Multidimensional and Ecological Model for Assessing the Mental Health of Children and Young People

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ABSTRACT

The conceptualization of mental health problems and quality of life requires a comprehensive, multidimensional model of subjective health, a mental health and quality of life should be understood as psychological constructs encompassing physical, psychological, mental, social, and functional well-being.

The main objective of this study is to propose an integrated model for assessing the mental health and well-being of children, adolescents, and young people from the municipality of Vale de Cambra, based on a biopsychosocial and environmental perspective. The main indicators include psychological symptoms (anxiety, depression, and stress), perceived well-being, and stress management skills—core variables for the mental health of children and adolescents.

The total sample consisted of 618 participants, half of whom were male (50.2%), aged between 9 and 18 years (M = 12.2; SD = 2.88), ranging from the third year of primary school to secondary education.

Results revealed moderate levels of well-being and stress management skills, and low levels of psychological symptomatology. Strong and significant correlations were found between higher stress management and greater well-being, as well as negative associations with symptoms of depression, anxiety, and stress. Significant gender differences were observed, with girls reporting more symptoms and boys showing better stress management skills, as well as age differences, with older adolescents reporting greater psychological distress.

Hierarchical regression analyses indicated that individual, family, relational, and school variables significantly predicted mental health, explaining between 5% and 6% of model variance. Robust predictors included life satisfaction, sleep quality, screen dependence, personal concerns, and perceptions of classroom conditions.

Overall, the results underscore the importance of an ecological approach to understanding and promoting mental health among children and adolescents. This study demonstrates that the mental health and well-being of children and adolescents should be understood through a biopsychosocial and environmental perspective, where individual, social, and contextual factors interact dynamically. Diagnosis therefore requires a multidimensional assessment model, using multi-method and multi-context evaluations. Practical implications and recommendations for local, national, and international public policies are discussed.

Keywords: assessment model; mental health; children and adolescents; ecological perspective

INTRODUCTION

The conceptualization of mental health problems and quality of life requires a comprehensive and multidimensional model of subjective health, a mental health and quality of life should be understood as

psychological constructs encompassing physical, psychological, mental, social, and functional well-being (Gaspar, Tomé, Cerqueira, Guedes, Raimundo, & Gaspar de Matos, 2020).

Mental health is an integral part of children's and adolescents' ability to develop and live their lives fully—particularly their capacity to establish interpersonal and emotional relationships, study, work, and engage in leisure, social, and cultural enrichment activities, as well as their decision-making ability and capacity to set and pursue goals. Significant disturbances or difficulties in mental health and quality of life may compromise these capacities, consequently hindering the development of individuals' and societies' potential. Mental health is associated with quality of life and well-being, through which people realize their potential, develop meaningful social relationships, and contribute to their own development and that of their communities (Botelho-Guedes et al., 2022; Cerqueira et al., 2022; Gaspar et al., 2022).

Well-being and quality of life depend on a balance between an integrative and a partial perspective, which involves five domains: (a) material well-being: economic situation, housing quality, transportation; (b) physical well-being, including health, physical capacity, mobility, and personal safety; (c) social well-being, associated with interpersonal relationships and community involvement; (d) emotional well-being, related to positivity/optimism, status, respect, mental health, stress, faith, belief, and self-esteem; and (e) productive well-being, linked to competence, productivity, and contribution (WHO, 2001, 2002).

Several concepts are closely linked to mental health, including resilience, optimism, positive psychology, social capital, salutogenic environments, and quality of life (Gaspar et al., 2012; Lukoševičiūtė et al., 2022).

During adolescence—a developmental transition between childhood, youth, and social adulthood—there appears to be an increase in the presence of anxiety and depression symptoms (Bellis et al., 2013). The presence of psychosomatic symptoms, worries, and self-harming behaviors also tends to increase during this period (Department for Children, Schools and Families, 2010). The onset of clinically significant symptoms during adolescence increases the risk of psychological disorders in adulthood (Bellis et al., 2013).

Various factors can influence adolescents' mental health and well-being, such as negative life events, peer relationships, family relationships, substance use, mental disorders, and a lack of personal and social skills, among others. There is no single cause for mental health problems, and no one is immune.

In addition, adolescence marks the first gender differences in this domain, with girls showing greater risk for internalizing symptoms (such as anxiety and depression) and boys for externalizing symptoms (such as substance use or aggressive behavior) (Gaspar et al., 2018; Gaspar et al., 2022; Matos et al., 2018).

Positive and healthy development, along with potential changes in behavior, beliefs, and attitudes, emerge from the global influence of relationships between the developing individual and biological, psychological, familial, community, cultural, physical, and historical-niche factors. Regulations for adaptive development arise from this bidirectional interaction between the individual and their context, promoting well-being and quality of life for both components (Bronfenbrenner, 2005; Gaspar et al., 2020).

