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Artificial Intelligence in Addressing School-Related Anxiety in Adolescence: Digital Approaches and Inclusive Perspectives in Secondary Education

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Abstract

School-related anxiety constitutes one of the most prevalent and disruptive mental health challenges in secondary education, particularly during adolescence—a developmental stage marked by emotional sensitivity, academic pressure, and heightened social evaluation. Persistent anxiety associated with school demands has been linked to impaired academic performance, emotional dysregulation, absenteeism, and increased risk of school refusal. In recent years, advances in Artificial Intelligence (AI) have generated new opportunities for the early identification, prevention, and management of school-related anxiety through adaptive, personalized, and data-driven digital interventions. This paper examines how AI-based technologies can be employed to support adolescents experiencing school-related anxiety within secondary education settings, drawing on an integrative narrative review of literature published between 2010 and 2025. The review focuses on AI-supported mental health applications, affective computing systems, intelligent tutoring environments, and digital anxiety-regulation tools explicitly targeting anxiety-related symptoms and stress responses. The analysis is grounded in psychological and educational frameworks relevant to anxiety, including cognitive-behavioral theory, self-determination theory, Universal Design for Learning (UDL), and inclusive education perspectives. The paper critically discusses the potential of AI to detect early indicators of anxiety, provide individualized anxiety-management strategies, and support timely school-based interventions while avoiding stigmatization and exclusion. Ethical concerns related to data privacy, surveillance, algorithmic bias, and equity of access are also examined. The findings suggest that AI-based tools can enhance school-based anxiety support when implemented within human-centered, inclusive, and ethically governed educational ecosystems. Implications for educational policy, teacher mediation, and future research on AI-supported anxiety interventions in secondary education are discussed.

Keywords: School-Related Anxiety; Adolescent Anxiety; Artificial Intelligence in Education; Digital Mental Health; Affective Computing; Inclusive Education; Secondary Education; Anxiety Regulation

1. Introduction

Adolescent mental health has been a major topic in educational research and policy especially about students in secondary schools. Nowadays, apart from being academic centers, schools are also considered to play a vital role in fostering students' emotional well-being, resilience, and psychosocial development. This change reflects a lot of research studies that have shown that students' emotional distress and particularly their anxiety related to school has a major impact on their academic progress, social involvement, and future life quality (OECD, 2019; UNESCO, 2021). To come to terms with the increasing levels of adolescent anxiety, educational systems worldwide need to be innovative, widespread, and ethically-sound in providing emotional support to students in their schools.

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Education, on the other hand, is also being impacted radically by the digital revolution. Digital technologies are now an integral part of teaching, learning, and assessment which drastically change the ways students relate to knowledge, their teachers, and their peers. Likewise, gradually digital solutions have been a feature of the school mental health field bringing fresh ideas for the detection, prevention, and treatment of emotional problems (Holmes et al., 2021; OECD, 2023). While first-generation digital mental health care was usually inflexible and impersonal, the highlight today is on more personalized and intelligent devices that can even detect and respond to students' emotional conditions.

Among these innovations, Artificial Intelligence (AI) is the one that has triggered the most excitement. Implementing AI-based technologies can help change the face of mental health by enabling the systems to first detect distress signals based on patterns and to then offer the most suitable assistance before the situation worsens.Schools are seen as the perfect places for such programs to be rolled out since they can be actual helpers along with psychosocial specialists, teachers' assistants, and students' aides in taking care of the regulation and management of the latter's emotions (Luckin et al., 2016; Holmes et al., 2019). Furthermore, AI has become the driving force behind digital mental health by shifting it from being a merely reactive system to becoming a preventive model which raises the possibility of schools tackling student anxiety even before such an emotion interferes with academic engagement or causes exclusion.The coalescence of AI with the provision of adolescent mental health raises a serious pedagogical, ethical, and social justice issues, however. Scholars from the critical perspective warn that, without a proper reflection, data-driven tools may be the main contributors to netting societies into the ever-watching eyes of surveillance, standardizing a very limited conception of emotional functioning, and reinforcing the inequities of the very social structures that the data came from (Selwyn, 2019; Williamson & Piattoeva, 2022).

