempo, obrigada pela colaboração, existe alguma coisa que não mencionei e que queira acrescentar?
Aconselha-me a falar com mais alguém?

Gostava de ter algumas informações suas para concluir a entrevista se estiver tudo bem por si:
Gênero
Idade
Função na empresa
Nacionalidade:
Escolaridade
Se quiser continuar envolvido no projeto e participar em futuras sessões e resultados (opcional),Email:

Appendix 3: Interview Consent

CONSENTIMENTO PARA PARTICIPAÇÃO EM INVESTIGAÇÃO
"MensSana"
SESSÃO DE ENTREVISTA E CO-CRIAÇÃO

O projeto "MensSana" pretende realizar um estudo de investigação para o desenvolvimento de uma interface para auto-reporte e manejamento de parâmetros relacionados com o bem-estar dos trabalhadores, nomeadamente a saúde física e mental dos mesmos.
Neste projeto participam as seguintes entidades: Faculdade de Engenharia da Universidade do Porto e Ikea Industry Portugal.
No âmbito deste estudo, pretendemos realizar entrevistas e actividades de co-criação junto de operadores, chefes de linha e decisores.
Esta atividade têm o objetivo de perceber:

- O contexto do trabalho.
- Conteúdo pertinente a ser medido e retornado aos trabalhadores.
- Expectativas e preocupações por parte dos participantes.

As entrevistas serão individuais e privadas.

Materiais
As entrevistas serão realizadas nas instalações da entidade empregadora, ou, caso se justifique, por videochamada. Acontecendo presencialmente utilizaremos um telemovel para gravar o som e tirar fotografias dos artefactos criados para depois ser analisada pela equipa de investigação com mais atenção. No caso de usarmos a videochamada a entidade patronal deverá disponibilizar um computador com câmara, microfone e ligação à internet. O participante acederá à videochamada através de um link, enviado previamente pela equipa de investigação. Seja presencialmente ou por via remota, esta atividade deverá decorrer num ambiente/espaço privado, calmo e silencioso, de forma a garantirmos uma comunicação efetiva.

Procedimentos
A sessão de entrevista e co-criação terá a duração estimada de 45 minutos e, se realizadas remotamente, utilizaremos a plataforma Microsoft Teams que, com a respetiva autorização do participante, também atuará como meio de gravação áudio e imagem para registo e posterior análise da informação.

Recolha e Análise de Dados
Os seus dados pessoais serão analisados pelos investigadores e destruídos três anos após o final do projeto. Os dados recolhidos são confidenciais e anonimizados. Tomaremos todas as medidas necessárias à salvaguarda e proteção dos dados recolhidos por forma a evitar que venham a ser acedidos por terceiros não autorizados.
Gostaríamos de contar com a sua participação. A participação não envolve qualquer prejuízo ou dano material, nem qualquer benefício. Todo o material necessário para este estudo será fornecido. A sua participação não envolve qualquer tipo de pagamento, não terá consequências no seu trabalho ou avaliação, nem terá custos para si ou para a empresa para quem trabalha.
A sua participação é voluntária, podendo em qualquer altura cessá-la sem nenhum tipo de consequência. Também poderá pedir a retificação ou destruição da informação recolhida a qualquer momento. Para isso, basta que nos contacte através do e-mail fornecido abaixo.
Agradecemos muito o seu contributo, fundamental para a nossa investigação.
Os resultados deste estudo serão transmitidos, se assim o desejar. Para o efeito, será-lhe-á pedido o seu contacto de e-mail.

O participante:
Declaro ter lido e compreendido este documento, bem como as informações verbais fornecidas e aceito participar nesta investigação. Permito a utilização dos dados que forneço de forma voluntária, confiando que apenas serão utilizados para investigação e com as garantias de confidencialidade e anonimato que me são dadas pelas investigadoras. Autorizo a comunicação de dados de forma ***anónima*** *a outras entidades parceiras do estudo para fins académicos e de investigação científica.*

[Opcional] Pretendo receber os resultados do estudo:

- Não
- Sim, por e-mail: _____

Nome do participante:

_____

Assinatura do participante:

_____

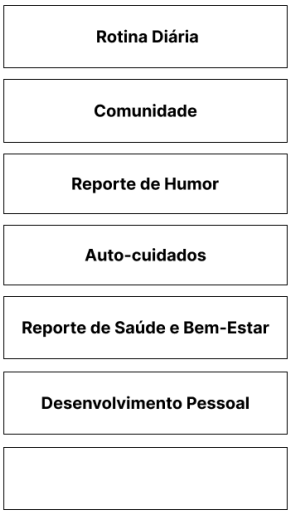
Data ___ / ___ / _____

Investigador responsável pelo projeto:
Nome: Inês Silva

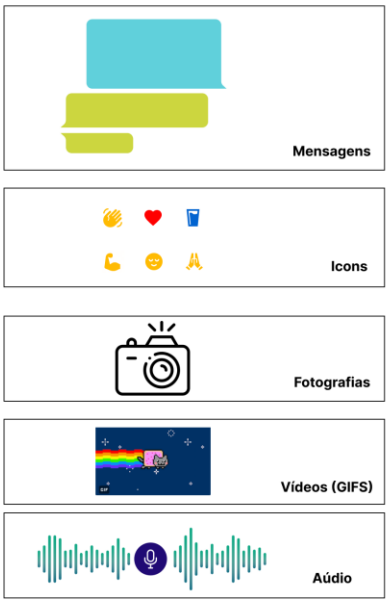
Telefone: 918081037
E-mail: ines.silva@fraunhofer.pt
Assinatura do investigador responsável:

