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Mental Health, anxiety and well-being

Gerard Parés Gallego

Abstract– This report can be used to improve the quality of life and mental health of citizens as long as the relevant legislation is applied and following the regulations step by step, it can be used for motivation and inspiration of new projects of personal, social and policy with the aim of providing greater well-being to the population. This has been a work supported by the Autonomous University of Barcelona (UAB) and contrasted with published studies. Adding personal content, innovation and citizen science. All data has been referenced and plagiarism is not contemplated in this document. Thanks to all of you who have made this work possible..

Keywords– Mental Health, Environment, Open spaces, Improvement, innovation, sustainability

1 INTRODUCTION

IN recent years, the important role of mental health in achieving global development goals has been increasingly recognized, as illustrated by the inclusion of mental health in the Sustainable Development Goals. Depression is one of the leading causes of disability. Suicide is the second leading cause of death among people 15 to 29 years of age. People with severe mental health disorders die prematurely (as much as two decades earlier) due to preventable physical illnesses.

Despite progress in some countries, people with mental health disorders often experience serious human rights violations, discrimination and stigma. Many mental health disorders can be effectively treated at relatively low cost, even though the gap between those who need care and those who can access it remains considerable.

In 2019, (WHO) launched the WHO Special Initiative for Mental Health (2019-2023): Universal Health Coverage for Mental Health, aimed at ensuring affordable access to quality care.

The environment influences much more than what we believe in us. What surrounds us contributes to us or, on the contrary, harms us, affecting our state of mind and defining a part of our personality. The buildings, the interior and exterior architecture of our city, the amount of green spaces there are, everything has an influence.

In order to get the most out of it, many experts from various fields are already carrying out studies on the influence of the environment on our well-being. A new concept emerges from the mixture of architecture and psychology: «wellness cities», which becomes at the same time the reason why urban design and mental health should go hand in hand.

The architect Luca Brunelli is one of the professionals in this sector who advocates the creation of this new concept. In Brunelli's words, "it would be ideal for specialists from the world of architecture and health to work together to defend a fundamental right, healthy living." And it is that well-being and health imply not only objective well-being (income, education, leisure, transport...) but also subjective well-being. That is, the internal experience of each one about how they feel and their degree of satisfaction with life.

For the architect Ignasi Bardera "the impact of urban design on people's health is unquestionable. The cities where we live have a lot to do with our health. Air pollution, light pollution and the lack of green areas near the house affect us physically and psychologically.

So, doing a quick review of our closest environment, from the stop where we take the subway or the bus to our workplace they exert (unconsciously) a notable influence on our brain and consequently on our mental health.

For this reason, it becomes vitally important to identify the characteristics that a healthy environment would have and to be able to apply them in our daily lives. From the field of psychologists, this work would be framed within the field of positive psychology, always with the aim of improving the quality of life of people, to prevent the appearance of mental disorders and to improve the lives of those who already suffer from some pathology; and of course taking into account that the environment would be exercising a promoting and facilitating action of health (not causality).

We want to introduce a new method applicable to multiple scenarios and we have called it UMH (Understanding Mental Health). We have thought a lot about how to solve this challenge and help our target audience, which in our case are students. Analyzing well, we have been able to find the key, keep track of different people and see which were the sites that they frequented the most. Once the study is done, think about what changes we can make to obtain a greater impact, improve the quality of life and mental health. In order to carry out our study, we saw the great importance of focusing on university

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environments and citizen environments, such as the towns where these students live. Once these stadiums are detected, we can begin to rebuild the environment to solve our great challenge [1].

2 OBJECTIVES

The objectives of this study are to find ways to reduce the anxiety of today's youth in an academic context and in a place of residence context.

We are going to try to explain the concepts that a young student can experience today, their possible identifications, the problems, the little information and training they receive at these ages and we are going to try to find a solution in these contexts. We want to create a model of innovation aimed at the young population of our cities. We want to base ourselves and focus on citizen science and urban innovation. This project will be presented at the Autonomous University of Barcelona (UAB) and at the Sant Joan D'Espí Town Hall. A proposal to improve the environment and the uses of public spaces will be proposed. It can also serve as a motivation tool for other towns, cities and localities that want an improvement in the mental health of the population. We promise to work hard to bring a possible solution to this detected problem. The information is extracted through studies, books, publications, interviews and conclusions of our own studies.

3 CONTEXTUALIZATION

Before beginning, we want to mention that this work consists of the second part of the work carried out in the subject of Innovation in the degree in Smart Cities, the work is called "MENTAL HEALTH, anxiety and well-being" and here we will develop our proposal for improvement. Delving into What, How, Where, When and Why. This work was done by myself, Gerard Parés Gallego, student of the Smart Cities course at the UAB. I will develop my improvement proposal and all its features in depth and finally we will see a sketch of how it would be implemented. The dedication has been maximum and the desire and motivation as well. I will take advantage of parts of the innovation work to continue contextualizing.

I want to thank all the articles, professionals and books that have made possible the insertion of very valuable information for this work.

4 WORK SCENARIOS

We will start by defining which scenarios we have focused on to carry out this improvement proposal.

We will work in two main scenarios to prepare our improvement proposal to achieve our objectives. The first scenario is about our university, the UAB or Autonomous University of Barcelona, where it will be the main scenario for study and modification. Afterwards, this proposal will be adapted to the municipality of Baix Llobregat de Sant Joan D'espí. Finally, the application proposal is given to other municipalities so that they adapt it to their specific needs.

4.1 UAB (Autonomous University of Barcelona)

The Autonomous University of Barcelona is a public university in Spain, founded in 1968. Most of its teaching centers and extra-academic services are on the Bellaterra Campus located in Cerdanyola del Vallés, (Barcelona). It also has educational centers in Sabadell, San Cugat del Vallés, Manresa and in the city of Barcelona. It has approximately 37,166 students and 3,262 teachers.

It has a residential complex of 812 apartments, the Vila Universitaria, located on the same campus, with capacity for 2,193 people and connected by train and road, 25 minutes from the center of Barcelona. It is one of the most outstanding universities on the Spanish university scene according to the majority of Spanish university academic classifications.