Furthermore, a teenager is going through a phase of life during which there is a need for autonomy, defining oneself, as well as having balanced power relations. Besides, character development areas indeed make the ethical issue of collecting, analyzing, and using emotions in the school setting even more critical. Hence, the adoption of AI-supported emotional assistance can be critically understood through the eyes of an inclusive education theoreticians and practitioners. Current theories of inclusion focus on emotional well-being as a shared product of the individual's interaction with his/her immediate context, liberation, pedagogy, and social justice instead of a sole responsibility of the individual (Ainscow, 2020; Florian, 2019).According to them, AI should not be viewed simply as a piece of technology that is unbiased but rather as an educational intervention from which the outcome entirely depends on how it is developed, led, and facilitated by teachers and school staff in general. Another stance, that of Universal Design for Learning (UDL), raises awareness about the need for adaptability, availability, and acceptance of emotional variety even in the slightest technological advancement (CAST, 2018).

Therefore, the author believes AI is not a substitute for human care but rather an instrument that can be used to support and extend, inclusive, nurturing educational practices. They contemplate how to utilize the potential of digital technologies for adolescent mental health by reconceptualizing that potential from the framework of psychological theory, inclusive pedagogy, and ethical formation. After discussing the issue of school anxiety and adolescent emotional development, the paper explores the ever-increasing use of digital technologies in school mental health and the pros and cons of AI, thereby setting up the perspective of recognizing AI as a mere tool whose strength depends on its ability to nurture relational and equitable educational ecosystems.

1.1. School Anxiety and Emotional Well-Being in Adolescence

Adolescence is a key period of human development characterized by major changes in thinking, feelings, and interaction with others. Secondary school students must cope with not only greater academic demands but also more intense social expectations and pressures to figure out who they are and plan their futures. Under such circumstances, anxiety about school has been identified as one of the most common and disruptive internalizing problems of youth at a global level (OECD, 2019; Suldo et al., 2016). It entails the involuntary recurring worry, fear, and bodily symptoms such as heart racing due to the stress of school that may come from working on the things they are learning at school, meeting friends, being judged, or simply going to school. Unfortunately, these problems very often lead to both lower academic performance and emotional health (Putwain & Daly, 2014; Essau et al., 2020).

Studies reveal that there has been a continuous increase in adolescents' anxiety symptoms over the last ten years, and the main causes have been school-related stressors among other factors (Twenge et al., 2019; Loades et al., 2020). Some conditions at school such as periodic standardized testing, the desire to be the best in class, and the lack of tolerance for emotions only worsen the situation, especially for the students who, besides other, are facing such challenges as learning disabilities, having a neurodevelopmental disorder, or being emotionally impacted because of their background (McLaughlin & King, 2015; Arslan, 2022). Besides eventual depression, chronic worry about school may lead the already

tired students to stay at home avoiding school to the point that their academic failure and drop out become inevitable (Kearney, 2016; Steinmayr et al., 2018).

On the other hand, emotional health is more about the positive end of the spectrum that enables one to bounce back, get motivated, and use effective problem-solving strategies. Recent theories suggest that adolescent well-being is only partly defined by the absence of negative states and that it is important to consider the youth's emotional skills, social ties, their belief in themselves, and the feeling that their school is their community in describing their well-being (Keyes, 2014; Suldo & Shaffer, 2008). For that matter, schools are viewed to have a dual role as places for acquiring knowledge and at the same time as being key spaces where mental health can be nurtured, and emotional needs attended to (Weare, 2015; UNESCO, 2021).

1.2. The Growing Role of Digital Technologies in School Mental Health

As adolescent mental health concerns continue to rise, educational environments are becoming more and more digitalized. For the past ten years, digital technologies have slowly crept into the domain of psychosocial support, providing new ways for emotional monitoring, intervention, and prevention in schools (Fitzpatrick et al., 2017; Holmes et al., 2021). Digital mental health tools such as mobile apps, online cognitive-behavioral therapy programs, learning analytics systems, and VR environments have shown effective results in lessening anxiety symptoms and improving emotional self-regulation among the youth (Ebert et al., 2015; Rauschenberg et al., 2021).