Appendix 4: Co-Design Session: Available Materials

Application Features

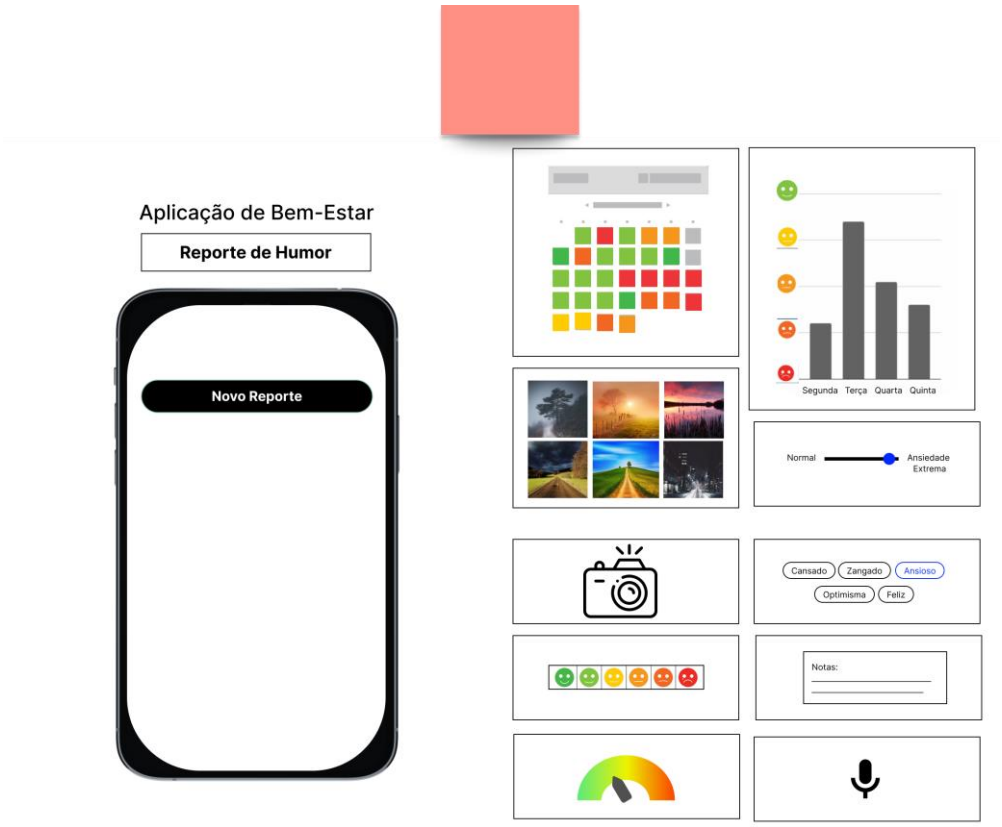


Community application page

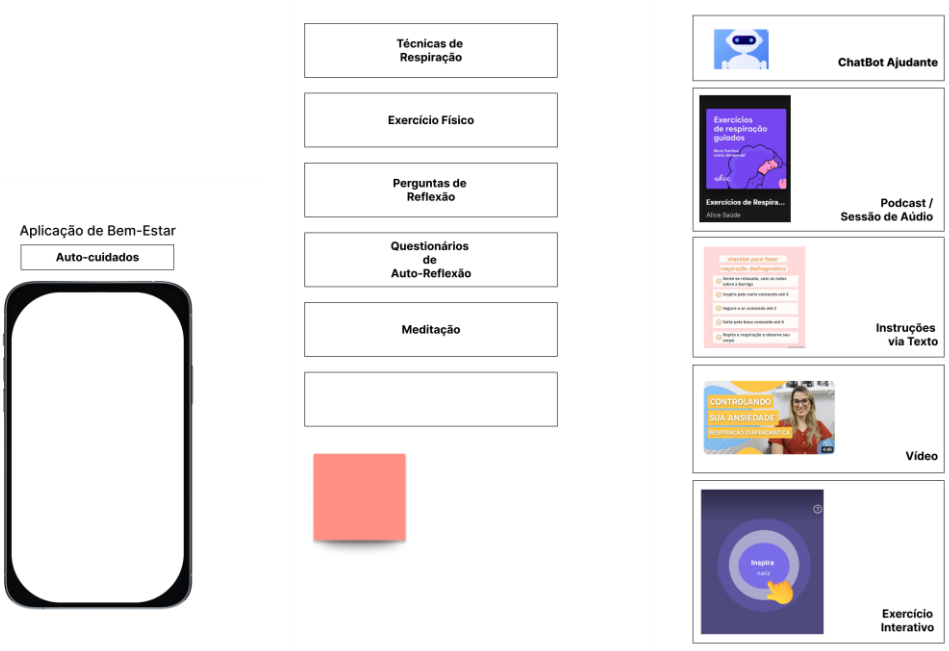


Daily routine application page

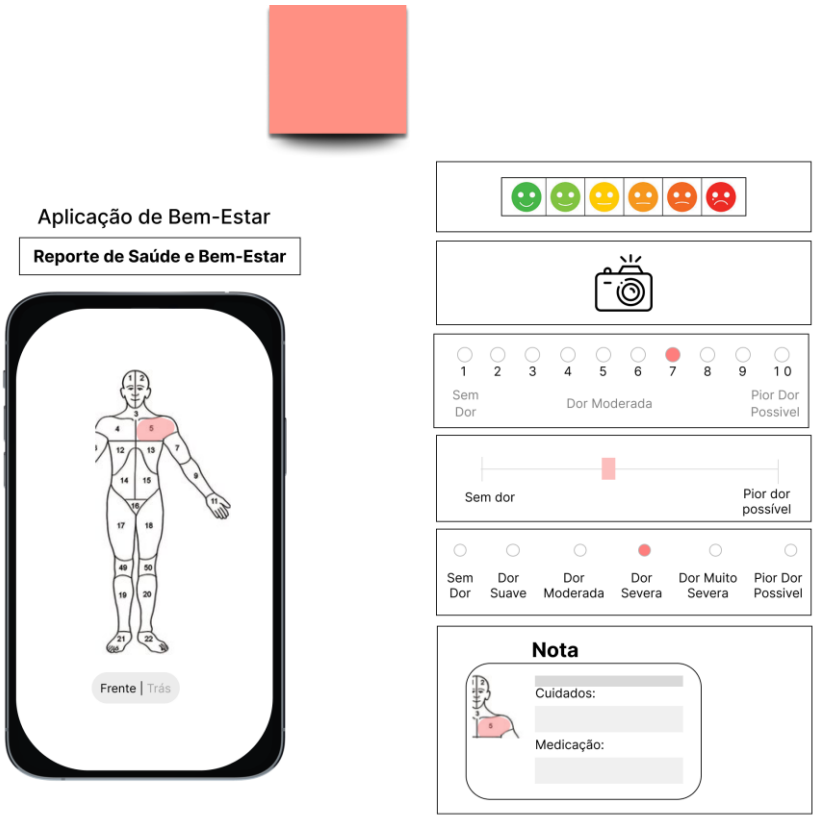
Humour report application page



Self-care tools application page

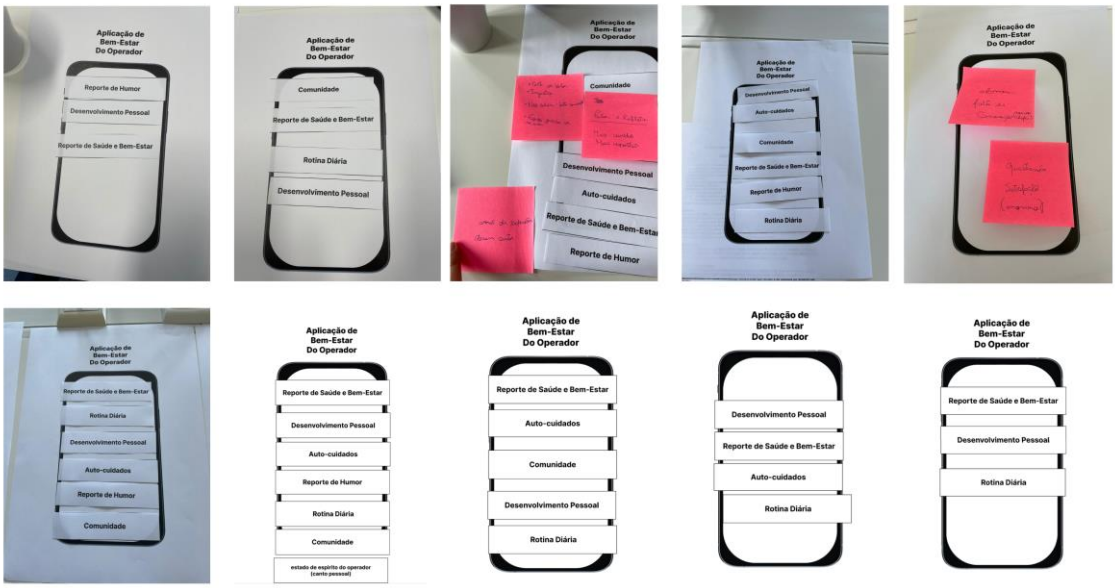