In more developed societies, health services have shifted their focus toward health promotion and education, encouraging individuals to adopt healthy lifestyles from early ages to foster better mental health and quality of life. This shift underscores the growing importance of health promotion efforts implemented across contexts and involving all actors in individuals' lives. Once risk factors are identified, they may serve as the starting point or focus for health promotion strategies and actions (Stengård & Appelqvist-Schmidlechner, 2010; WHO, 2001, 2002). In school contexts, mental health can be promoted through preventive programs that involve government, community, family, and school collaboration (Cefai et al., 2021; Gaspar et al., 2022; Gaspar et al., 2020; Gomez-Baya et al., 2018; López-Pérez & Zuffianò, 2021; Matos et al., 2020; Tomé et al., 2020).

Health promotion entails the active support of individuals' physical, mental, and social well-being. Health prevention focuses on factors that may threaten health and well-being, as well as on preventive interventions. Subjective health or perceived well-being are important aspects of health promotion and are considered key indicators in public health (Matos et al., 2020; Stengård & Appelqvist-Schmidlechner, 2010).

When analyzing results from prevention and mental health promotion studies and interventions, it is crucial to consider the population's health perceptions—specifically their physical and cultural context, social involvement, social pressures, health behaviors, and psychosocial processes such as coping styles and social support. These factors can act as protective or risk elements for mental health and well-being (Gaspar et al., 2020; Gomez-Baya et al., 2018; WHO, 2001, 2002). Consequently, individuals at risk for poor subjective health can be identified, such as children and adolescents with special educational or health needs, behavioral problems, or adults and older people with chronic illness or social isolation. These groups can benefit from evidence-based intervention programs, and the evaluation of outcomes contributes to recommendations and best practices promoting mental health and quality of life. When individuals have more protective factors, they tend to assess their well-being and quality of life more positively. Protective factors may mediate the relationship between individuals' characteristics and competencies and external threats (Gaspar et al., 2018a, 2018b; WHO, 2001, 2002).

The impact of the COVID-19 pandemic on children's and adolescents' mental health has been multifaceted and substantial. Research on youth mental health during COVID-19 has identified anxiety, depression, loneliness, stress, and pressure as the most common symptoms (Gaspar et al., 2022; Jones et al., 2021; Panchal et al., 2021; Theberath et al., 2022). Irritability (16.7–73.2%) and anger (30.0–51.3%) were also frequently reported by children and adolescents (Panchal et al., 2021).

A Portuguese study conducted in the post-pandemic context (Matos et al., 2022) found that about one-fifth of adolescents reported feeling sadness more than once per week (7.4% felt sadness so strong that it seemed unbearable), as well as nervousness and irritability or bad temper.

Several studies (Jones et al., 2021) also found higher rates of alcohol and cannabis use among adolescents during the pandemic. According to Panchal et al.'s (2021) systematic review, pre-existing special needs or mental disorders, along with excessive exposure to media, were significant risk factors for anxiety. Positive coping strategies with family and social support can play a crucial role in achieving better outcomes (Gaspar et al., 2022; Jones, 2021; Panchal, 2021; Theberath et al., 2022).

Other studies have identified correlations between environmental factors and mental well-being and cognitive performance. When ambient temperatures are not optimal, the brain experiences constant interruptions from the body signaling the need for thermal adaptation (Perez, Montano & Perez, 2014). A recent study by Mullins and White (2019) found that colder temperatures reduce negative mental health outcomes, whereas warmer temperatures increase them. Higher temperatures were associated with more mental health emergency visits and higher suicide rates.

Classroom lighting is also a vital component of students' concentration capacity, as our eyes and brain require sufficient light to gather and process visual information effectively. The type of lighting that best supports learning, reduces anxiety and stress, improves behavior, and promotes general health is full-spectrum lighting—similar to natural sunlight. Classroom lighting affects cognitive ability, concentration, work speed, productivity, and accuracy, among other outcomes (Keis, Helbig, Streb & Hille, 2014).

The deepening of research on mental health, well-being, and quality of life has become increasingly important as a means to monitor population health over time, detect subgroups of children and adolescents facing greater difficulties, and assess the impact of prevention and health promotion interventions in specific populations and contexts.

Analyzing the relationship between environmental factors (such as air quality, CO_2 levels, temperature, humidity, ambient noise, and luminosity) and students' mental health can provide data to support guidelines and policies that promote increasingly healthy and productive environments in school contexts.

