



Analysis of the Perception of an Interactive Digital Tool for Anxiety Self-Regulation in Engineering Students

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Abstract. Academic anxiety in engineering students manifests in various ways that affect their performance and well-being. Self-regulation by students prevents burnout and academic dropout. The objective of this research is to interpret the data from a focus group test administered to a group of computer science and information technology students regarding their perception of the interactive resources of a digital tool for anxiety self-regulation. The methodology is based on User-Centered Design (UCD), where in the first phase the interactive digital tool for anxiety self-regulation is developed, and in the second phase the instrument is applied to a focus group of computer science students to analyze their perception of the tool's use. The results of the *Mann-Whitney U test*, with a significance level of $p = 0.025$, indicate the importance of using interactive resources for anxiety self-regulation among the focus group of 47 students. The importance of a digital service tool for anxiety self-regulation: 76.6% of students mention the need for a digital space in the context of engineering.

Keywords: Anxiety, Educational technology, Inclusion, Usability.

1 Introduction

Anxiety is considered a natural emotional response to situations perceived as threatening; however, when it is persistent, it can become a disorder that significantly affects daily life. In recent years, an increase in mental health problems has been observed, which has driven the development of new digital intervention strategies [1]. Furthermore, anxiety disorders represent one of the main causes of behavioral disturbances globally, highlighting the need for accessible and effective tools for their treatment [2]. Emotional regulation refers to the ability of individuals to manage their emotions appropriately. This process includes identifying, understanding, and modifying emotional responses. Current digital interventions integrate emotional regulation strategies such as cognitive restructuring and mindfulness, which have proven effective in reducing anxiety symptoms [3]. Cognitive Behavioral Therapy (CBT) focuses on the relationship between thoughts, emotions, and behaviors. In the digital context, CBT is implemented

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through digital applications that include interactive exercises, thought tracking, and coping techniques. Several studies have shown that digital CBT based interventions are effective in reducing anxiety, especially when applied in a structured manner [4, 5].

Evidence of anxiety in university students in Latin America is closely related to academic stress and the demands of the educational environment [6, 7]. Similarly, in Ecuador, high levels of anxiety have been identified as being associated with a significant decrease in students' quality of life [8]. In this context, factors such as academic overload, sleep quality, and cognitive demands directly influence the emergence of anxiety symptoms [9]. This problem is especially relevant in fields such as engineering and computer science, where academic demands increase vulnerability to mental health problems [10]. Studies conducted in Mexico on anxiety in engineering students are associated with academic and emotional factors, such as workload and social pressure [11]; in particular, anxiety related to learning mathematics is considered a relevant component within engineering programs, affecting academic performance [12]. Furthermore, variables such as emotional intelligence influence students' ability to manage anxiety [13, 14]. In general, academic stress is directly related to high levels of anxiety in Mexican university students [15]. Technological tools that utilize artificial intelligence make it possible to address anxiety (see Table 1) using chatbots.

The present study integrates in its first section the introduction to anxiety as an emotional response that affects university engineering students for various reasons in the context of academic demands, in addition to the resources for self-regulation of anxiety; in the second section, the methodology for the design of the interactive digital tool for the self-regulation of anxiety in engineering students based on User-Centered Design (UCD); and in the third section, the analysis of the results of the tests of a group of 47 students expert in computing and information technologies, and the conclusions of the use of the digital tool.

2 Methodology

This research constitutes a practical approach and represents a method whose objective is precisely to empirically ensure the results. The User-Centered Design (UCD) methodology is applied, utilizing the factors involved in the development of an interactive digital tool for anxiety self-regulation in engineering students. The research is experimental, obtaining data from a focus group of engineering students to understand their perception of the digital tool for anxiety self-regulation. The research question is: How do university engineering students perceive the interactive resources of the digital tool for anxiety self-regulation?

The overall objective of the research is the interpretation of the data from the focal test of a group of student experts in computing and information technologies of the perception of the interactive resources of the digital tool for the self-regulation of anxiety.

The specific objectives are established in two phases: the development of the digital tool to promote self-regulation and the focal test of the perception of 47 engineering students in computer science and information technologies.