Health report application page

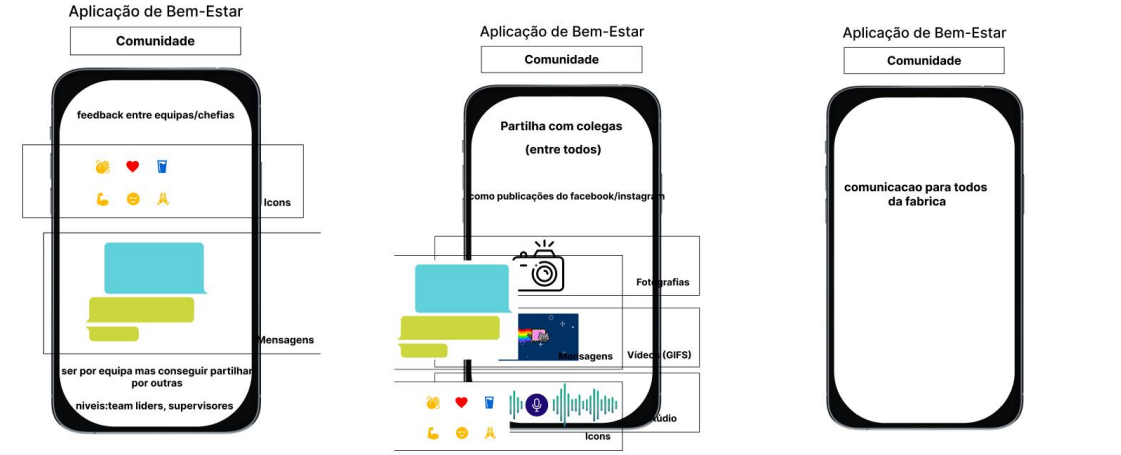


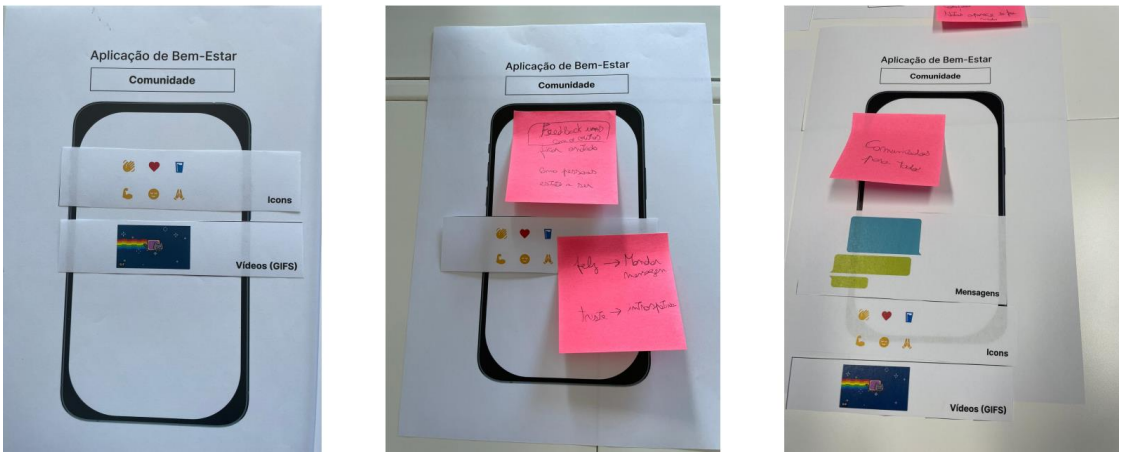
Personal development application page

Appendix 5: Co-design general application results

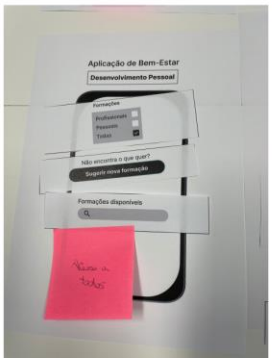


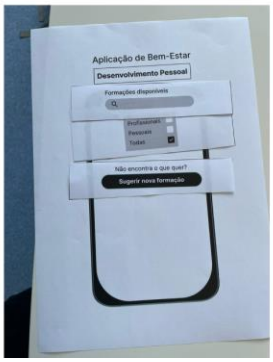
Appendix 6: Community co-design results



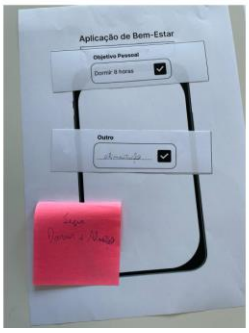