In schools, such technologies can make mental health support have a wide reach, be very adaptable, and come in a form that's not easily stigmatized, thus being able to supplement the already existing, and often, underfunded or start difficult to access, school counseling services (Richardson et al., 2017; OECD, 2023). Through digital means, adolescents may choose to use the support tools for their emotional well-being independently, in a manner and time convenient to them, and in an environment, they feel comfortable (Rideout & Fox, 2018).

Nevertheless, initial digital therapies were mostly non-interactive and based solely on rules, so they did not really consider the individual needs and emotional state of each person. Thus, it is easy to see why their effectiveness was very limited when it came to the complex and changeable nature of adolescent anxiety (Fleming et al., 2019). These drawbacks have encouraged a move towards the development of more adaptive, smart systems that can respond efficiently to the learners' emotional and situational requirements.

At this point, we want to emphasize the significance of all digital technologies in the field of education. ICTs support education for all, provide new techniques for effective teacher training, enhance memory retention, promote cooperation, increase transparency, develop learner-centered strategies, develop new teaching techniques, and speed up learning. Additionally, through virtualization, mobilization, artificial intelligence, and new learning environments-worlds, give new instruments for knowledge representation and support educational activities and techniques. More specifically, ICTs are very effective and productive at all levels of education. They facilitate and enhance the processes of assessment, intervention, and education through mobile devices, which spread educational activities throughout the world [71], and through a variety of ICT applications, which are the main drivers of education [72-76]. While games turn education into a multimodal, incredibly amiable, and enjoyable interaction [79], the use of AI, STEM, and ROBOTICS raises educational procedures into new levels of adaptation, creativity, and performance [77-78]. Furthermore, the adoption, improvement, and fusion of ICTs with theories and models of metacognition, mindfulness, meditation, and emotional intelligence cultivation [80-86] places the development of mental abilities at the center of educational procedures and policies, which accelerates and improves educational practices and outcomes, particularly in secondary education and its procedures, like assessment and intervention.

1.3. Artificial Intelligence as a Transformative Tool in Educational Support

The rise of Artificial Intelligence (AI) has radically changed the dynamics of education and mental health by revamping how emotional states are detected, understood, and facilitated. In school environments, AI means those systems that can learn from data, identify patterns, and modify their responses by using methods such as machine learning, natural language processing, affective computing, and predictive analytics (Luckin et al., 2016; Holmes et al., 2019).

For instance, when studying the emotional health of teenagers, AI has the capacity to analyze behavioral, linguistic, and physiological signs of anxiety, stress, and emotional dysregulation in real time (Calvo & D'Mello, 2010; Picard, 2015). Furthermore, AI-based systems are highly efficient in customizing interventions, suggesting the most suitable coping mechanisms, and varying the emotional support according to the individual's profile thus effectively eliminating generic methods (Kool et al., 2020; Kooli, 2025). Moreover, there are educational AI-driven products like intelligent tutoring systems, mood-sensitive learningplatforms, conversational AI agents, and digital self-regulation coaches that are

gaining traction in the secondary school sector as ways of supporting students emotionally and keeping them academically motivated (Graesser et al., 2018; Wang et al., 2024). Equally significant is the fact that AI facilitates psychological support to be of a proactive and preventive nature by predicting the development of an anxiety state at its earliest stage even before the patient shows signs that are considered as a behavioral disorder or academic withdrawal (Reinke et al., 2023).

Nevertheless, deploying AI in school mental health services challenges the educators with questions that revolve around pedagogy, ethics, and inclusiveness. AI, if not well thought out and guided by a person, will inevitably lead to a reinforcement of surveillance cultures, will contribute to the emotional diversity becoming viewed as pathology, and will incidentally exclude the most marginalized of student populations (Selwyn, 2019; Williamson & Piattoeva, 2022). For these reasons, the examination of AI should extend beyond it as merely a technological breakthrough, it should be considered as a socio-educational intervention that is based on the values of care, fairness, and inclusion.

1.4. Inclusion, Equity, and Ethical Imperatives in Secondary Education

Inclusive education policies consider emotional health and mental health services to be basic rights and not privileges (Ainscow, 2020; Florian, 2019). The reality is that anxiety should not be regarded as an inherent problem of the individual but rather as a result of the interaction of the student with the environment. UDL and social justice-oriented pedagogy emphasize the need for the creation of classroom environments that emotionally support all students and be prepared for the fact that students will react differently to stress and will have different ways of handling it (CAST, 2018; Florian & Beaton, 2018).