The UAB offers approximately 105 undergraduate degrees, 328 postgraduate programs and 90 doctoral programs [10].

4.1.1 Places of interest

We have detected different places where we can apply changes taking into account everything we have seen so far and improve in all aspects. The idea is to find the spaces where people frequent the most and have little use. In this way, converting the exterior into a warm place to spend some time, relax, enjoy and, ultimately, improve the mental health of the students. At the university we can detect many disused spaces where people only come passing through, perhaps to go home, to class or some other place. Let's say they're just passing through. We are talking about the "Plaça Cívica" and "Eix central" where it has been modified for the use of students, and finally the exterior spaces between the corridors of the Faculty of Engineering. Precisely our faculty, where we have a greater knowledge of the spaces. The first two scenarios we focus on the busiest spaces, and the last one is disused spaces within everyone's reach. These will be the scenarios where we will focus for our study within the Autonomous University of Barcelona (UAB). We don't want a change in the entire university, because this would lead us to poor management and poor study. But if we focus on a few specific scenarios, we will be able to have greater control and see what changes occur in the behavior of students and what new uses they will have.

4.1.2 Conclusion

As we can see, we are talking about a very large university campus with many students. That makes us think about the important impact that our implementation will have on this site. In addition to the numerous advantages that we are going to observe. We believe that we have carefully selected our study scenarios and we believe that we will have a good impact on the mental health of students in relation to the outdoor spaces of the University.

4.2 Sant Joan D'Espí

Sant Joan Despí is a Spanish municipality in the province of Barcelona, located in the Baix Llobregat region, Catalonia.

Its history dates back to the Roman era when it received the name of Vicomiciano. Later the municipality had several names, highlighting San Juan del Llobregat and San Juan Despí. During the Civil War, the name of the town became "Pi de Llobregat", eliminating the religious connotations. In 1939 this change of name was annulled, and San Juan Despí remained as the official form until 1984, when the name in Catalan Sant Joan Despí was adopted. Given its proximity to Barcelona, Sant Joan Despí has seen its population grow constantly during the 20th century. From less than 1.000 inhabitants in 1900, to 31.671 in 2007. According to the 2020 data from the National Institute of Statistics, Sant Joan Despí has 34.267 inhabitants.

4.2.1 Places of interest

Taking into account the information above, we have detected different places where we can apply changes taking into account everything we have seen so far and improve in all aspects. The main difference between the UAB and the municipality of Sant Joan D'espí is the size and population, where the chosen municipality is much larger in these fields. The idea is to find and select the most specific spaces where people frequent the most and have little use. Thus turning the exterior into a warm place to spend some time, relax, enjoy and, ultimately, improve the mental health of the population. In a municipality we can detect many disused spaces where people only pass by, perhaps to go home, to buy or some other place. Let's say they're just passing through. Personally, living in this municipality, I have been able to detect some of these sites for years. We are talking specifically about the "Rambla Josep Maria Jujol" where it was built with people in mind and not vehicles. Even so, we can make improvements to make this beautiful transit space a pleasant place to stay. This will be the main scenario in which we will focus for our study within the municipality of Sant Joan D'espí. As we have mentioned before, we do not want a change in the entire municipality, because that would lead to very poor management, high public spending and poor study. But if we focus on a few specific scenarios and sites, we will be able to have greater control and see what changes occur in the behavior of the population and what new uses they will have.

4.2.2 Conclusion

As we can see, it is a fairly large municipality and close to Barcelona. This makes us think about the important positive impacts that our proposal would have for the municipality and for the nearby neighbors. We will study only one specific area of the municipality and we will give the opportunity to expand to other areas. In this way we can focus on few things and get the maximum benefit.

5 STUDY SCENARIOS

Once the study scenarios have been focused and found, we proceed to detail, analyze and study them in depth. We will use photographs taken by us, satellite images and information from different web pages. We will start with the areas of the UAB (Autonomous University of Barcelona)

and then we will continue with the municipality of Sant Joan D'espí. Later, once we have seen all its characteristics, its pros and cons, we can begin to propose changes and possible improvements that satisfy our criteria and help improve the mental health of our students and population, which is our main objective.

5.1 UAB

As we have said before, the UAB or Autonomous University of Barcelona is a large university, with many faculties, courses and opportunities for everyone. It is a public university with international prestige, ranked as the 3rd best university in Spain, the 62nd best university in Europe and the 200th in the world [7]. It offers a wide range of training opportunities and is located in Cerdanyola del Vallès, shared with Bellaterra. As we have said, we will also focus on the following scenarios that we will now describe in detail. The photographs that you will see below are taken by us.

5.1.1 Eix Central



Fig. 1: Eix Central (Source: Own Work).

As we can see in the Figure 1 above, the Eix Central of the UAB is shown. It is a currently pedestrian street that serves to communicate the different faculties. Formerly this street used cars and buses. At the moment they remodeled it thinking about the well-being of the students. Let's say it's an example of improvement in the human sense. Pedestrians and their mental well-being are prioritized. We wanted to put this example to show that these improvements that we propose can be real. Both in the same university and in municipalities. It is a matter of priorities.

We see the use of sustainable materials, such as wood, reused parts, cheap materials such as paint, then we can observe plants, trees and natural things that stimulate the well-being of our brain. We will talk about this section of materials later in our improvement proposal, there we will detail all the aspects and characteristics of each material that is going to be used.

Let's see this scenario at different times of the day and we will see at what times it is used the most and how the space could be used more. The following Figure 2, shows this same street, the Eix Central at 2:00 p.m. A busy hour where people change classes, eat or finish the day.

We are seeing the same scenario at a specific moment, full of people walking, eating or just being with friends laughing. This is the main objective of our work, to make



Fig. 2: Eix Central (Source: Own Work).

people stop and use this space to multitask, whether it is to have fun, study, eat, laugh, play games, talk...

Let's say, how can we hook people to use that unused space. In this street, chess tables, planters with aromatic plants (let's remember that smells are an important feature in mental well-being) and different benches, tables and stands have been installed to bring people together. That is what we want to mention, the good use that this street has now. Let's remember that a couple of years ago this street was only for vehicles and people walked on it without interacting with the space.