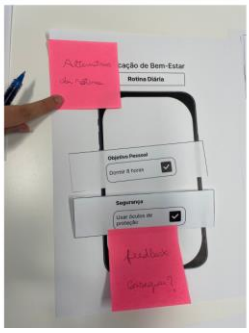
Appendix 7: Personal development co-design results

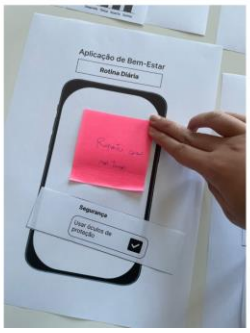




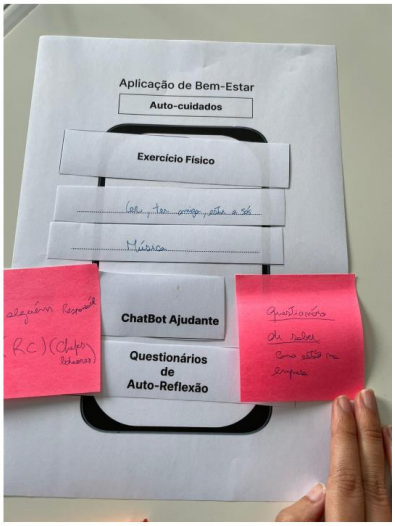
Appendix 8: Daily Routine co-design results

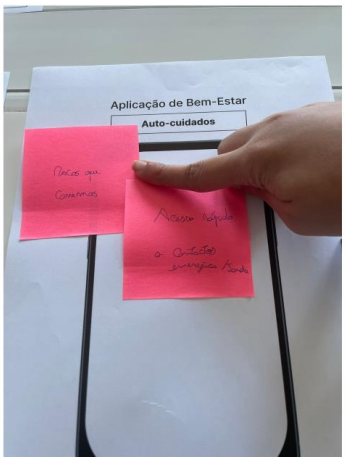


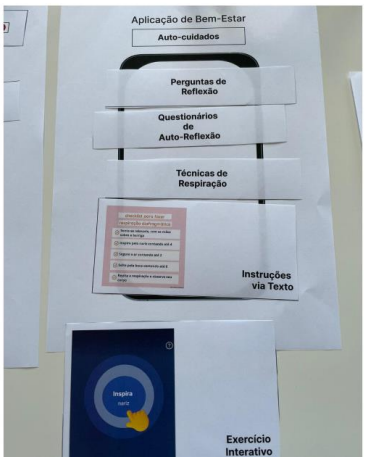




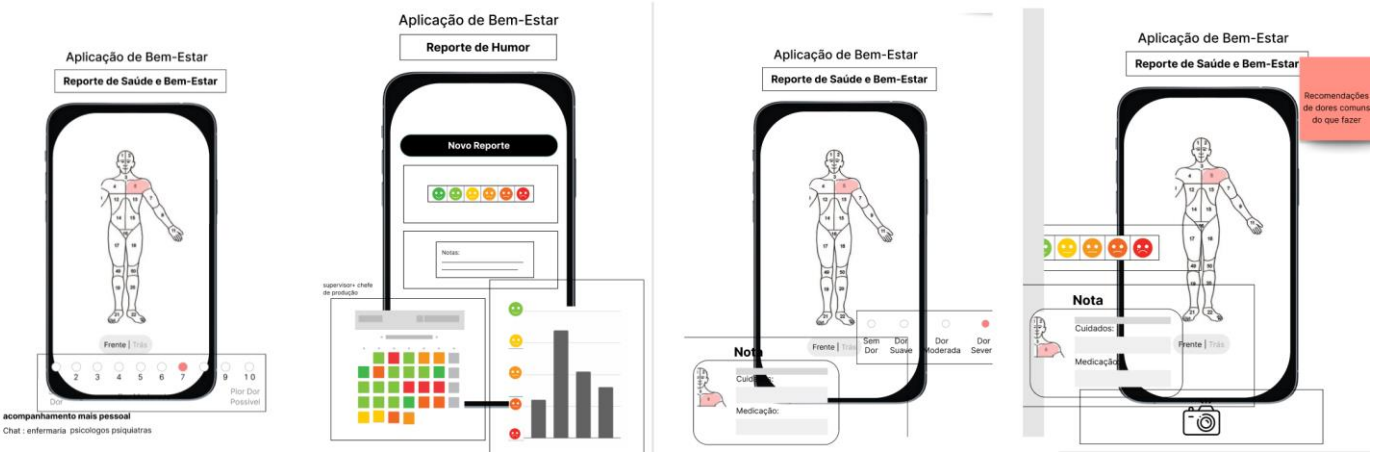
Appendix 9: Self-care tools co-design results