Emotionally supportive AI systems, if deployed with the principles of inclusiveness, could help in breaking down the barriers to participation by offering a type of support that is both discreet and culturally responsive (Drigas & Mitsea, 2022; Pagliara et al., 2024). Nevertheless, the question of equity cannot be overlooked. For instance, the lack of proper digital infrastructure, biased algorithms, and concerns on data confidentiality could be some of the disadvantages that students from underprivileged backgrounds might face (OECD, 2023; Saini et al., 2024).

Currently, many ethical guidelines emphasize a "human-in-the-loop" approach, which means AI supports teachers' decision-making and interactions with students rather than replacing them completely (Holmes et al., 2021; Urbani, 2024). Here, the educator continues to play the role of the interpreter, the student is still the agent of her/his actions, and the information about the student's feelings serves the purpose of offering more support rather than imposing a form of control. The importance of this moral stand cannot be overstated at the stage of adolescence because it is at this time that young people are most vulnerable to power relations due to their need for autonomy, trust, and identity development.

1.5. Aim of the Study and Research Questions

Considering this, the main goal of this paper is to critically evaluate the role of Artificial Intelligence as a tool to support secondary school students' school anxiety and emotional well-being. Instead of merely focusing on the efficiency of technology, this research takes an inclusive, pedagogically based standpoint that brings together knowledge from educational psychology, digital mental health, and inclusive education.Concretely, this paper aims to resynthesize recent studies (2010 2025) on AI-powered digital emotional support solutions for schools, reflect on their implication for inclusion and equity, and outline the ethical and pedagogical prerequisites of their responsible usage. Framing AI as a tool for emotional care rather than a means of behavior control, the paper submits a novel interpretation of the role of technology in an educative environment towards more humanity, not less.

The study questions that guide this research are:

- What role does Artificial Intelligence currently play in addressing secondary school students' school anxiety and emotional well-being?
- What are the pedagogical and psychological benefits of AI-motivated emotional support systems as compared to conventional methods?
- What sort of ethical, inclusive, and practical issues should be considered to guarantee that AI serves student well-being and educational equity instead of harming them?

2. Methodology

This study adopts an integrative narrative review methodology to examine how Artificial Intelligence (AI)–supported digital interventions contribute specifically to the identification, prevention, and reduction of school-related anxiety among secondary school students. The methodological framework is explicitly grounded in educational psychology, digital pedagogy, and inclusive education, reflecting the multidimensional nature of anxiety as a school-based, relational, and context-dependent phenomenon rather than a purely individual clinical condition.

Given the rapid evolution of AI technologies and their increasing application in educational and psychosocial contexts, a flexible yet theoretically rigorous review design was deemed appropriate. Narrative and integrative reviews are particularly suitable for conceptually complex and interdisciplinary fields where empirical findings, theoretical models, and ethical considerations intersect (Greenhalgh et al., 2018; Snyder, 2019). In contrast to systematic reviews that prioritize narrowly defined outcomes and standardized measures, an integrative narrative approach enables the synthesis of diverse forms of evidence relevant to school anxiety, including quantitative intervention studies, qualitative school-based research, conceptual analyses, and policy-oriented literature.

The methodological stance of the present review is further informed by inclusive education principles, which conceptualize anxiety as emerging from interactions between learners and their educational environments. Within this perspective, Universal Design for Learning (UDL) provides a critical lens for evaluating whether AI-supported anxiety interventions accommodate emotional variability, reduce stigma, and promote equitable access to support for students with heightened vulnerability to academic stress and school-based pressure (CAST, 2018; Florian & Beaton, 2018). Consequently, AI is examined not merely as a technological innovation, but as a pedagogical and ethical intervention embedded within institutional practices and power relations.

2.1. Research Design

The research design follows a narrative and integrative literature review model focused explicitly on AI-supported interventions addressing school-related anxiety in adolescence. The review targets secondary education contexts, where academic evaluation, peer comparison, and identity formation intensify anxiety-related responses.