Let's see a similar Figure 3 at another time of the day, approximately 6:00 p.m.



Fig. 3: Eix Central (Source: Own Work).

As we observe, there is no one. Even though the space is the same, there is no one sitting or walking. Also because in those hours most people no longer have classes. But it is shocking to see the same space full and in a few hours of difference we see it empty. Empty is how it was before the fix, so we can get an idea of how much space we were wasting.

We are grateful to the Autonomous University of Barcelona for the good arrangement it has made in this part of the University and the good use it has today.

Next we are going to study the following scenario of our university (UAB). This is the "Plaça Cívica". A very large square where students theoretically gather for parties,

events, meetings... but currently only students who want to eat at the bar stop. All the remaining space is destined only to stones and asphalt. Let's see the image below and we will develop the topic further.

5.1.2 Plaça Cívica

In the following Figure 16 made by us we can see our second study scenario. This is the Plaça Cívica that we have already mentioned before. This square represents the epicenter of the university. Where activities, parties, events are organized... that is where, in theory, the students gather and where they meet. But we will see that there is a problem, if we look closely we will see very few elements that invite us to spend some time.



Fig. 4: Plaça Cívica (Source: Own Work).

As we can see, it is simply a large esplanade or a large asphalted area where it is not used in any way. It is shocking to see such a large space in disuse. That is why we have focused on such an important element for the university, but few people pay attention, simply because they see it as normal to not have anything there. We will propose a solution later. In this square there is a bar and restaurant, a cinema, different university services and some shop. These elements are completely on the periphery of the square and are barely visible. It is a place where you could readapt a lot and be able to create something very beautiful that, definitely, taking into account the elements described above, would be very professional. Compared to the Eix Central we see clear differences in the priorities of these spaces and for whom and what they have been designed.

Next, we have looked at what this square involved. It is an incredible space that surprises everyone and invites you to spend some time, meet friends, eat and even study. It is a space that recreates a small valley, with a small forest, a small river that crosses from end to end and a natural green area. We do not know what name it has but between us it will remain as a small forest. Then in the Figure 5 you will understand why. Saying that the photograph was taken in winter, that means that the grass is dirty and the trees are dry. Although you understand the essence of this wonderful place that contrasts a lot with the Plaça Cívica.

We see that it is a beautiful place. The objective would be to create more spaces like this and transport this idea to our Plaça Cívica. The contrast is strong, but we can appreciate that the university does keep in mind the use of natural spaces to relax, enjoy and have a good time.



Fig. 5: Small Forest (Source: Own Work).

Later we will propose a practical solution to make the most of this incredible space. Now we continue with the last point of study of the UAB or Autonomous University of Barcelona, which is about the corridors that are between the classes of the Faculty of Engineering, our current Faculty. To give you an idea of what it is about, we have some photographs taken by us so that you understand what it is about when I say the word "corridors"

5.1.3 Corridors of the Faculty of Engineering

In this last point of study at the UAB we will talk about the corridors between the classes of the Faculty of Engineering. As we will see in the Figure 6, they are open-air corridors that are totally in disuse and only have an emergency exit path, a tree and poorly maintained grass. We believe that it is an essential space if it is used well, since it would make it easier for students to go outdoors while being very close to their classes, whether it is to take a break, eat, study... it would be very useful to reestablish those spaces.



Fig. 6: Corridors (Source: Own Work).

As we look, we see the emergency exit path, overgrown grass, and a tree. This is a clear example of poorly used space, it is located between the classes of the faculty and nobody pays attention to it.

We see a great opportunity in how to reuse these spaces. Later in the improvement proposals section we will see what we can do with this space.

5.1.4 Conclusion

As we have seen, the UAB has spaces for everything. Spaces that are very well used, such as the Eix Central and spaces that are unfortunately poorly used but with enormous potential for transformation. We have focused only on 3 spaces in order to be more accurate and be as efficient as possible. We have these 3 spaces where we can apply improvements and changes that, taking into account the unique characteristics of each site, we can make an improvement proposal adapted to each space. Next we will see a single space in the municipality of Sant Joan Despí and we will see the similarities and differences with the spaces of the UAB described above and we will do the same study.

5.2 Sant Joan D'espí

Once the scenarios of the UAB have been studied, we proceed to begin to analyze the chosen scenario of the municipality of Sant Joan D'espí. But before all we will mention some characteristics of this municipality. We briefly summarize what was in the Work Scenarios section on Sant Joan D'espí.

Sant Joan Despí is currently a city with more than 34,000 inhabitants. A city with four well-defined and well-equipped neighborhoods: with more and more green spaces, more areas to enjoy and socialize, two libraries, two sports centers, four civic centers, a rich modernist heritage and a powerful associative fabric. A city that increasingly has a better quality of life [2].

5.2.1 Rambla Josep Maria Jujol

Let's see our case study. It is the "Rambla Josep Maria Jujol", it is an avenue designed for people and construction began in the year 2000 approximately. There have been different reforms but always looking towards the welfare of the population. We will see that it has similarities with the Eix Central of the UAB and we will see what characteristics they share and which they do not. In the following Figure 7 we are going to observe this street of Sant Joan Despí and we are going to comment on it.



Fig. 7: Rambla Josep Maria Jujol (North) (Source: Own Work).

As we can see, we see that it is a residential street where pedestrians have been prioritized. We have green areas on the sides separating the road from the pedestrian street. Lately many restaurants and shops have been established as the population in this place is increasing every year. It is a quiet area, where banks, fountains, routes to walk and social services have been installed. If we compare it with the central eix we will see that they are not very different, one dedicated to the inhabitants and the other dedicated to the students. The two streets have structures on the sides, pedestrian traffic has been prioritized and playful elements have been installed that help well-being. The difference is that in the Rambla Josep Maria Jujol the traffic of cars has not been completely eliminated and in the eix central yes. This is due to the fact that the Rambla communicates different habitats and basic services that must be communicated by road. Next we will see a Figure 8 of the same boulevard looking south.



Fig. 8: Rambla Josep Maria Jujol (South) (Source: Own Work).