Table 1. Tools for Managing Anxiety

Tool name	Description
Woebot	A conversational system based on Artificial Intelligence and structured decision trees that provides immediate cognitive restructuring techniques in response to anxiety spikes. https://humanfactors.jmir.org/2025/1/e76377/PDF
Sentinel	Self-guided micro-digital platform and intervention co-created for emotional self-regulation, coping with occupational traumas and daily monitoring of anxiety and stress levels. https://www.researchprotocols.org/2026/1/e72250/PDF
Wysa	Interactive conversational agent (<i>chatbot</i>) validated in tiered care settings to assess the therapeutic alliance and reduce subclinical anxiety symptoms. https://doi.org/10.3389/fdgth.2022.847991
MindShift CBT	Interactive application based on predictive and behavioral models that breaks down anxiety into subtypes using coping cards and cognitive diaries. https://doi.org/10.1016/j.invent.2025.100824

First phase: development of a digital tool to promote emotional self-regulation of anxiety in engineering students; the following stages are considered:

- The definition of functional requirements focused on the emotional well-being of the user by integrating visual elements, such as a guide mascot, to strengthen the emotional bond and the user experience.
- The design of the daily recording and monitoring of emotions, interactive resources for emotional regulation, graphic visualization of emotional states and information on free psychological support services, structured in use cases using *Unified Modeling Language* (UML).
- The implementation of the digital tool was carried out in (Hyper Text Markup Language (HTML), Cascading Style Sheets (CSS) and JavaScript, and functional testing was performed.

Second phase: apply the instrument to a group of expert students in computer science and information technology engineering, which consists of the following stages:

- Apply the instrument to gather students' satisfaction opinions about the digital tool (the digital personal diary, daily recording and monitoring of emotions, interactive resources for emotional regulation, graphic visualization of emotional states and information on free psychological support services).
- Analyze the results of resource efficiency for emotional self-regulation, software design, and opinion to identify user experience.

2.1 First phase: development of the digital tool for self-regulation of anxiety

Human-Computer Interaction (HCI) using a user-centered approach and user experience (UX) design principles are considered for the development of the digital tool for anxiety self-regulation for engineering students.

The functional requirements identified are as follows:

- Student registration and login. The design includes a registration screen to create a personalized account using an institutional email address and password.
- Digital personal diary. The design of this section promotes everyday emotional observation, key in CBT. Burns [16] emphasizes that you can't change what it does not recognize, so this exercise allows the user identify your emotions Clearly. Using icons of a university identity character, the *Little Wolf*, facilitates an emotional connection, generating a safe emotional environment, to reduce the Fear of students expressing their feelings; furthermore, the use of images instead of words decreases the cognitive load, aligned with good UX practices.
- Graphical visualization of emotional states: Visualizing an emotional calendar allows you to notice patterns in emotional changes over time. This structured self-observation allows you to identify the connections between emotions and distorted thoughts.
- Resources Interactive emotional self-regulation tools. Access to CBT exercises. The My Toolbox section: 4-7-8 Breathing, which helps regulate physiological arousal and is recommended for managing anxiety spikes. What if...? an exercise where the user imagines the worst-case scenario and then questions it. Color counting or visual anchoring, which serves to distract the mind from ruminative thinking.
- Daily recording and tracking of emotions. Access to a non-judgmental journal; writing is promoted as a tool for expressing emotions, identifying distortions, and recording automatic thoughts. This section acts as an intimate and uncensored space where users can express their experiences without fear of judgment.
- Information on free psychological support services. The contact section includes a map of psychological support institutions. The interface incorporates a contact section with a map showing nearby psychological support institutions. This feature aims to reduce barriers to accessing professional help by providing accessible and visual information.

The visual style is established under the principles of emotional design and recommendations for digital mental health, which suggest creating safe and empathetic visual environments. The use of the character *Little Wolf*, along with non-directive communication, aims to generate a sense of companionship to reduce anxiety and facilitate interaction between students and the digital tool. Research by Shibata and Norman [17, 18] affirms the importance of friendly characters in digital interfaces, such as robots or virtual pets, to generate feelings of companionship, reduce stress, and increase emotional engagement, especially in contexts related to mental health. A *little wolf* was chosen as the emotional character because of its symbolism of guidance, protection, and connection to the community—values that align with the purpose of the digital tool as emotional support in contexts of vulnerability, as well as its connection to university

identity. Previous experiences, such as the self-help chatbot *Woebot*, which uses CBT techniques, demonstrate that relatable characters can contribute to a more human and comforting interaction. This type of design aims not only to inform but also to offer a sense of emotional security that facilitates continued use of the tool. Based on the defined requirements, a *UML use case diagram* was developed to graphically represent the main interactions between students and the digital tool. The diagram allows observation of the system's functions and the student's role as the main actor (see Fig. 1).