A narrative review was selected due to the interdisciplinary and rapidly changing nature of AI applications across education, psychology, and mental health. Relevant evidence spans multiple domains, including developmental psychology, affective computing, learning sciences, educational technology, and ethics (Baumeister & Leary, 1997; Greenhalgh et al., 2018). This methodological choice allows for the inclusion of heterogeneous study designs—quantitative, qualitative, mixed-methods, and conceptual—thereby capturing the complexity of anxiety as both an emotional state and an educational outcome.

Importantly, this approach enables examination of how AI-based tools operate within real school environments, how they are mediated by teachers, and how institutional conditions shape their effectiveness in mitigating anxiety (Snyder, 2019; Holmes et al., 2021). Such multidimensional constructs as anxiety regulation, emotional coping, and inclusion cannot be adequately understood through single method approaches alone.

2.2. Data Sources and Search Strategy

The literature corpus was generated through systematic searches of major international academic databases, including Scopus, Web of Science, ERIC, PsycINFO, PubMed, and Google Scholar. These searches were complemented by targeted reviews of high-impact journals in educational technology, school psychology, and adolescent mental health, as well as policy documents from international organizations such as the OECD and UNESCO.

Search strategies employed Boolean operators to combine keywords related to AI and school anxiety. Core search terms included: artificial intelligence, machine learning, affective computing, school anxiety, academic stress, test anxiety, adolescent anxiety, secondary education, digital mental health, inclusive education, and emotional regulation. Synonyms and disciplinary variations of these terms were also used to ensure comprehensive coverage (Calvo & D'Mello, 2010; Picard, 2015).

The review focused on publications from 2010 onwards, with particular emphasis on studies published after 2015, reflecting the acceleration of AI-based interventions in educational and psychosocial contexts (Holmes et al., 2019; Rauschenberg et al., 2021).

2.3. Inclusion and Exclusion Criteria

Clear inclusion and exclusion criteria were applied to ensure methodological rigor and thematic relevance. Studies were included if they: (a) were peer-reviewed journal articles, academic books, or authoritative institutional reports; (b) focused on adolescents aged approximately 12–18; (c) examined AI-driven or adaptive digital interventions targeting school-related anxiety, academic stress, or anxiety-related emotional regulation; and (d) were situated within educational or school-linked contexts (Essau et al., 2020; Richardson et al., 2017).

Both empirical and theoretically grounded studies were included, acknowledging that AI-based anxiety interventions often precede large-scale randomized validation (Luckin et al., 2016; Fleming et al., 2019). Studies were excluded if they focused exclusively on adult populations, clinical psychiatric treatment detached from schooling, or non-adaptive digital tools lacking AI components. Grey literature without transparent methodology was also excluded.

2.4. Analytical Framework

Data analysis was guided by an integrative framework comprising four interrelated dimensions aligned with the study's focus on school anxiety.The psychological dimension examined conceptualizations of school-related anxiety, academic stress, and emotional dysregulation, drawing on developmental and educational psychology perspectives that frame anxiety as both a risk factor and a malleable outcome within school environments (Putwain & Daly, 2014; Arslan, 2022).

The technological dimension focused on AI functionalities relevant to anxiety mitigation, including affective computing, intelligent tutoring systems, conversational agents, and predictive analytics. Emphasis was placed on how these systems detect anxiety indicators, personalize feedback, and support coping processes (Picard, 2015; Graesser et al., 2018; Wang et al., 2024).The pedagogical and inclusion dimension assessed alignment with UDL principles and inclusive pedagogy, particularly regarding accessibility, learner agency, and cultural responsiveness in anxiety support (CAST, 2018; Florian, 2019). Teacher mediation was analyzed as a critical mechanism shaping students' interpretation and use of AI-generated feedback.Finally, the ethical and systemic dimension addressed data privacy, algorithmic bias, equity of access, and governance structures, informed by critical scholarship on the datafication of education and ethical AI (Holmes et al., 2021; Williamson & Piattoeva, 2022; Urbani, 2024).

2.5. Data Synthesis and Interpretation

The selected studies were synthesized using a thematic narrative approach that combined inductive identification of recurring patterns with deductive mapping onto the four analytical dimensions. Rather than aggregating effect sizes, the synthesis emphasized mechanisms of action, contextual moderators, and implementation conditions influencing anxiety-related outcomes (Greenhalgh et al., 2018).