We have parks for the little ones, schools and nurseries. Parties, concerts, fairs and different activities are also organized in this area... without a doubt, it is a space dedicated to people and not to cars.

5.2.2 Conclusion

To conclude, we see that even though they are miles apart, the ideas of improving our outdoor spaces are similar and share the same objective. This study helps us to know what we are doing well and what needs to be improved. Without a doubt, it is a good municipality with a vision of a sustainable future and all these works demonstrate it.

6 DATA ENVIRONMENT

In this section we are going to recover the information from the work of the Innovation subject to refer to the technologies that we are going to use to be able to apply our improvement proposal with a guarantee of improvement as optimal as possible, and we will do it thanks to the two technologies that we will mention next, Digital Twin and virtual reality

6.1 Digital Twin

A digital twin is an up-to-date representation of an actual physical asset in operation. As a representation of an asset in operation, a digital twin reflects the current asset condition and includes relevant historical data about the asset [4]. Digital twins can be used to evaluate the current condition of the asset and, more importantly, predict future behavior, refine the control, or optimize operation [4].

A digital twin can model: A component, a system of components, a system of systems. Examples include pumps, engines, power plants, manufacturing lines, and a fleet of vehicles [4].

These common applications drive the intended use of the digital twins. In a characteristic smart connected system topology as shown below, the digital twins could be executed on the smart asset, at the edge, or on the IT/OT layers depending on the response time that the application requires.

For example, predictive maintenance generally would require making real-time or time-sensitive decisions. When you implement multiple digital twins for different applications, you can deploy each one differently into the system topology [4]. In the following Figure 9 we can see a schematic of the data models.

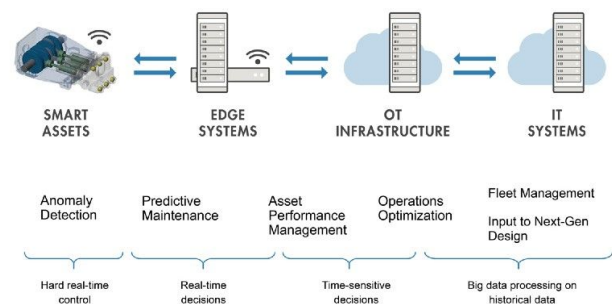


Fig. 9: Digital Twin [4].

An important feature of a digital twin is that it captures the real asset's history. Recall that the digital twin model is updated periodically to represent the real asset's current state. Over time, these past states become the asset's history.

The type of information included in this history might differ based on how you're using the digital twin and what's captured in the current state.

For example, if you're using the digital twin for fault classification, the history captured by each digital twin can be the operational data from the specific pump and its healthy and faulty state.

In the future, you can compare the operational data from one pump to the digital twin histories of other pumps to understand how they behaved under similar faults and the effect on the fleet's efficiency [4].

To see how it works, we are going to see an example and then we will explain how to apply it to our study. Imagine that we have three oil extraction pumps spread over a large territory, instead of going one by one to check their status, we can implement sensors in each pump and connect them to a central unit in a remote place that we want, once this is

done we will have a simulated fictitious pump in our central, in this way we can have the data collected by the sensors in real time from the real pumps in this digital pump many kilometers away, in this way we can have real-time control of each one of the pumps extraction. As we can see very graphically in the Figure 10 below, this would consist of a digital twin of our extraction pump.



Fig. 10: Digital Twin Pump [?].

In our study we want to apply something similar to see the impact that these improvements would have without having been implemented through our Digital Twin.

6.2 Virtual Reality

Virtual reality (VR) is an environment of realistic-looking simulated objects and scenes. The most common meaning refers to an environment generated by computer technology, which creates in the user the sensation of being immersed in it. Said environment is contemplated by the user through a device known as virtual reality glasses or helmet. This can be accompanied by other devices, such as gloves or special suits, which allow greater interaction with the environment as well as the perception of different stimuli that intensify the sensation of reality. Virtual reality comprises two main elements: the user environment and the virtual environment. As the user interacts with the virtual reality system, the two environments communicate and exchange information through a barrier called an interface. The interface can be considered as a translator between the user and the virtual reality system. There are two types of Virtual Reality methods. Immersive virtual reality methods are often tied to a three-dimensional environment created by a computer, which is manipulated through headsets, gloves, or other devices that capture the position and rotation of different parts of the human body. Non-immersive virtual reality also uses the computer and uses media such as the one currently offered by the Internet, in which you can interact in real time with different people in spaces and environments that do not really exist without the need for additional computer devices [9]. In the next Figure 11 we can see an artificial image of artificial intelligence put on a human being, so we see how it would actually look.

In psychotherapy, the use of virtual reality has been quite novel, since it ensures that the subject is no longer in a passive position, allowing them to move around the environment and interact with it in different ways, making the interaction more intimate and thereby gain ergonomics. The main applications that have been developed so far have to do with exposure techniques commonly used for the



Fig. 11: Virtual Reality [5].

treatment of phobias Max M. North, Sarah M. North and Joseph K. Coble, these scientists treated aerophobia, social phobia, agoraphobia, but progress has also been made in other fields such as eating disorders. Also, there are numerous applications of virtual reality for psychological and psychomotor rehabilitation. In the case of aerophobia or fear of flying, virtual reality offers many advantages for the treatment of illnesses or mental disorders. In the first place, there is total control over what happens in the virtual world, which is why the patient can be guaranteed that what they want to happen in that virtual world will happen. In this way, the therapy environment will be characterized as a protected environment where the patient can explore without obtaining direct consequences and, later, can apply the acquired skills in the natural environment.[9].

As far as psychotherapy research is concerned, several advantages offered by virtual reality are being used and can be summarized as: greater control over the introduction of stimuli; greater variety in response options; introduction of stimuli in three dimensions; creation of complex scenarios; generation of varied sensory stimuli, potentially including audio, touch, smell, and movement, that are perceived simultaneously with the graphically generated environment; precise and independent manipulation of the geometric and photometric relationship between objects; possibility of examining sophisticated and complex behaviors of the participants such as avoidance; and the study of situations that in real life may be impractical, dangerous or ethically questionable. However, despite the enormous potential of virtual reality, researchers must be aware of certain limitations, among which the "presence" variable stands out, since virtual immersion is not necessarily enough to give the participant the sensation that the objects are "really there" and react genuinely [9].