General Objective of the SENTIR Model

The main objective of this study is to propose an integrated model for assessing the mental health and well-being of children, adolescents, and young people in the municipality of Vale de Cambra, from a biopsychosocial and environmental perspective. The primary indicators include psychological symptoms

(anxiety, depression, and stress), perceived well-being, and stress management skills—fundamental variables for children's and adolescents' mental health.

This study also aims to contribute to scientific knowledge in the field of child and adolescent mental health by providing valuable information to stakeholders and supporting the development of public health, educational, and social policies.

Expected Impact of the Study or Project (in Ethical, Social, and/or Political Terms) - The expected impact of a diagnostic study on mental health and well-being in children, adolescents, and young people is significant across multiple domains:

Early Interventions - Early identification of mental health problems will enable appropriate interventions, which can help prevent the worsening of mental disorders and prolonged suffering.

Improvement of Quality of Life and Well-being - The study has the potential to enhance the quality of life of children, adolescents, and young people by reducing the negative impact of mental disorders on their development and social interactions.

Destigmatization - By normalizing the discussion of mental health at an early age, the study can contribute to reducing the stigma associated with mental health problems and encourage help-seeking behaviors when necessary.

Informing Public and Local Policies - The study results can provide critical data to inform public policies related to child and adolescent mental health. This may influence resource allocation, the development of prevention and treatment programs, and educational and social strategies.

Contribution to Knowledge - The study can enrich the scientific knowledge base on child and adolescent mental health, contributing to a better understanding of risk factors, disorder prevalence, and best intervention practices.

Establishment of Benchmarks - The study results can serve as benchmarks for future research and for improving diagnostic and assessment practices.

METHOD

Participants

The total sample consisted of 618 participants. Half of the sample was male (50.2%), and ages ranged from 9 to 18 years (M = 12.2; SD = 2.88). Participants were enrolled from the third year of primary school through upper secondary education.

Measures and Variables

The diagnostic model involved multiple data collection points, using a mixed-methods approach and different contexts.

In the initial and final assessments, qualitative methods were applied through individual interviews conducted by a psychologist with each child and adolescent. The interview guide is presented in **Table 1**.

Table 1 Initial and Final Interview Guide
1. I would like to get to know you better, tell me about the activities you usually do in your free time? The ones you like the most and the ones you don't like so much? Deepen the more or less healthy use of ICT and the development of sports activities, habits...
2. The more or less healthy use of ICT. Up to 2 years old – 0 minutes. From 2 to 5 years old – 60 minutes. From 5 to 17 years old – up to 120 minutes (excluding homework)

3. Sports activity from 5 to 17 years old, children and adolescents must have a physical activity at least 3 days a week and lasting at least 60 minutes.
4. Sleep hygiene. 3 to 5 years old – 10 to 13 hours. 6 to 13 years old – 9 to 11 hours. 14 to 17 years old – 8 to 10 hours.
5. Other relevant aspects of lifestyle (e.g., eating habits)
6. How do you evaluate your health, do you have any health problems that make it difficult for you to carry out some activities? If so, deepen the impact at the personal, school, family and peer group level...
7. Explore the impact on a personal level.
8. Explore the impact on school.
9. Explore the impact on the family.
10. Explore peer group impact
11. Regarding school, what do you like the most and what do you like the least. Deepen the relationship with teachers, the perception of school competence and the relationship with colleagues. Perception of safety at school. Address the perception of environmental conditions in the classroom
12. Deepen the relationship with teachers (e.g., discipline, conflict, "messages in the notebook", etc.).
13. Explore the perception of school competence (e.g., study habits, current and past school performance)
14. Deepen the relationship with colleagues (what is the involvement with them, acceptance, opinion about colleagues)
15. Explore perception of safety at school
16. A classroom neither too hot nor too cold
17. A classroom that is neither too dark nor too bright
18. A classroom with fresh air and smelling good.
19. A quiet classroom, where you can hear the teacher
20. Classroom ambient temperature: do you like your classroom warmer or cooler?
21. Classroom lighting: do you like your classroom with more light or less light?
22. Ambient noise in the classroom: do you like your classroom with some background noise or totally silent?
23. Regarding your friends, what activities do you usually develop together, what do you value most in a friendship relationship? Addressing friends in and out of school, risky activities and behaviors and in adolescents addressing the sexual pair
24. Approaching friends inside and outside of school
25. Risk activities and behaviors.
26. In adolescents, addressing the sexual pair (affective relationships)
27. A bridge can be made with the family and the perception of autonomy to carry out activities with friends.
28. In relation to your family, with whom do you live? Do you have siblings? What activities do you usually do with your family on weekdays and weekends? Understand the quality of family relationships, the ease of communication with parents and the perception of
29. Quality of family relationships (e.g. exploring parenting style)
30. Ease of communication with parents.
31. Perception of support from the family.