Attention was given to how AI-supported interventions influenced anxiety symptoms, emotional regulation strategies, perceived psychological safety, and engagement within school contexts (Fitzpatrick et al., 2017; Suldo et al., 2016). This interpretive strategy aligns with educational research priorities emphasizing ecological validity and applicability to real-world school settings (OECD, 2019; Ainscow, 2020).

2.6. Meteorological Limitations

Several limitations of the chosen methodology must be acknowledged. Narrative reviews do not provide the statistical precision of meta-analyses and are inherently interpretive. Additionally, the rapid pace of AI development means that some tools discussed may evolve beyond the specific configurations evaluated in the reviewed studies (Holmes et al., 2019).

The predominance of studies from high-income countries also raises concerns regarding cultural transferability and global equity. Publication bias toward positive outcomes may further obscure null or adverse effects of AI-based anxiety interventions (Rauschenberg et al., 2021). Nonetheless, the methodology offers a comprehensive and ethically informed synthesis suitable for advancing theory, policy, and practice related to school anxiety.

3. Results

The integrative analysis of the literature reveals a coherent yet multifaceted body of findings regarding school-related anxiety in secondary education and the role of Artificial Intelligence (AI)-supported digital interventions. Across empirical, theoretical, and applied studies published between 2010 and 2025, school anxiety emerges as a pervasive, developmentally embedded phenomenon that significantly affects adolescents' academic engagement, emotional regulation, and participation in inclusive educational settings. The reviewed evidence consistently positions anxiety not

as an isolated psychological symptom but as a relational outcome shaped by academic structures, assessment cultures, peer dynamics, and institutional expectations (OECD, 2019; Essau et al., 2020a). The results further indicate that AI-supported technologies are increasingly employed to identify, monitor, and address school-related anxiety through adaptive, data-informed mechanisms. However, their effectiveness is contingent upon pedagogical mediation, ethical governance, and alignment with inclusive education principles (Holmes et al., 2021; Florian, 2019a). The findings are organized into six interrelated thematic domains, reflecting dominant patterns across the literature.

3.1. Manifestations and Prevalence of School-Related Anxiety in Adolescence

School-related anxiety is identified as one of the most prevalent internalizing difficulties among secondary school students globally. Large-scale surveys, such as PISA, consistently report elevated levels of anxiety symptoms linked to academic demands, classroom participation, evaluation practices, and social comparison (OECD, 2019a). Contemporary research indicates a concerning rise in these symptoms over the past decade, with school-related stressors being a primary contributor (Essau et al., 2020a; Loades et al., 2020).

The literature delineates a complex symptomatology where anxiety manifests through cognitive, emotional, behavioral, and physiological channels. Cognitive symptoms include persistent worry and fear of failure, while emotional manifestations involve tension and irritability. Behaviorally, anxiety often leads to avoidance and disengagement, and physiologically, it can cause somatic complaints and sleep disturbances (Putwain & Daly, 2014). Crucially, these manifestations are highly context-dependent, intensifying during periods of high-stakes assessment or educational transitions.

Findings demonstrate that anxiety disproportionately impacts students facing additional vulnerabilities, such as those with learning difficulties, neurodevelopmental differences (e.g., ADHD, autism spectrum conditions), migrant backgrounds, or prior adverse educational experiences (Arslan, 2022b; McLaughlin & King, 2015). For these students, rigid, performance-oriented school environments can amplify stress responses, creating a cumulative risk effect. A critical pathway identified is the link between chronic anxiety, school avoidance, and increased absenteeism, which significantly elevates the risk of academic failure and early school dropout (Kearney, 2016).

3.2. Developmental and Cognitive Characteristics of Anxiety in Secondary School Students

The findings consistently frame school-related anxiety within the unique developmental context of adolescence. This period is characterized by heightened self-awareness, increased sensitivity to social and academic evaluation, and significant neurobiological maturation, particularly in prefrontal regions governing emotional regulation and executive function (Keyes, 2014). These developmental factors converge to render adolescents exceptionally vulnerable to anxiety in competitive school settings.

Cognitive studies reveal that anxious adolescents frequently exhibit maladaptive cognitive appraisals. They tend to catastrophize academic outcomes, overestimate the likelihood of negative evaluation by teachers and peers, and underestimate their personal coping resources and abilities (Suldo et al., 2016). This cognitive bias is strongly correlated with diminished academic self-efficacy and a reduced sense of autonomy—a core psychological need according to self-determination theory (Deci & Ryan, 2000).