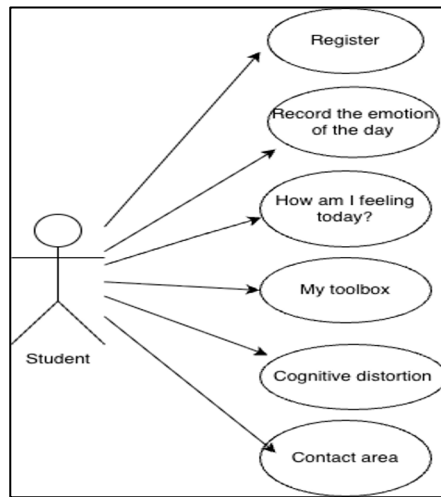


Fig. 1. Diagram of the digital tool for anxiety self-regulation in *UML*.

My toolbox features interactive resources such as guided 4-7-8 breathing, cognitive exercises like counting colors in various scenarios, mini-challenges, and positive thinking, designed to self-regulate anxiety. (See Fig. 2).

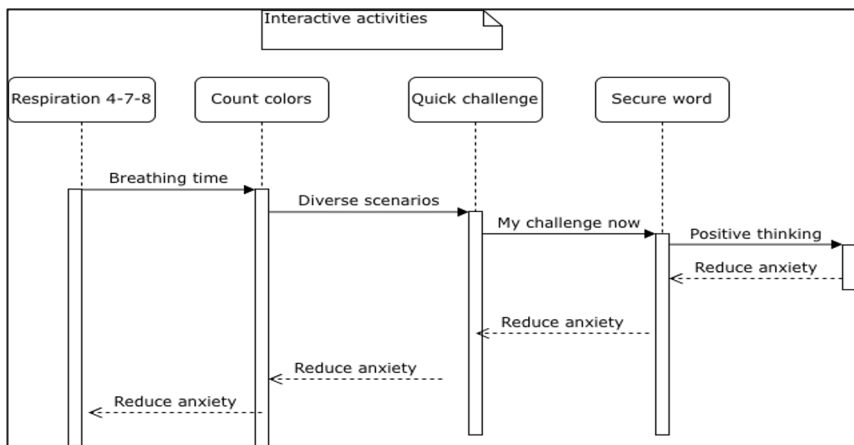


Fig. 2. Diagram of the interactive activities for anxiety self-regulation in the Toolbox.

2.2 Second phase: apply the instrument to a group of expert engineering students

The student body is made up of students from the Information Technology Engineering, Computer Science Engineering and Computer Science Bachelor's programs; 47% are in their seventh and eighth semesters and 24% are finishing their academic programs. They also have knowledge in: Interaction Design, Web Development Modeling, Network Administration, Equipment and Network Maintenance, Business Intelligence and Software Quality Control.

The interactive digital tool for anxiety self-regulation in engineering students is presented for the daily management of their emotions, along with interactive resources for anxiety self-regulation. The instrument consists of items identifying the need for anxiety tools, usability, user experience, intention to use, and open-ended questions about the digital tool (see Table 2). The items are answered using the Likert scale: strongly disagree, disagree, neutral, agree, and strongly agree.

Table 2. Instrument for the perception of anxiety by students regarding the digital tool.

Dimension	Item
Acceptance and Need	1. I believe that anxiety is a common situation among engineering students.
	2. I would be interested in having digital tools for emotional self-regulation.
	3. I find it useful to record my emotions digitally in order to track them.
	4. I consider it useful to include interactive resources for emotional regulation.
	5. It is important to include information about psychological support institutions.
Usability (IHC)	6. The tool was easy to use.
	7. The navigation was clear.
	8. I had no difficulties using it.
	9. I found the design pleasing.
	10. The colors convey tranquility.
	11. The platform responds well.
User Experience (UX)	12. The character "Little Wolf" made me feel accompanied.
	13. Emotional recording is useful.
	14. The diary allowed me to express myself easily.
	15. The tools (breathing, challenges, etc.) are useful.
	16. I felt calmer after using the tool.
	17. The tool helped me to reflect.
	18. I felt accompanied during use.
Intended use	19. Would you use this tool in your daily life?
Open questions	What would you improve about the tool?
	What did you like the most?
	What would you like it to have in the future?

3 Results of the focus group analysis on the digital tool for anxiety self-regulation

The focus group data of the 47 engineering students shows that 76.6% agree or strongly agree in identifying anxiety; in addition, 61.7% consider self-regulation tools to be of interest; with daily records of emotions of approval in 57.4%, 76.6% assume the interactive resources are favorable and 78.7% agree on the importance of information on psychological support (see Table 3).