32. When you think about the future that dreams you have, what would you like to do? And what fears do you have? Understand future expectations and projects - optimism/orientation for life.
33. Explore life expectations and goals (e.g. vocational guidance).
34. Identify dreams and aspirations (It is important to evaluate the capacity for flexibility. If your plans don't go exactly as you expect, what will you do? What alternatives do you have?).
35. Explore possible concerns and coping mechanisms.
36. Would you like to add any more information about yourself and the things that are important to you?

Next, during the school year, quantitative data were collected in the classroom context. At this stage, questions from the Health Behaviour in School-aged Children (HBSC) study protocol (Gaspar et al., 2022) were used. Each week, a mood tracker measure was collected, in which participants rated their mood from 0 to 10, where 0 indicated “very sad” and 10 “very happy.” The questions and response operationalization are shown in **Table 2**.

Table 2 Questions and the Operationalization of Answers

Question	Operationalization of the response
Do you feel satisfied with your life?	S/N
Moodtracker	0-10
Feeling tired and out of energy?	S/N
Feeling agitated and stressed?	S/N
Feeling focused?	S/N
Are you or worried?	S/N
In the last week, have you felt alone?	S/N
How would you describe your sleep?	S/N
Screen dependency	S/N
In the last week have you felt worried about your appearance?	S/N
Do you feel happy at home?	S/N
Concerns about the home	S/N
Have you bullied other people at school in the last 2 months?	S/N
In your opinion, how do you rate the air quality in the classroom?	S/N
In your opinion, how do you rate the temperature in the classroom?	S/N
In your opinion, how do you classify light in the classroom?	S/N

At the end of the school year, along with the final interview, quantitative instruments were administered by psychologists to assess psychological symptoms, perceived well-being, and stress management skills. The instruments used in this phase are described in the following section.

Psychological Instruments

Depression Anxiety Stress Scale (DASS)

The Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995; Portuguese version: Ribeiro et al., 2004) is a reference instrument for assessing symptoms of anxiety, depression, and stress. The Portuguese version used with young adults and adults consists of 21 items organized into three subscales—each containing

seven items—to measure each construct. It uses a 4-point Likert-type response scale, ranging from 1 ("Does not apply to me at all") to 4 ("Applies to me most of the time").

In Portugal, the use of this scale has been mainly directed toward adults or young adults (e.g., Massano-Cardoso et al., 2024), and there are few, non-recent studies examining its performance among children and adolescents (e.g., Leal et al., 2009).

In the present study, the total scale showed good internal consistency (α = .910), as did the subscales: DASS-Stress (α = .796), DASS-Depression (α = .813), and DASS-Anxiety (α = .763), according to Nunnally and Bernstein's (1994) criteria.

World Health Organization – Five Well-Being Index (WHO-5)

The World Health Organization – Five Well-Being Index (WHO-5; WHO, 1988; Portuguese version: Gaspar et al., 2022) assesses well-being over the previous two weeks. It consists of five items (e.g., "I have felt cheerful and in good spirits" – Item 1), using a 6-point Likert-type response scale ranging from "All of the time" to "At no time." Higher scores indicate greater well-being.

In the present study, the scale showed good internal consistency (α = .846), consistent with Nunnally and Bernstein's (1994) standards.

Psychological Symptoms (HBSC)

Psychological symptoms were assessed using a 4-item scale (nervousness, irritability/bad temper, sadness, and fear) with a 5-point Likert-type response scale, ranging from 1 ("Almost every day") to 5 ("Rarely or never"). Scores may range from 4 to 20, with higher values indicating fewer symptoms (Gaspar et al., 2024). The original scale is included in the Health Behaviour in School-aged Children (HBSC) questionnaire.

The HBSC/WHO study is a collaborative project of the World Health Organization aimed at examining adolescents' lifestyles and behaviors across various domains of life, covering demographic, behavioral, and psychosocial health aspects (Matos & Social, 2018).

In the present study, the scale showed good internal consistency (α = .738), according to Nunnally and Bernstein's (1994) criteria.

Perceived Stress Scale (PSS-4)

The Perceived Stress Scale (PSS; Cohen et al., 1983; Portuguese version: Gaspar et al., 2022) measures perceived stress. The version used in the present study includes 4 items (e.g., "In the last month, how often have you felt unable to control the important things in your life?" – Item 1), with a 5-point Likert-type scale ranging from "Never/Almost never" to "Always/Almost always."

To ensure that higher scores reflect greater stress management ability, items 1 and 4 are reverse-coded.

In the present study, the scale demonstrated very good internal consistency (α = .855), following Nunnally and Bernstein's (1994) criteria.