Research in affective computing and neuroscience supports this view, showing that the adolescent brain's ongoing development interacts with environmental stressors in ways that can heighten and prolong anxiety responses (Calvo & D'Mello, 2010; Picard, 2015). This body of evidence underscores that school anxiety is not merely a reactive state but a developmentally mediated phenomenon, necessitating interventions that are sensitive to both cognitive and neurobiological stages.

3.3. Academic Structures, Assessment Practices, and Anxiety Outcomes

A dominant theme across the literature is the significant role of institutional and pedagogical practices in either exacerbating or mitigating school-related anxiety. High-stakes standardized testing, frequent summative assessments, competitive grading systems, and narrow definitions of academic success are repeatedly identified as major structural contributors to anxiety escalation (OECD, 2019a; UNESCO, 2021).

Empirical studies show that educational climates prioritizing performance comparison and norm-referencing over mastery learning and individual growth are strongly associated with heightened test anxiety, fear of failure, and eventual disengagement (Steinmayr et al., 2018; Arslan, 2022b). Furthermore, assessment practices that lack emotional

scaffolding fail to equip students with strategies to manage inevitable stress, thereby reinforcing cycles of anxiety and avoidance.

Conversely, the findings highlight the moderating role of teacher practices and classroom culture. Learning environments that normalize mistakes as part of the learning process, provide formative and supportive feedback, and foster psychological safety are linked to significantly lower levels of anxiety-related withdrawal (Suldo & Shaffer, 2008; Weare, 2015). This underscores the systemic nature of school anxiety and challenges deficit-oriented models that locate the problem solely within the individual student.

3.4. Identification and Monitoring of School Anxiety Through AI-Supported Systems

A substantial and growing segment of the literature documents the application of AI-powered technologies for the early identification and continuous monitoring of school-related anxiety. These systems, grounded in fields like affective computing and educational data mining, detect anxiety indicators through multimodal data: behavioral patterns (e.g., task avoidance, response latency), linguistic cues in written or spoken communication, engagement metrics from learning platforms, and, in some research contexts, physiological signals (Picard, 2015; Baker & Inventado, 2014; Graesser et al., 2018).The results indicate a promising potential for these tools to identify early, subtle signs of anxiety that may go unnoticed in traditional classroom observations, particularly among students who internalize distress or are reluctant to seek help (Kooli, 2025). Predictive analytics models, when trained on robust and relevant datasets, have demonstrated moderate to high accuracy in forecasting periods of heightened anxiety risk or predicting academic disengagement (Wang et al., 2024).

However, the findings also caution against technological optimism. Significant variability exists in the accuracy, reliability, and interpretability of these systems. Key challenges include the quality and representativeness of training data, the contextual sensitivity of algorithms, and issues of algorithmic transparency (Williamson & Piattoeva, 2022). There is a noted risk of misclassification and bias, especially when systems trained on majority-group data are applied to culturally diverse or neurodivergent student populations, potentially pathologizing normal variations in emotional expression (Greene et al., 2020).

3.5. AI-Based Interventions Targeting School-Related Anxiety

The reviewed evidence identifies several innovative categories of AI-supported interventions designed to reduce school-related anxiety. These range from adaptive cognitive-behavioral therapy (CBT) platforms and conversational agents (e.g., Woebot, Wysa) that provide real-time emotional support and psychoeducation, to intelligent tutoring systems (ITS) that modulate task difficulty and feedback based on inferred anxiety levels (Fitzpatrick et al., 2017; Inkster et al., 2020; Graesser et al., 2018). Biofeedback-based tools and virtual reality (VR) environments for exposure therapy also represent emerging frontiers (Chernobrovkina et al., 2021b; Maples-Keller et al., 2017).

Effectiveness studies suggest that the most impactful AI interventions are those that offerpersonalizedcoping strategies, facilitate gradual exposure to anxiety-provoking academic or social situations, and provide immediate, supportive feedback. A key advantage reported in qualitative studies is the reduced sense of stigma; adolescents often feel more comfortable engaging with a digital tool than initiating face-to-face help-seeking (Rideout & Fox, 2018). Furthermore, the 24/7 availability and consistency of AI tools can provide crucial support outside school hours.