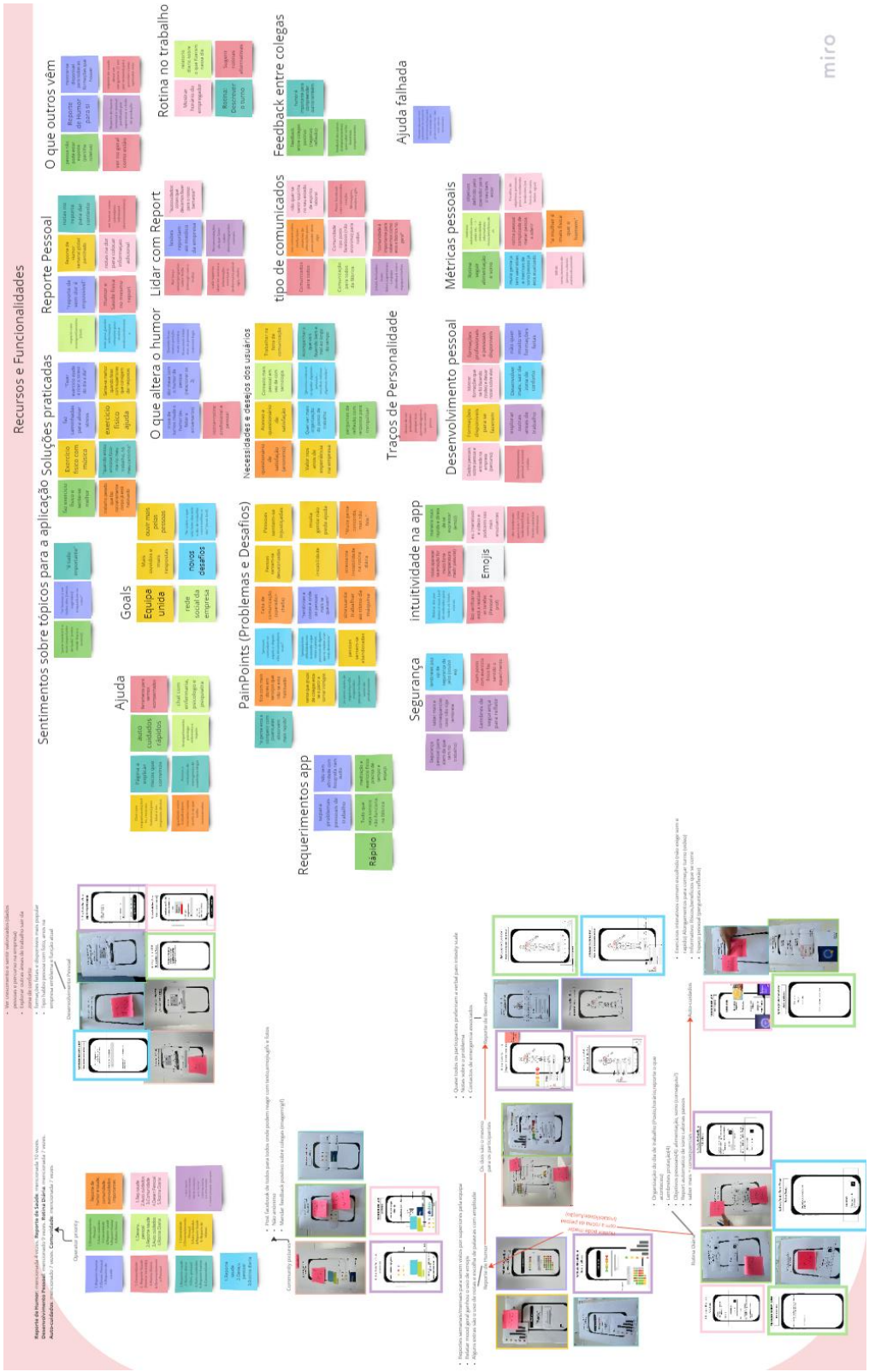




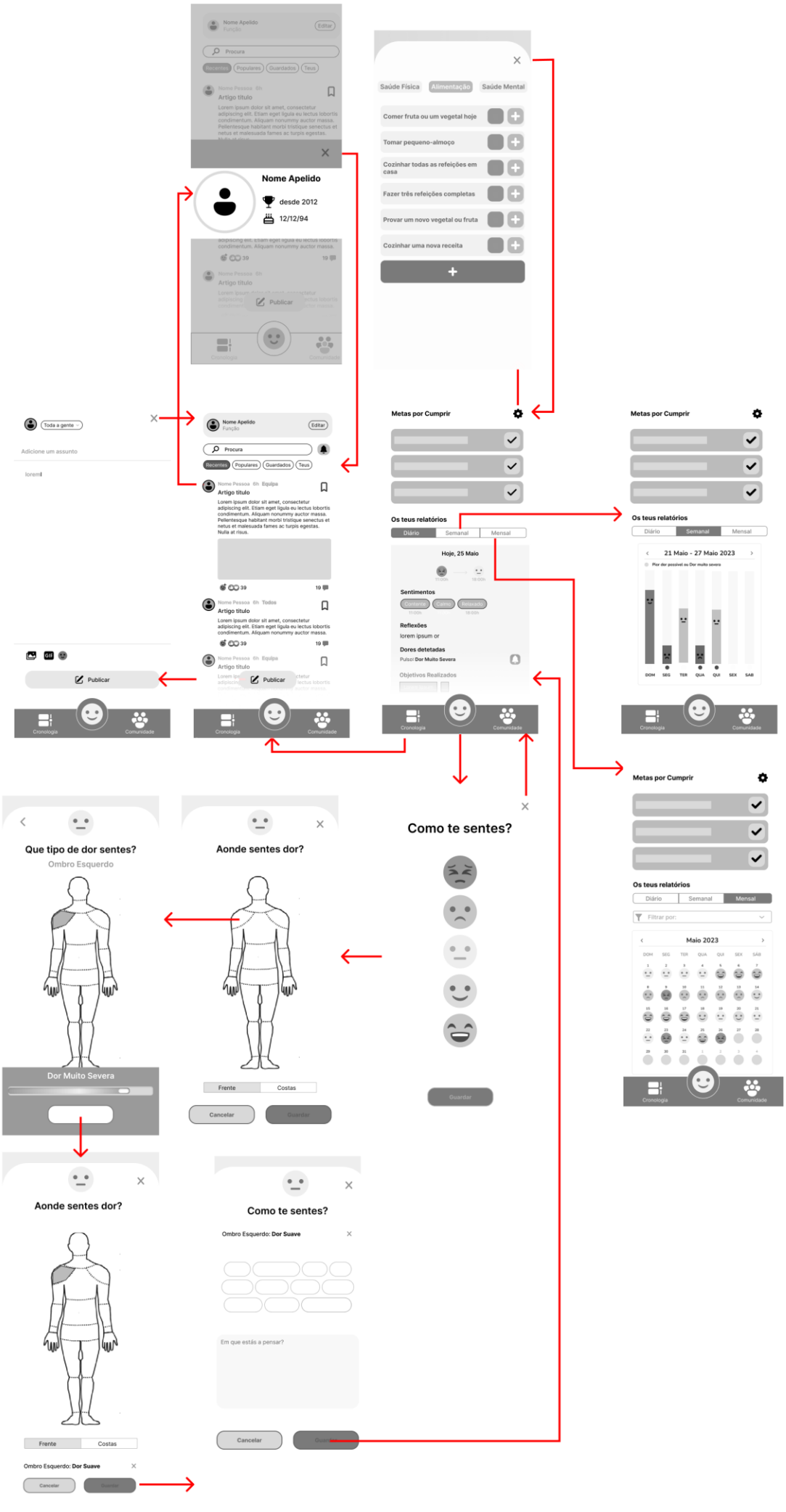
Appendix 10: Self-report co-design results



Appendix 11: Affinity mapping of the user research collected



Appendix 12: Wireframe


Nome Apelido
Função
Editar
Procura
Recentes
Populares
Guardados
Teus
Artigo título
Publicar
Cronologia
Comunidade
Nome Apelido
desde 2012
12/12/94
Saúde Física
Alimentação
Saúde Mental
Comer fruta ou um vegetal hoje
Tomar pequeno-almoço
Cozinhar todas as refeições em casa
Fazer três refeições completas
Provar um novo vegetal ou fruta
Cozinhar uma nova receita
Toda a gente
Adicione um assunto
Equipa
Todos
Metas por Cumprir
Os teus relatórios
Diário
Semanal
Mensal
Hoje, 25 Maio
Sentimentos
Reflexões
Dores detetadas
Objetivos Realizados
21 Maio - 27 Maio 2023
Maio 2023
Filtrar por:
Como te sentes?
Aonde sentes dor?
Que tipo de dor sentes?
Ombro Esquerdo
Dor Muito Severa
Frente
Costas
Cancelar
Guardar
Em que estás a pensar?
Ombro Esquerdo: Dor Suave

Appendix 13: Usability testing consent

CONSENTIMENTO PARA PARTICIPAÇÃO EM INVESTIGAÇÃO "MensSana" SESSÃO DE TESTE DE USABILIDADE

O projeto "MensSana" pretende realizar um estudo de investigação para o desenvolvimento de uma interface para auto-reporte e manejamento de parâmetros relacionados com o bem-estar dos trabalhadores, nomeadamente a saúde física e mental dos mesmos.
Neste projeto participam as seguintes entidades: Faculdade de Engenharia da Universidade do Porto e Ikea Industry Portugal.
No âmbito deste estudo, pretendemos realizar testes de usabilidade do protótipo proposto junto de operadores, chefes de linha e decisores.
Esta atividade têm o objetivo de perceber:

- Melhorar a qualidade da interface de auto-relato identificando falhas e compreendendo o que funciona bem no design da interface;
- Entender intuitividade nas tarefas propostas á realização na interface