Environmental Measures

The model also integrates **environmental measures**. The main variables analyzed are related to ambient temperature, humidity, atmospheric pressure, air quality, carbon dioxide (CO_2), light intensity, ambient noise, Wi-Fi signal strength, colorimetry, light temperature, flux, and number of people.

Table 3 Environmental measures

Greatness	Interval	Precision	Error
Room temperature	-20 to +85ºC	0.1º C	± 0.4ºC
Humidity	0 to 100%	1%	± 3%
Atmospheric pressure	260 to 1260 hPa	0.5 hPa	± 1 hPa
Air Quality (VOC's)	0 to 32768 ppb	1 ppb	< 4%
Carbon Dioxide	400 to 29206 ppm	1 ppm	± 2%
Luminous Intensity	0.01 to 83 K light	0.01 lux	< 0.2%
Ambient noise	17 to 120 dB SPL	1 dB	FS ± 1 dB
WiFi Intensity Level	-100 to 0 dBm	1 dBm	± 2 dBm
Collometry (RGB)	0 to 100%	1%	< 0.5%
Light Temperature	0 to 1000ºK	0.1 ºK	± 0.8 ºK
People Flow (devices)	-1000 to +1000	1	< 1
Number of People	0 to 500	1	< 1

Each variable is measured within a specific range, and as shown in **Table 3**, both sensor precision and measurement error are ensured. This information was collected by sensors placed in classroom settings, operating continuously throughout the school year.

Procedure

This cross-sectional and quantitative study was approved by the Ethics and Deontology Committee for Scientific Research (CEDIC) (Ref. CEDIC-2023-10-18).

Data collection took place in two distinct ways: through in-person data gathering at various schools within

schools in the municipality of Vale de Cambra, and digitally, via online links completed by participants and teachers. The instruments administered included collective questionnaires and complementary individual forms.

A web-based platform was developed to enable centralized data collection, integration, and management. In parallel, a mobile application (app) was made available to children, adolescents, and young people aged 8 to 18 years, allowing them to voluntarily answer complementary questions and supporting the study's dissemination.

Additionally, environmental data from classrooms were collected through IoT sensors, later integrated into the digital platform to complement the overall analysis.

The diagnostic model involved initial and final assessments, conducted by trained psychologists. Weekly data collection in the classroom context was carried out by the teacher responsible for each class, selected by the school and trained by the project team.

Informed consent was obtained from parents or legal guardians after information and awareness sessions about the study's objectives and procedures. The study was implemented over two academic years (2023/2024 and 2024/2025). The data collected were anonymized and will be stored for a period of five years to enable further analyses and the potential expansion of the diagnostic model to other populations.

For statistical analysis, the SPSS software was used, applying descriptive, comparative, and correlational analyses to explore the relationships among the study variables.

Data Analysis and Processing

The interviews were subjected to content analysis, organized by predefined categories and subcategories, and subsequently classified into three risk levels—low, moderate, and high—within each analytical category, to enable statistical treatment of the qualitative data.

For the statistical analyses, the SPSS software was used. Descriptive, comparative, and correlational analyses were performed to explore the relationships among the study variables.

RESULTS

Comparisons Between Initial and Final Assessments

To assess the impact of the SENTIR model on psychological and environmental indicators, comparisons were made between the **initial** and **final evaluations** of the same participants.

Table 4 presents the results of the paired-sample t-tests comparing the pre- and post-assessment means across key variables.

Table 4 Comparison of Student's T Groups for Paired Samples - Initial Assessment Final Assessment

	Initial Assessment		Final Evaluation		t/sig
	M	DP	M	DP	
1. I would like to get to know you better, tell me about the activities you usually do in your free time? The ones you like the most and the ones you don't like so much? Deepen the more or less healthy use of ICT and the development of sports activities, habits...	0.38	0.65	**0.51**	0.75	-2.805**
2. The more or less healthy use of ICT. Up to 2 years old – 0 minutes. From 2 to 5 years old – 60 minutes. From 5 to 17 years old – up to 120 minutes (excluding homework)	0.58	0.75	**0.76**	0.83	-3.672***
3. Sports activity from 5 to 17 years old, children and adolescents must have a physical activity at least 3 days a week and lasting at least 60 minutes.	0.33	0.63	0.29	0.63	0.791
4. Sleep hygiene. 3 to 5 years old – 10 to 13 hours. 6 to 13 years old – 9 to 11 hours. 14 to 17 years old – 8 to 10 hours.	0.29	0.57	0.34	0.63	-1.247
5. Other relevant aspects of lifestyle (e.g., eating habits)	0.27	0.51	0.22	0.48	1.290
6. How do you evaluate your health, do you have any health problems that make it difficult for you to carry out some activities? If so, deepen the impact at the personal, school, family and peer group level...	0.23	0.51	0.21	0.47	0.896
7. Explore the impact on a personal level.	0.18	0.46	0.17	0.44	0.397
8. Explore the impact on school.	**0.18**	0.39	0.12	0.39	2.073*
9. Explore the impact on the family.	**0.10**	0.36	0.06	0.26	1.721*
10. Explore peer group impact	0.10	0.38	0.07	0.30	1.349
11. Regarding school, what do you like the most and	0.21	0.49	**0.28**	0.57	1.951*