Table 3. Analysis of the variables for identifying anxiety in engineering students and the need for the use of a digital tool.

Item	I completely disagree	Disagree	Neutral	OK	Totally agree
Frequent anxiety in engineering	8.5% (4)	2.1% (1)	12.8% (6)	34.0% (16)	42.6% (20)
Interest in self-regulation tools	8.5% (4)	2.1% (1)	27.7% (13)	38.3% (18)	23.4% (11)
Digital emotion recording utility	10.6% (5)	4.3% (2)	27.7% (13)	25.5% (12)	31.9% (15)
Usefulness of interactive resources	6.4% (3)	2.1% (1)	14.9% (7)	36.2% (17)	40.4% (19)
Importance of information on psychological support	6.4% (3)	2.1% (1)	12.8% (6)	23.4% (11)	55.3% (26)

The perception of the *User Experience* (UX) of the digital tool regarding direct interaction, navigation, and design. 76.6% agree or strongly agree that it is easy to use, 78.7% rate the navigation as easy to understand, and 66% reported no problems using it.

Regarding the interface aesthetics, 70.2% of the participants found the visual and emotional design appealing, while 72.3% agreed with the color palette selection. Furthermore, 63.8% reported feeling a connection with the Little Wolf character.

Based on the multiple-choice question (see Table 4): from the *digital personal diary*, Regarding the *following selections for emotion tracking and recording, interactive emotion regulation resources, graphic visualization of emotional states, and information on free psychological support services*, students indicated the following selections : daily emotion tracking and recording at 51.1%, digital personal diary and interactive regulation resources at 44.7%, information on free psychological support at 2.6%, and graphic visualization of emotional states at 38.30%, out of a total of $n = 104$.

In the multiple-choice question where students were asked, would you use this tool in your daily life? 11% indicated no, 34% responded yes, and 55% maybe. Applying the *Mann-Whitney U test*, the significance value was found in the interactive resources for emotional regulation. Although the recording and tracking feature had the highest frequency (24), the statistical test confirmed that it is not the determining factor in daily

use. The p -value ($p = 0.025$) for interactive resources demonstrates that convinced users *would* use the digital tool, valuing this function significantly more than undecided users. While recording is what students believe they need, the interactive resources ultimately convince them.

The graphical visualization ($p = 0.06$) is very close to statistical significance. This suggests that for an engineering profile, observing progress through data is a strong secondary motivator that could be considered for students who answered *maybe*.

Psychological support shows a small difference, but its mere existence does not guarantee that students will use the tool every day.

Table 4. Analysis of the variables for identifying anxiety in engineering students and the need for the use of a digital tool.

Selection	Rank Difference (Z)	p-value (Sig.)	Interpretation
Registration and Monitoring (24)	-1.12	0.262	Not significant
Digital Personal Diary (21)	-0.98	0.327	Not significant
Interactive Resources (21)	-2.24	0.025	Significant
Psychological Support (20)	-0.54	0.589	Basic requirement
Graphical Visualization (18)	-1.86	0.063	Trend (almost sign)

4 Conclusions

The importance of a digital tool for anxiety self-regulation services is highlighted by the fact that 76.6% of engineering students experience anxiety. The tools themselves (breathing exercises and challenges) are considered useful by 72.3%, positioning the tool as a link within a university wellness space. This is achieved through the use of technology for anxiety self-regulation. However, the *daily recording and monitoring of emotions, interactive emotional regulation resources, graphical visualization of emotional states, and information on free psychological support services* are also considered important, as is the feeling of well-being when recognizing moments of anxiety. The statistical results show a high concentration of responses in the "agree" and "strongly agree" categories, exceeding 70% in most of the variables analyzed. This indicates a positive perception of both the problem of anxiety and the usefulness, usability, and functionality of the application. Furthermore, the intention to use the tool shows a favorable trend, with a predominance of positive responses. Digital tools do not replace professional care, but they can function as an important complement. Recent scientific evidence indicates that the most effective applications combine multiple tools, such as emotional recording, digital CBT, diary and data visualization, in addition to information on psychological support services in the emotional care of the person. Based on the findings, which demonstrate strong acceptance, perceived usefulness, and intention to use the interactive tool, future research should incorporate experimental or

quasi-experimental designs to rigorously measure and evaluate changes in the psychological variables associated with anxiety among engineering students.

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