- Compreender a satisfação e a experiência do usuário.

As sessões serão individuais e privadas.

Materiais
As sessões serão realizadas nas instalações da entidade empregadora. Irá ser utilizado um telemóvel para gravar vídeo da realização das tarefas do teste de usabilidade, apenas apanhando as mãos dos participantes para depois ser analisada pela equipa de investigação com mais atenção. Esta atividade deverá decorrer num ambiente/espaço privado, calmo e silencioso, de forma a garantirmos uma comunicação efetiva.

Procedimentos
A sessão terá a duração estimada de 30 minutos, com uma fase de interação com o protótipo e outra fase de preenchimento de um questionário..

Recolha e Análise de Dados
Os seus dados pessoais serão analisados pelos investigadores e destruídos três anos após o final do projeto. Os dados recolhidos são confidenciais e anonimizados. Tomaremos todas as medidas necessárias à salvaguarda e proteção dos dados recolhidos por forma a evitar que venham a ser acedidos por terceiros não autorizados.
Gostaríamos de contar com a sua participação. A participação não envolve qualquer prejuízo ou dano material, nem qualquer benefício. Todo o material necessário para este estudo será fornecido. A sua participação não envolve qualquer tipo de pagamento, não terá consequências no seu trabalho ou avaliação, nem terá custos para si ou para a empresa para quem trabalha.
A sua participação é voluntária, podendo em qualquer altura cessá-la sem nenhum tipo de consequência. Também poderá pedir a retificação ou destruição da informação recolhida a qualquer momento. Para isso, basta que nos contacte através do e-mail fornecido abaixo.
Agradecemos muito o seu contributo, fundamental para a nossa investigação.
Os resultados deste estudo serão transmitidos, se assim o desejar. Para o efeito, será-lhe-á pedido o seu contacto de e-mail.