In medicine, recent years have brought about a drastic change in patient awareness and sense of adverse effects in medical care. Combining this process with an increasing focus on patient safety has challenged traditional medical education paradigms. Especially in the surgical field, the time-honored concept of theoretical education followed by supervised clinical practice, often referred to as "see, do, teach", is becoming less acceptable, so innovative and complementary methods of teaching medical knowledge

are being sought [9].

In addition to these two mentions, which are the most important for us, we have other areas, such as personal training, video games, software...

In our study we want to implement some kind of virtual reality to carry out a study on different people with the aim of showing them a familiar environment, such as the "Rambla Josep Maria Jujol", in the case of the municipality of Sant Joan D'espí and showing them an improvement where through all the senses of the body they can experience the real sensation of being there present. Next we will analyze the behaviors of these people and see if it would really cause a positive impact on our mental health before the actual implementation. This will help us significantly in applying the necessary changes so that when we are on the ground we can do our best.

7 QUADRUPLE AND QUINTUPLE HELIX

In this section we are going to collect the information on the innovation work so that it is clear what kind of entities are going to bet on our project and how they are going to do it. We are going to mention the Quadruple helix and even the fifth.

The Quadruple Helix Model of innovation recognizes four major actors in the innovation system: science, policy, industry, and society. In keeping with this model, more and more governments are prioritizing greater public involvement in innovation processes [?].

The quadruple and quintuple innovation helix framework describes university-industry-government-public-environment interactions within a knowledge economy. In innovation helix framework theory, first developed by Henry Etzkowitz and Loet Leydesdorff and used in innovation economics and theories of knowledge, such as the knowledge society and the knowledge economy, each sector is represented by a circle (helix), with overlapping showing interactions. The quadruple and quintuple innovation helix framework was co-developed by Elias G. Carayannis and David F.J. Campbell, with the quadruple helix being described in 2009 and the quintuple helix in 2010 [8].

The quadruple and quintuple helix framework can be described in terms of the models of knowledge that it extends and by five subsystems (helices) that it incorporates; in a quintuple helix-driven model, knowledge and know-how are created and transformed, and circulate as inputs and outputs in a way that affects the natural environment. Socio-ecological interactions via the quadruple and quintuple helices can be utilized to define opportunities for the knowledge society and knowledge economy, such as innovation to address sustainable development, including climate change [8].

The quadruple helix adds as fourth helix the public, specifically defined as the culture- and media-based public and civil society. This fourth helix includes, for example, sociological concepts like art, the creative industries, culture, lifestyles, media, and values. If we want to go one step further, which is contemplated in our project, we have the option of Quintuple helix. The quintuple helix adds as fifth helix the natural environment, more specifically socio-ecological interactions, meaning it can be applied in an

interdisciplinary and transdisciplinary way to sustainable development [8].

The quintuple helix visualizes the collective interaction and exchange of this knowledge in a state by means of five subsystems (helices).

- (1) Education system
- (2) Economic system
- (3) Natural environment
- (4) Media-based and culture-based public (also 'civil society')
- (5) Political system

Each of the five helices has an asset at its disposal, with a societal and scientific relevance. In the next Figure 12 we can see all of them.



Fig. 12: Quadruple Helix [6].

7.1 Companies

In this section we will talk about possible organizations and companies that could contribute to our proposal. First mention the companies that would take charge of the assembly and maintenance of outdoor spaces, such as gardening, outdoor construction companies and plumbing. Then mention the companies that could give us support in the digital twin and virtual reality, lending simulators, equipment, computers and electrical systems to make it possible, and, finally, companies, private or hospitals that help us with psychological issues and analysis of results. Once we have them clear we can mention them.

7.2 Researchers

In this section we are going to focus on describing how universities and research groups could give us good support in our proposal. In the first place, mention as an essential element the students and graduates in psychology, who are the ones who would provide us with a very real and reliable value of the results of our research. These people are studying or have studied how the human brain works and some have specialized in anxiety, which is the key

topic of our study. These people could provide us with studies related to our proposal, which, with the results, see if progress is being made or more adjustments are needed. These people would be the ones that we would have to be closest to throughout the process and to make an evolution of the results. Next to the environmental science students who would help us with real measurements of whether or not our proposal is sustainable. Next, we could mention the students and researchers related to artificial intelligence and new technologies, so that they could help us and learn from a real digital twin and virtual reality model, applied to real life and a proposal for improvement. Last but not least mention teachers and students who want to dedicate themselves to it. We should keep these people close throughout the process, so that later in the classroom they can mention the benefits of our proposal, and choose to use these spaces during school and non-school hours. In addition to possible training on how classes could be given in these spaces and how to use them. These would be the people related to the academy that we should have close at the time of our improvement implementation.

7.3 Users

This section is, for me, the most important. We are going to focus on the behavior of users, the habits that a human being establishes, how they affect us, and how a habit is created. Before continuing, I want to mention the books and professionals from whom I have obtained this information, the first book, *Atomic Habits* by James Clear, followed by the book on undoing anxiety by Judson Brewer and finally the book *Invicto* by Marcos Vázquez. I want to mention my psychologist Judith Gallego and my mentor María Martínez, psychologist, educator, director of the Teatre Lliure de Barcelona and director of foundations for young people.

First of all say that the brain is designed to perform tasks easily and automatically, saving energy to discover and learn new habits. When we perform our routine tasks, we do them unconsciously and we spend almost no mental energy doing them. This is because the brain has mechanized the habit process and does it unconsciously. There are different ways to mechanize a habit, and to do it as the word properly says, a habit. According to one of the most recognized books in this field "*Atomic Habits*" to generate a habit that marks a before and after it has to be based on the following.

- **Make it obvious:** No excuses, self-control, creating the perfect environment to do the task at hand.
- **Making it attractive:** Making it irresistible, the role of family and friends in habit formation, and finally locating and fixing the causes of detected bad habits.
- **Keep it simple:** Go slow but don't back down, less effort, don't procrastinate, incentivize with the awesome reward strategy.
- **Make it satisfying:** change in behavior, keep it up every day, changes in your personality.