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what do you like the least. Deepen the relationship with teachers, the perception of school competence and the relationship with colleagues. Perception of safety at school. Address the perception of environmental conditions in the classroom					
12. Deepen the relationship with teachers (e.g., discipline, conflict, "messages in the notebook", etc.).	0.17	0.45	0.13	0.36	1.196
13. Explore the perception of school competence (e.g., study habits, current and past school performance)	0.27	0.52	0.23	0.51	1.166
14. Deepen the relationship with colleagues (what is the involvement with them, acceptance, opinion about colleagues)	0.22	0.52	0.23	0.52	-0.377
15. Explore perception of safety at school	**0.13**	0.43	0.04	0.21	3.374***
16. A classroom neither too hot nor too cold	1.52	1.03	1.63	1.00	1.284
17. A classroom that is neither too dark nor too bright	**1.70**	1.03	1.53	1.01	2.130*
18. A classroom with fresh air and smelling good.	1.58	1.13	1.69	1.16	1.317
19. A quiet classroom, where you can hear the teacher	1.00	1.18	**1.16**	1.120	-1.816*
20. Classroom ambient temperature: do you like your classroom warmer or cooler?	0.45	0.50	**0.65**	0.48	5.438***
21. Classroom lighting: do you like your classroom with more light or less light?	**0.41**	0.49	0.23	0.42	5.007***
22. Ambient noise in the classroom: do you like your classroom with some background noise or totally silent?	0.52	0.50	0.47	0.50	1.525
23. Regarding your friends, what activities do you usually develop together, what do you value most in a friendship relationship? Addressing friends in and out of school, risky activities and behaviors and in adolescents addressing the sexual pair	**0.18**	0.49	0.12	0.40	1.898*
24. Approaching friends inside and outside of school	**0.17**	0.45	0.10	0.37	2.609**
25. Risk activities and behaviors.	0.16	0.44	**0.06**	0.27	3.182***
26. In adolescents, addressing the sexual pair (affective relationships)	0.02	0.13	0.01	0.15	0.301
27. A bridge can be made with the family and the perception of autonomy to carry out activities with friends.	**0.13**	0.41	0.07	0.32	1.738*
28. In relation to your family, with whom do you live? Do you have siblings? What activities do you usually do with your family on weekdays and weekends? Understand the quality of family relationships, the ease of communication with parents and the perception of	0.26	0.54	0.20	0.51	1.621*
29. Quality of family relationships (e.g. exploring	**0.26**	0.57	0.19	0.50	1.795*

parenting style)					
30. Ease of communication with parents.	0.28	0.55	0.23	0.50	1.224
31. Perception of support from the family.	**0.18**	0.51	0.10	0.39	2.615**
32. When you think about the future that dreams you have, what would you like to do? And what fears do you have? Understand future expectations and projects - optimism/orientation for life.	0.27	0.51	0.27	0.49	-0.099
33. Explore life expectations and goals (e.g. vocational guidance).	0.23	0.47	0.23	0.49	-0.104
34. Identify dreams and aspirations (It is important to evaluate the capacity for flexibility. If your plans don't go exactly as you expect, what will you do? What alternatives do you have?).	**0.26**	0.53	0.19	0.43	1.807*
35. Explore possible concerns and coping mechanisms.	0.33	0.61	0.32	0.54	0.239
36. Would you like to add any more information about yourself and the things that are important to you?	**0.04**	0.22	0.01	0.11	1.675*

Note *p < .05; **p < .01; *** p < .001

The analysis showed statistically significant improvements in mood (p = .021), reduction of psychological symptoms such as anxiety (p = .003), sadness (p = .002), irritability (p = .034), and fear (p = .005), as well as a decrease in fatigue (p = .048).

Environmental perceptions—namely air quality, classroom temperature, and lighting—also exhibited positive trends, though without reaching statistical significance.

Descriptive Statistics and Correlations Between Main Variables

Table 5 presents the descriptive statistics for the main variables under study.

Variables	Mean	Standard Deviation	Minimum	Maximum
Well-being (WHO-5)	16.94	4.39	0	25
Depression (DASS)	5.02	4.42	0	21
Anxiety (DASS)	5.58	4.07	0	21
Stress (DASS)	8.42	4.62	0	21
Psychological symptoms (HBSC)	15.21	2.94	4	20
Stress management (PSS-4)	10.05	2.99	0	16

Table 6 displays the correlation matrix among the main variables analyzed in the study.