O participante:
Declaro ter lido e compreendido este documento, bem como as informações verbais fornecidas e aceito participar nesta investigação. Permito a utilização dos dados que forneço de forma voluntária, confiando que apenas serão utilizados para investigação e com as garantias de confidencialidade e anonimato que me são dadas pelas investigadoras. Autorizo a comunicação de dados de forma ***anónima*** *a outras entidades parceiras do estudo para fins académicos e de investigação científica.*

[Opcional] Pretendo receber os resultados do estudo:

- Não
- Sim, por e-mail: _____

Nome do participante:

_____

Assinatura do participante:

_____

Data ___ / ___ / _____

Investigador responsável pelo projeto:
Nome: Inês Silva

Telefone: 918081037
E-mail: ines.silva@fraunhofer.pt
Assinatura do investigador responsável:

_____

Appendix 14: Task list

Teste de Usabilidade

2023

O objetivo deste teste é avaliar a usabilidade da interface que desenvolvemos

e garantir que seja intuitiva e fácil de usar. **Ao participar, está-nos nos ajuda a identificar possíveis problemas e melhorar a experiência do usuário.**
Durante o teste, você será solicitado(a) a realizar uma **série de tarefas** na interface. Essas tarefas são projetadas para representar as atividades típicas que os usuários realizam no sistema. Queremos **observar como irá interagir com a interface, entender** quais recursos são encontrados mais facilmente e onde pode encontrar **dificuldades**.
Fique à vontade para pensar em voz alta e compartilhar as suas opiniões durante o teste. As suas respostas ajudarão-nos a entender o que está funcionando bem e o que precisa ser aprimorado.
Lembre-se: Este teste **não avalia as suas habilidades, mas sim o design da interface.** Não há respostas certas ou erradas. Queremos apenas saber como a interface se comporta e como podemos torná-la melhor.

Atividade0: Login

Atividade 0.0: Faça login na aplicação

Atividade 1: Auto-reporte

Atividade 1.1: Quer fazer um auto-reporte na aplicação sobre como está-se a sentir.

- Sente-se bastante mal, frustrado, pois está com uma dor física gigantesca no ombro esquerdo.

Atividade 1.2: Quer fazer outro auto-reporte na aplicação .

- Sente-se agora contemplativo e quer escrever uma nota que diga que não gosta muito de trabalhar sozinho.

Atividade 2: Comunicados Entre Funcionários

Atividade 2.1: Procura o comunicado “Evento de confraternização”.

- Vê o perfil de quem publicou isso
- Mostra que apoias essa notícia.

Atividade 2.2: Encontra o comunicado “Reconhecimento dos colaboradores”

- Guarda esse comunicado.
- Vai à página dos comunicados que guardaste para ver se está lá.

Atividade 3: Metas

Atividade 3.1: Encontra os objetivos por cumprir.

- Diz que completaste a meta de dormir 7-9 horas hoje.

Atividade 3.2: Edita os objetivos atuais

- Elimina a tarefa “Experimentar um novo restaurante” da tua lista de metas.
- Acrescenta das tarefas já sugeridas: “Comer fruta ou um vegetal hoje” para ser lembrado diariamente.

Atividade 4: Análise de Reportes

Atividade 4.1: Vê o teu reporte Diário.

- Vê como estavas no dia 24 de Maio

Atividade 4.2: Vê o teu reporte Mensalmente

- Filtra para ver a nível de Humor os reportes nos dias em que estavas muito bem?
- Filtrar agora para ver a nível de metas qual foi a meta que mais vezes realizaste e quando a fizeste.

Appendix 15: Task list adaptation for low literacy participants

Teste de Usabilidade

2023

O objetivo deste teste é avaliar a usabilidade da interface que desenvolvemos e garantir que seja intuitiva e fácil de usar. **Ao participar, está-nos nos ajuda a identificar possíveis problemas e melhorar a experiência do usuário.** Durante o teste, você será solicitado(a) a realizar uma **série de tarefas** na interface. Essas tarefas são projetadas para representar as atividades típicas que os usuários realizam no sistema. Queremos **observar como irá interagir com a interface, entender** quais recursos são encontrados mais facilmente e onde pode encontrar **dificuldades**.
Fique à vontade para pensar em voz alta e compartilhar as suas opiniões durante o teste. As suas respostas ajudarão-nos a entender o que está funcionando bem e o que precisa ser aprimorado.
Lembre-se: Este teste **não avalia as suas habilidades, mas sim o design da interface.** Não há respostas certas ou erradas. Queremos apenas saber como a interface se comporta e como podemos torná-la melhor.

Atividade0: Login

Atividade 0.0: Faça login na aplicação

Atividade 1: Auto-reporte

Atividade 1.1: Quer fazer um auto-reporte na aplicação sobre como está-se a sentir.

- Sente-se **bastante mal**, muito **frustado** pois está com uma **dor fisica gigantesca no ombro esquerdo**.

Atividade 1.2: Quer fazer um auto-reporte na aplicação sobre como está e dizer que está se a sentir de novo.

- Sente-se agora **contemplativo** e quer escrever uma **nota** que diga que não gosta muito de trabalhar sozinho.

Atividade 2: Comunicados Entre Funcionários

Atividade 2.1: Procura o comunicado “Evento de confraternização”, a segunda publicação.

- Vê o perfil de quem publicou isso
- Mostra que apoias essa notícia.

Atividade 3: Análise de Reportes

Atividade 3.1: Vê o teu reporte Diário.