Well, these are the very summarized points to take into account when creating a new habit. We proceed to explain how anxiety is generated and we will see correlations

between habits and anxiety. We mention the second book, "*Undoing Anxiety*" where he tells us about a pattern that is repeated whenever we experience this sensation that we all know as anxiety, and that surely we all have or will experience at some point in our lives. Anxiety does not appear alone because yes, it has some factors that make it arise. It is a very simple but very accurate rule. According to Judson Brewer there are three aspects to always keep in mind. First of all there is a trigger, an event that we have no control over, for example a lot of traffic in the morning. Next we have the behavior that we have in front of this fact, to which we do have control. For example, - there's a lot of traffic, I'm going to be late for the meeting! I'm going to get fired! And, finally, we have the result, which in this case would be experiencing anxiety. We see it all together.

- **Trigger:** Lots of traffic.
- **Conduct:** Thinking I'm late and getting fired.
- **Result:** Anxiety.

This exercise can be done with many everyday situations. We call this mapping our anxiety loops, which basically follow a full-fledged habit pattern. It would be the first exercise to observe and only observe how our mind behaves, and see all these patterns that are always repeated. We give another example.

- **Trigger:** The exam has gone badly.
- **Conduct:** Thinking that I am going to fail the subject.
- **Result:** Anxiety.

We see the same pattern, and we can do it like this for all our daily situations that generate anxiety and we will see that they behave the same. So how do we eliminate this habit of anxiety?

Our author proposes the second step, which is to question this discomfort. Ask yourself, what does this feeling of anxiety bring me? What value am I giving it? Together with the help of a very prestigious psychologist named Judith Gallego, he proposes a variation of the exercise that is very focused on that, and is based on cognitive-behavioral therapy. A new way of treating patients that is giving very good results. She calls it the "small balls" scheme, which consists of a set of balls. The first ball A where we would have the trigger (non-controllable event or situation), B with the behavior (our thoughts regarding A) and C with the result (what we experience emotionally). She proposes us to go back and stop at B, think and question what was mentioned above and analyze if we are thinking with our values, what kind of importance we give it, how we feel and have an internal dialogue to be able to go from B to D, where we experience a different sensation of tranquility and well-being. We carry out the same example above.

- **Ball A:** The exam went wrong
- **Ball B:** Think that I am going to fail the subject (internal dialogue enters here)
- **Ball C:** Anxiety

- **Ball D:** Jump from B to D, where tranquility and serenity are experienced, and thus improve our mental health and well-being.

Let's see the diagram Figure 13 drawn and that way it will be better understood.

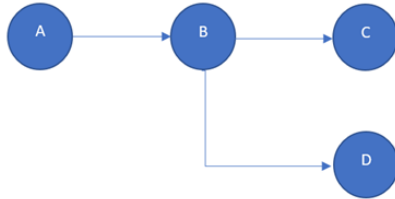


Fig. 13: Balls Scheme (Source: Own Work).

The question is that users or students use these types of techniques mentioned at home to be able to better manage themselves emotionally. In this way, not only our open spaces influence, but the whole complex. To end this section, I want to say that better mental health is not only achieved by improving outdoor spaces. It is individual and collective work to make this possible, our study will help these spaces influence people so that each one finds their spiritual and emotional path to start working on themselves. We remember that the best investment a human being can make is in himself, and that the person he will spend the most time in your life is himself. Then, it is better to get along, know yourself and know how to manage emotionally. Thank the professionals who have helped me and are helping me personally in my personal development and make me a better version every day. That is why I identify so much with this project and we want to do our best to help the more people the better. Thank you.

7.4 Public Organisations

In this section we focus on what type of public organizations can contribute to our proposal. According to our study, when carried out at the Autonomous University of Barcelona "UAB", their involvement will have to be notable. Likewise, in the municipality of Sant Joan D'espí, the town hall will also have a strong involvement. Adding all those municipalities that also want to implement our proposal. Next, we would have the general organizations such as the Generalitat de Catalunya, Aigües de Barcelona, cleaning, gardening, treatment and maintenance of infrastructures. Then those organizations from private spheres such as assemblers, agencies, construction could contribute...

8 IMPROVEMENT PROPOSAL

We enter the improvement proposal. In this proposal we have designed the aforementioned spaces with a virtual program and we will see what improvements they can have. We remember that the objective will be to recreate these spaces virtually and make a digital twin. Then, using virtual reality, get some volunteers to show us how they feel in these new spaces and finally recreate these scenarios in the

real world. We have used the Sketchup 2017 program to make our sketches.

8.1 Program

SketchUp is a face-based three-dimensional (3D) modeling and graphic design program. It is used for environment modeling in urban planning, architecture, civil engineering, industrial design, scenic design, GIS, video games, or movies. It is a program developed by Last Software, a company acquired by Google in 2006 and later sold to Trimble in 2012 [3].

Its main feature is being able to make 3D designs in a simple way. The program includes among its resources a video tutorial to learn step by step how to design and model your own environment. It allows updating and printing 3D images of buildings, cars, people and any object or article that the designer or draftsman can imagine, in addition to the fact that the program includes a gallery of objects, textures and images ready to download [3]. In the following Figure 14 we can see the logo of the program that we have used to create the design.



Fig. 14: Sketchup [3].

We have recreated the scenarios mentioned in the "work scenarios" section and we have added improvements in order to achieve our main objective, which is to improve the mental health of students and inhabitants. We mention again that our innovative proposal is to generate this virtual space as Digital Twin and through virtual reality see what impact it would have without applying it in real life. This way we save material and economic resources that could go to other areas. Once we have the optimal design, then it would be time to make it happen. We believe that it is the best and most sustainable option.

8.2 Sketches

Finally, we are going to expose our designs created by us of the study scenarios that we have been determining throughout the work. We will start with the Autonomous University of Barcelona (UAB) and end with our municipality of Sant Joan D'espí.