Variables	**1**	**2**	**3**	**4**	**5**	**6**
1. Well-being (WHO-5)	—					
2. Depression (DASS)	-.528**	—				
3. Anxiety (DASS)	-.450**	.714**	—			
4. Stress (DASS)	-.470**	.744**	.803**	—		

5. Psychological symptoms (HBSC)	.562**	-.546**	-.459**	-.518**	—	
6. Stress management (PSS-4)	.556**	-.472**	-.454**	-.454**	.492**	—

The results reveal strong negative correlations between well-being and psychological symptoms **(**depression, anxiety, and stress), as well as positive correlations between well-being and stress management skills**.**

Specifically, higher levels of stress management were significantly associated with greater well-being and fewer symptoms of depression, anxiety, and stress. These associations are consistent with the theoretical model, highlighting the protective role of coping and stress regulation skills in the mental health of children and adolescents.

Group Comparisons: Gender, Nationality, and Age

Table 7 Comparison by Gender

Variables	**Male (M)**	**Female (M)**	**t**	**p**
Well-being (WHO-5)	17.54	16.35	2.91	.004**
Depression (DASS)	4.45	5.57	-2.55	.011*
Anxiety (DASS)	4.96	6.20	-3.21	.001**
Stress (DASS)	7.75	9.12	-3.13	.002**
Psychological symptoms (HBSC)	15.74	14.65	3.26	.001**
Stress management (PSS-4)	10.43	9.66	2.39	.017*

Gender comparisons revealed that girls reported significantly higher levels of anxiety, depression, and stress**,** while boys demonstrated higher stress management skills and overall well-being.

These results are consistent with previous research indicating greater vulnerability among girls to internalizing symptoms and a greater tendency among boys toward emotional regulation and coping behaviors.

Table 8 Comparison by Nationality

Variables	**Portuguese (M)**	**Foreign (M)**	**t**	**p**
Well-being (WHO-5)	16.97	16.63	0.37	.709
Depression (DASS)	5.00	5.47	-0.51	.609
Anxiety (DASS)	5.60	5.10	0.54	.592
Stress (DASS)	8.42	8.40	0.02	.985
Psychological symptoms (HBSC)	15.20	15.36	-0.26	.796
Stress management (PSS-4)	10.06	9.77	0.36	.717

significant differences were observed according to nationality, indicating similar levels of mental health and well-being between Portuguese and foreign participants in this sample.

Table 9 Comparison by Age Group

Variables	**9–12 years (M)**	**13–15 years (M)**	**16–18 years (M)**	**F**	**p**
Well-being (WHO-5)	17.85	16.45	15.50	5.33	.005**
Depression (DASS)	4.13	5.17	6.30	5.18	.006**
Anxiety (DASS)	4.72	5.63	6.72	6.14	.002**

Stress (DASS)	7.49	8.56	9.84	6.78	.001**
Psychological symptoms (HBSC)	15.82	15.13	14.34	5.25	.006**
Stress management (PSS-4)	10.61	9.90	9.11	4.88	.008**

A significant age effect was observed across all mental health indicators.Younger students (ages 9–12) presented higher well-being and stress management skills and fewer psychological symptoms, whereas older adolescents (ages 16–18) exhibited higher levels of depression, anxiety, and stress**.**

These findings reinforce the progressive increase in psychological vulnerability during adolescence and highlight the importance of early prevention and intervention programs to promote mental health and well-being in younger age groups.

Regression Models

To identify the main predictors of mental health and well-being, hierarchical regression analyses were conducted including individual, family, relational, and school variables.

Table 10 Regression Model for Well-Being (WHO-5)

Predictors	**β**	**t**	**p**
Life satisfaction	.356	8.67	.000***
Sleep quality	.202	4.90	.000***
Screen dependence	-.119	-2.89	.004**
Concerns/worries	-.113	-2.83	.005**
Classroom conditions (air, temperature, lighting)	.076	2.01	.045*

R^2 = .26; F(5, 612) = 43.46; p < .001

*p < .05; **p < .01; **p < .001

The model explains **26**% of the variance in well-being. The strongest predictors were life satisfaction, sleep quality, lower screen dependence, and fewer personal concerns. Better classroom environmental conditions also contributed positively, though with a smaller effect size.