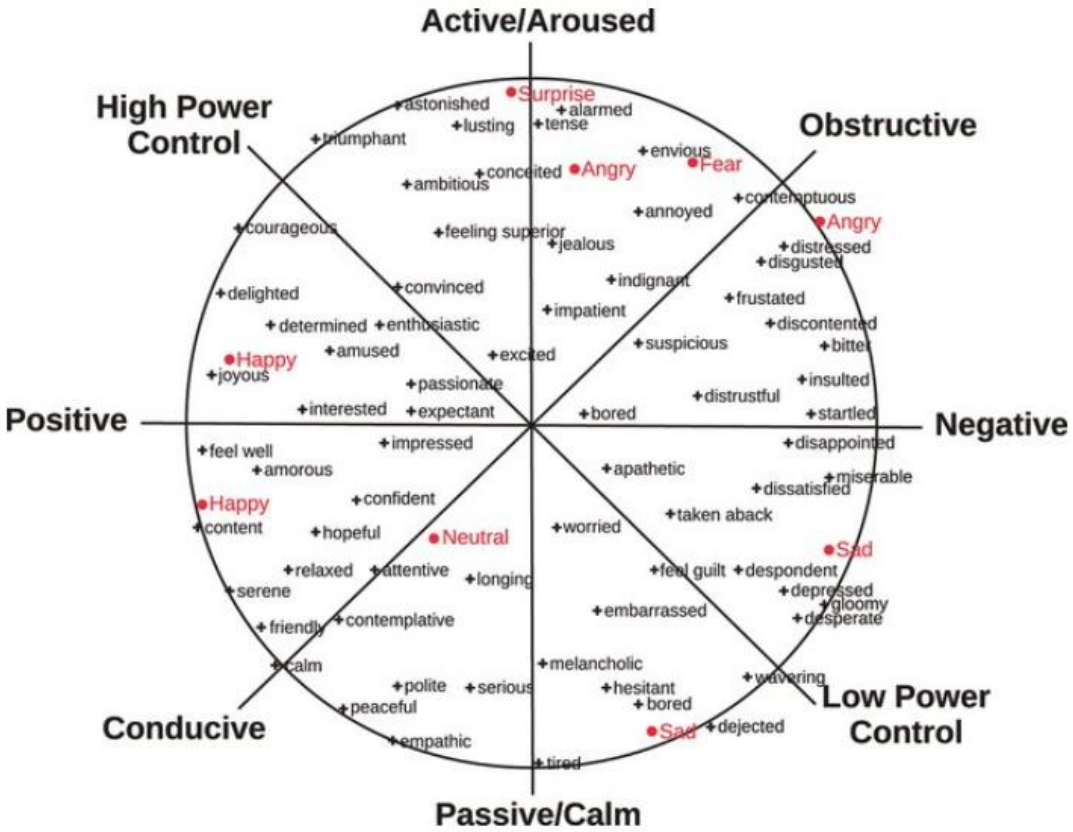
- Vê como estavas no dia 24 de Maio

Atividade 3.2: Vê o teu reporte Mensalmente

- Filtra para veres a nivel de Humor os reportes nos dias em que estavas muito bem?

12. Annexes

Annex 1: Scherer's circumplex model (Mano et al., 2019)



Annex 2: User experience questionnaire

Por favor dê-nos a sua opinião.

A fim de avaliar o produto, por favor preencha o seguinte questionário. É constituído por pares de opostos relativos às propriedades que o produto possa ter. As graduações entre os opostos são representadas por círculos. Ao marcar um dos círculos, você pode expressar sua opinião sobre um conceito.

Exemplo:

Atraente	○	●	○	○	○	○	○	**Feio**

Esta resposta significa que avalia o produto mais **atraente** do que **feio**.

Marque a sua resposta da forma mais espontânea possível. É importante que não pense demasiado na resposta porque a sua avaliação imediata é que é importante.

Por favor, assinale sempre uma resposta, mesmo que não tenha certezas sobre um par de termos ou que os termos não se enquadrem com o produto.

Não há respostas "certas" ou respostas "erradas". A sua opinião pessoal é que conta!

Por favor, dê-nos a sua avaliação atual do produto em causa.

Por favor, marque apenas um círculo por linha.

	1	2	3	4	5	6	7	
Desagradável	○	○	○	○	○	○	○	Agradável
Incompreensível	○	○	○	○	○	○	○	Compreensível
Criativo	○	○	○	○	○	○	○	Sem criatividade
De Fácil aprendizagem	○	○	○	○	○	○	○	De difícil aprendizagem
Valioso	○	○	○	○	○	○	○	Sem valor
Aborrecido	○	○	○	○	○	○	○	Excitante
Desinteressante	○	○	○	○	○	○	○	Interessante
Imprevisível	○	○	○	○	○	○	○	Previsível
Rápido	○	○	○	○	○	○	○	Lento
Original	○	○	○	○	○	○	○	Convencional
Obstrutivo	○	○	○	○	○	○	○	Condutor
Bom	○	○	○	○	○	○	○	Mau
Complicado	○	○	○	○	○	○	○	Fácil
Desinteressante	○	○	○	○	○	○	○	Atrativo
Comum	○	○	○	○	○	○	○	Vanguardista
Incómodo	○	○	○	○	○	○	○	Cómodo
Seguro	○	○	○	○	○	○	○	Inseguro
Motivante	○	○	○	○	○	○	○	Desmotivante
Atende as expectativas	○	○	○	○	○	○	○	Não atende as expectativas
Ineficiente	○	○	○	○	○	○	○	Eficiente
Evidente	○	○	○	○	○	○	○	Confuso
Impraticável	○	○	○	○	○	○	○	Prático
Organizado	○	○	○	○	○	○	○	Desorganizado
Atraente	○	○	○	○	○	○	○	Feio
Simpático	○	○	○	○	○	○	○	Antipático
Conservador	○	○	○	○	○	○	○	Inovador