8.2.1 UAB sketches

Now we will continue with the section of the "UAB Sketches" of the UAB and we will see what improvements we can implement. We start with the creation of the digital twin with our Sketchup program in the "Plaça Cívica" space and we will see what improvements and changes we are going to implement. We will continue with the corridors between faculties, and finally we will not design the "Eix Central" because it was remodeled a few months ago and an effort was made to create that space for students. We will also comment on it and add extras to make it better. First we

will see our designs and compare it with the real version. As we can see in the following Figure 15 of the digital twin of the "Plaça Cívica" we see the transformation that we would carry out if our proposal were made possible. It is the first sketch and would be updated with improvements, but this would be our first ready design.



Fig. 15: Rambla Panoramic (Source: Own Work).

Let's remember how the "Plaça cívica" is currently and appreciate the changes. In the figure 15 above we can see more green areas, spaces set up to study and teach, a personal help point called PP (Psychological Point), areas with scented flowers, smart lamps, rest areas and multiple paths with sustainable tiles. On the other hand, in the Figure 16 below we have a large extension in disuse and filled with cement.



Fig. 16: Rambla Panoramic (Source: Own Work).

Now we are going to see all those elements that we have mentioned above. In the following figure 19 we will observe the areas specifically designed for studying outdoors and for teaching classes. We see that they are covered, equipped with power points and plugs, with smart lamps and solar panels that cover the energy of these power points and plugs, and, finally, the structure made of sustainable wood.

Now we will see the psychologist point (PP) where students and teachers will be able to have guidance sessions on how to manage their emotions, learn more about their strengths and weaknesses, and be able to find mechanisms to put their heads in order. We believe that it will be one of the key points of our improvement design that will help many people who are interested in growing as people and



Fig. 17: Rambla Panoramic (Source: Own Work).

getting to know themselves better. I personally believe that this is the key point of our proposal, to improve the mental health of students, not only through the transformation of the environment but also with psychological help that dictates guidelines and provides methods to get to know each other better. In the following Figure 18 we see this "pp".

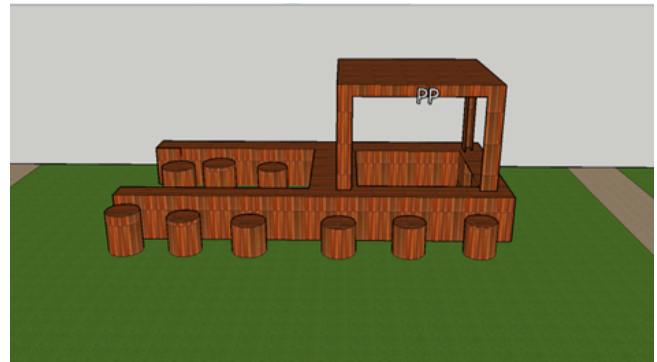


Fig. 18: Rambla Panoramic (Source: Own Work).

And, finally, we will observe the bar that is currently in the "Plaça Cívica", but improved to guarantee what we said in the introduction of the characteristics that an outdoor space must have in order to be beneficial for mental health. We see the following Figure 19 where we expose it.



Fig. 19: Rambla Panoramic (Source: Own Work).

Once we have seen the design made to improve "plaça Cívica" we proceed to show the design to improve our last scenario at the UAB, which are the corridors in the engineering faculty. As we said previously, the "Eix Central" we have not made a design, since when studying it we saw that it already meets our pattern of characteristics

to benefit mental health. We are going to see how our corridors would look between the classes of the Faculty of Engineering and we will compare it with the current state. We see the Figure 20 of our design for this space and then we will comment.



Fig. 20: Rambla Panoramic (Source: Own Work).

Let's see the changes we have made, we have added some modern and sustainable lumber wooden tables equipped with electricity and plugs, a retractable wooden roof to be able to stay even when it rains, some benches at the end of the corridor and some pots with aromatic flowers. Now we see and contrast this Figure 20 with the Figure 6 of the real scenario shown in the Study Scenarios section.



Fig. 21: Rambla Panoramic (Source: Own Work).

We see a clear improvement and refusal of space to be able to use it so that we can meet our objective. We provide students with materials so that they can enjoy the outdoors and carry out group work in places that up to now it was unthinkable that they could be used. Next we show two images where we will see these incorporated elements in more detail. We see in the following Figure 22 the tables equipped with plugs and current, protected by the retractable roof, waterproof and fireproof, made with lumber wood.

Next we will see in the following Figure 23 the benches and the pots with aromatic plants that will provide life to this space and are located at the end of this scenario.

We already have all the UAB scenarios described and designed. The "Eix central" contains all the characteristics that we believe necessary to be able to follow the objective



Fig. 22: Rambla Panoramic (Source: Own Work).



Fig. 23: Rambla Panoramic (Source: Own Work).

of improving the mental health of students. We can see the images in the Work Scenarios section. Now we proceed to show you the design of the stage of our municipality of Sant Joan D'Espí. We will see it in the next section.

8.2.2 Sant Joan D'espí sketch

In this section we are going to expose our improvement proposal in relation to the Digital Twin. Next we will see a sketch in the Figure 14 of the Rambla Josep Maria Jujol in the municipality of Sant Joan Despí after having modified various aspects. We remember that it is currently considered a space for walks and focused on people, but we will see what innovations we can bring.

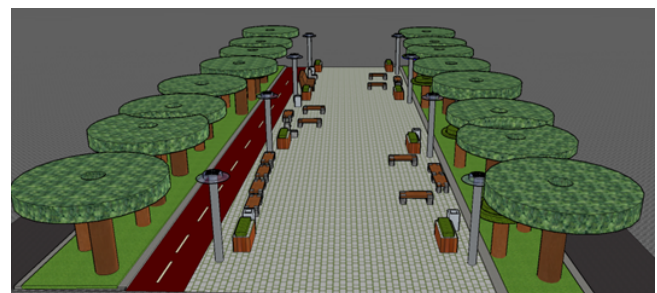


Fig. 24: Rambla Panoramic (Source: Own Work).

First of all we reinsert the same Figure 8 from the Sant Joan Despí section to see how clearly they look alike.



Fig. 25: Rambla Josep Maria Jujol (South) (Source: Own Work).