Table 11 Regression Model for Psychological Symptoms (HBSC)

Predictors	**β**	**t**	**p**
Life satisfaction	.310	7.02	.000***
Sleep quality	.173	3.95	.000***
Screen dependence	-.102	-2.54	.011*
Concerns/worries	-.151	-3.79	.000***
Classroom conditions (air, temperature, lighting)	.078	2.02	.044*

R^2 = .24; F(5, 612) = 38.46; p < .001

*p < .05; **p < .01; **p < .001

The predictors together explained 24% of the variance in psychological symptoms. Again, higher life satisfaction and better sleep quality were associated with fewer psychological symptoms, whereas screen dependence and personal concerns were associated with greater symptomatology. Positive classroom environmental conditions acted as a modest protective factor.

Table 12 Regression Model for Stress Management (PSS-4)

Predictors	**β**	**t**	**p**
Life satisfaction	.332	7.93	.000***
Sleep quality	.204	4.82	.000***
Screen dependence	-.126	-3.10	.002**
Concerns/worries	-.109	-2.71	.007**
Classroom conditions (air, temperature, lighting)	.083	2.18	.030*

R^2 = .25; F(5, 612) = 40.63; p < .001

*p < .05; **p < .01; **p < .001

The predictors accounted for 25% of the variance in stress management skills.Higher life satisfaction and good sleep quality were associated with better stress management, while screen dependence and concerns reduced adaptive coping. Favorable environmental conditions also contributed modestly to higher stress regulation.

Taken together, the regression analyses demonstrate that individual variables (life satisfaction, sleep quality, and personal concerns) and contextual variables (environmental classroom conditions) play a significant role in predicting well-being and mental health outcomes among children and adolescents.

These findings reinforce the biopsychosocial and ecological perspective of the SENTIR model, highlighting the interaction between individual and contextual dimensions.

DISCUSSION AND CONCLUSIONS

The main objective of this study was to propose and test a multidimensional and ecological model for assessing mental health and well-being among children and adolescents, integrating individual, relational, and environmental variables. The results confirm the model's relevance and highlight the importance of adopting an integrative approach to understanding and promoting mental health.

Overall, the findings revealed moderate levels of well-being and stress management skills, as well as low levels of psychological symptomatology among the participants. The analyses also indicated significant associations between well-being, stress management, and the presence of symptoms such as depression, anxiety, and stress. These results are consistent with previous research emphasizing the protective role of coping skills and life satisfaction in mental health (Gaspar et al., 2018; Gaspar et al., 2022; Matos et al., 2021; WHO, 2001).

The comparison between the initial and final assessments demonstrated significant improvements in mood and reductions in anxiety, irritability, sadness, and fear, suggesting that ecological and preventive interventions within the school context may foster positive changes in mental health and well-being. These findings align with prior studies showing the effectiveness of school-based mental health promotion programs (Cefai et al., 2021; Tomé et al., 2020; Gaspar et al., 2020).

Gender differences followed the well-documented trend of greater internalizing symptomatology among girls and better stress regulation among boys, consistent with the literature (Gaspar et al., 2018; Matos et al., 2018; Gomez-Baya et al., 2018). Likewise, the age gradient observed — with older adolescents reporting higher levels of distress and lower well-being — reinforces the need for early and age-tailored interventions. These findings reflect the developmental vulnerabilities of adolescence and the increasing psychosocial demands during this life stage.

The regression models confirmed that life satisfaction, sleep quality, screen dependence, personal concerns, and classroom environmental conditions are significant predictors of well-being, psychological symptoms, and stress management. This underscores the multidimensional nature of mental health, in which individual,

behavioral, and contextual factors dynamically interact. Notably, environmental variables, though showing smaller effect sizes, demonstrated consistent associations across the models, reinforcing the ecological perspective of the SENTIR model.

The findings support the notion that mental health promotion in children and adolescents should encompass a biopsychosocial and ecological approach, addressing not only individual competencies but also relational and environmental dimensions that influence development and well-being (Bronfenbrenner, 2005; WHO, 2002). This approach encourages the creation of healthy and inclusive school environments, integrating psychological, social, and physical components that foster resilience and quality of life.

In practical terms, the SENTIR model contributes to the diagnosis, monitoring, and promotion of mental health through the combined use of psychological, behavioral, and environmental indicators. The results highlight the potential of this integrated model for informing educational and municipal policies, improving the articulation between schools, families, and health services, and supporting evidence-based decision-making at local and national levels.

Future studies should extend this model to longitudinal and intervention-based designs, allowing the evaluation of change over time and the testing of targeted actions to enhance mental health and well-being. It is also recommended to include biometric and physiological measures, along with digital behavioral indicators, to expand the understanding of the interaction between environmental and psychological dimensions.

In conclusion, this study demonstrates that the mental health and well-being of children and adolescents must be understood through a multidimensional and ecological perspective, in which individual, social, and environmental factors interact dynamically. This integrated view enables the development of comprehensive, preventive, and participatory policies, contributing to healthier, more resilient, and inclusive communities.

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