Once visually compared, we are going to mention the aspects that we have added to improve our street. We observed a clear lack of seats, which we have expanded in the virtualized version, we have designed some benches made of sustainable wood with stone legs to cause the least possible impact, then we will see the insertion of potable and drinking fountains throughout the area, we have delimited Better the bike lane so as not to interrupt pedestrians. The streetlights would be of the intelligent type, they would have a solar panel on top that would make them work sustainably, they recharge during the day and illuminate at night. The current bins will be replaced by more solid ones, a problem on this street is the strong gusts of wind, this causes the bags to fly and the garbage to be scattered along the street. With these new solid bins we would end the problem. We have added more vegetation in the form of pots and trees grown. It is not appreciated but the sound factor plays a very important role in mental well-being, so we have traffic reduction and the insertion of bird nests in the trees to encourage the reproduction of birds and thus be able to enjoy their song. And finally the floor tiles leave space between them to let some grass grow.

Once the improvements have been mentioned, we proceed to show some Figures 26 to see these aspects more clearly. First of all we are going to observe the wooden benches with the stone legs.



Fig. 26: Rambla seats (Source: Own Work).

Next we will observe the Figure 27 where drinking fountains and the new litter bins are.

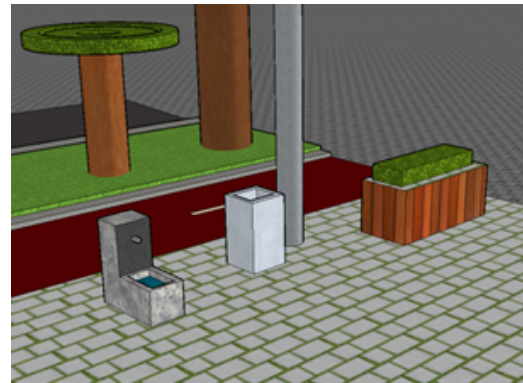


Fig. 27: Rambla Fountain and bins (Source: Own Work).

We see how they are more solid litter bins, we can also appreciate the large new pots and the stone fountain with drinking water. And finally we will observe in the following Figure 28 the delimited bike lane



Fig. 28: Rambla Bike Path (Source: Own Work).

We see how the line of benches, flower pots, bins and fountains delimit the bike lane very well to prevent accidents. On the other hand we have the trees that already exist in reality and the road for a single lane of cars as a last term.

9 IMPACT

In this section we will talk about what type of impact our project produces and what metric is a consequence of that. Suppose we have achieved our goal. We will improve the mental health of our students, this means now identifying our KPIs (key performance indicators). The first thing we can detect is the quantification of how much the mental health of our students and inhabitants has improved, through possible surveys and interviews. Next, we could detect how much more time students use those spaces and see if it helps them improve their mental health.

Now we will talk about a very important index in which you belong to society. It is called SROI (social Return Of Investment). How society will change with the application of our project. If we achieve our objective of improving the mental health of students and inhabitants, following our values we will achieve a more relaxed society, less

worried and with more calm to be able to carry out daily tasks. As we said a few points earlier, society today goes at an unnatural speed, we go fast everywhere and we don't pay attention to the really important things. Our proposal indirectly seeks to stop, think, reflect and make good decisions. We believe that this is the true return value, achieving a more relaxed society, that does not take things too seriously and that we can once again be a humane and affective society.

In terms of sustainability, the impact of our project would hardly consume fossil energy and we would not need materials that consume a lot. The materials that we would use to implement our proposal would be virtualized devices, we are talking about the digital twin and virtual reality, and, of the physical space, we would be talking about sustainable materials such as wood, stones, plants, trees, and reusable materials.

10 DISCUSSION

In this section we will mention the points discussed and comment on it. Firstly, we agree that the characteristics that open spaces must have to guarantee good mental health are very convincing. Due to the aspects that it takes into account and that have been demonstrated and contrasted with numerous studies. Next, in the study scenarios we have only mentioned four, since to make a good analysis the fewer the better. If our proposal is successful, we could extend our study to different areas. We believe that we will improve the mental health quality of our target audience due to the good development of our idea. It should also be said that it would be very innovative to opt for digital twin technology and virtual reality before physically implementing our improvement. In this way we would obtain greater success in our implementation.

11 CONCLUSIONS

We are going to conclude our work validating or not our initial objectives and hypotheses.

Have we found ways to reduce the anxiety of young students and residents? The answer to this question and objective is true, through a good study of the scenarios in which work is going to be done and taking into account different characteristics of the environment, it has been shown that it reduces anxiety and stress levels in people.

Have we explained the concepts that young students can experience and their possible identifications, problems and the little information they have about it? Thanks to psychology we can detect patterns of behavior and create methods to be more aware of ourselves and get to know ourselves better. We have mentioned some effective technique on how to react to what happens to us and be able to know how to manage better with practice. This work does not focus on the psychological state and methods to reduce stress, but on how to relate this to the open spaces of the mentioned scenarios. For that we would need much more extension to go into detail in psychology. So we can say that we have explained the concepts but we have not deepened them.

Have we created an innovation model to improve our

outdoor spaces and enable them to be used and thus improve people's mental health? We cannot ensure that mental health will be improved, as it requires time and monitoring of our implementation. We believe that it will have a very positive impact and the ultimate goal is that, to reduce anxiety and stress and improve people's mental health. But to verify it we would need implementation time and follow-up.

We have concluded our objectives, evaluating them and seeing what can be improved even more. It has been a very worthy job and we have put a lot of effort into it. We are very happy with the end result. Hopefully we can implement this method at some point and see if mental health can be improved.

12 ACKNOWLEDGMENTS

In this section we want to thank all the people and organizations that have made it possible for this work to be carried out. First of all, I would like to thank my two psychologists who have accompanied me during these last years in my personal growth, who have given me a lot of useful information to be able to carry out this work. They are Maria Martinez and Judith Gallego. Next, I would like to thank the authors of the books where I have been able to extract a lot of information as well. I would also like to thank two mentors who I have been following for a while and they have helped me a lot in my personal growth. Thanks also to all the web pages consulted and all the portals that I have visited, such as the United Nations. Finally, thank myself for the desire, love, dedication and effort that I have put into this work.

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ANNEX