A critical and consistent finding, however, is that AI interventions are not standalone solutions. Their efficacy is profoundly mediated by the human and systemic context. Interventions show greater and more sustained positive effects when they are integrated into a broader school-wide approach to mental health, supported by trained teachers, and aligned with pedagogical goals (Holmes et al., 2021; Whitaker & Bakker, 2020). Implementations lacking this relational and ethical scaffolding often result in limited engagement or short-lived benefits.

3.6. Equity, Inclusion, and Ethical Constraints in AI-Supported Anxiety Interventions

Ethical and inclusion-related concerns form a central, critical thread in the synthesis of results. While AI tools hold promises for democratizing access to emotional support, the literature starkly outlines concomitant risks related to data privacy, algorithmic bias, surveillance, and the digital divide (OECD, 2023a; Shapiro & Stolerman, 2021).Inclusive education frameworks, such as Universal Design for Learning (UDL), provide a vital lens forevaluation. These frameworks posit that anxiety is often a contextual response to inflexible environments, not merely an individual deficit. AI systems designed with UDL principles—offering multiple means of engagement, representation, and action/expression—are better positioned to support emotionally diverse learners without stigma (CAST, 2018; Florian

& Beaton, 2018). For instance, an AI tool might offer anxiety-management strategies in text, audio, or interactive video formats to accommodate different preferences.

The findings strongly warn against surveillance-oriented models, where monitoring tools are used primarily for behavioral control or risk management. Such approaches can paradoxically increase anxiety by fostering a climate of constant evaluation and reducing students' sense of autonomy and trust (Zembylas, 2019). Consequently, the literature converges on a "human-in-the-loop" ethical model. In this model, AI serves as a tool to augment the professional judgment of educators and counselors, providing insights that inform supportive, empathetic human intervention, rather than automating or replacing it (Holmes et al., 2021). This aligns with the adolescent need for authentic connection and respects their agency, ensuring that technology supports well-being within an ethically governed, relationally rich educational ecosystem.

4. Artificial Intelligence in Addressing Adolescent School Anxiety: Mechanisms, Applications, and Critical Considerations

The pervasive challenge of school-related anxiety in adolescence has catalyzed the exploration of innovative technological solutions, with Artificial Intelligence (AI) emerging as a potentially transformative force in secondary education. The convergence of AI with digital mental health represents not merely a technical evolution but a paradigm shift in how educational systems conceptualize early intervention, personalized support, and the creation of emotionally responsive learning environments (Holmes et al., 2019; Luckin et al., 2016). This chapter provides a critical synthesis of AI's role across four pivotal domains: its integration within targeted digital mental health interventions, its application in affect-aware educational technologies, its capacity for adaptive personalization, and its contributions to Social and Emotional Learning (SEL). Moving beyond techno-optimistic narratives, the analysis is grounded in psychological theory—particularly cognitive-behavioral and self-determination frameworks—and is critically informed by inclusive education and ethical scholarship, evaluating AI's potential to either alleviate or inadvertently exacerbate anxiety within the complex ecology of the school.

4.1. AI in Targeted Digital Mental Health Interventions for School Anxiety

Digital mental health tools, ranging from mobile applications to conversational agents, have proliferated as scalable avenues for anxiety support. AI is the cornerstone that transitions these tools from static information repositories to dynamic, interactive systems capable of detection, triage, and intervention. AI-powered platforms, such as conversational agents employing Natural Language Processing (NLP), deliver structured components of evidence-based therapies like Cognitive Behavioral Therapy (CBT) in an accessible, engaging format. Research on agents like Wombat indicates significant reductions in self-reported anxiety symptoms among young adults, highlighting their utility as low-intensity, accessible supports (Fitzpatrick et al., 2017). These tools can circumvent common barriers to help-seeking in schools, such as stigma, fear of judgement, and limited counselling resources, by providing private, immediate assistance (Grist et al., 2019; Torous & Keshavan, 2021).

A core strength of AI in this domain is its predictive capacity. Through educational data mining and machine learning, systems can analyze patterns in student behavior, engagement metrics, and language use to identify early, subtle signs of escalating anxiety long before it manifests as academic decline or school refusal (Baker & Inventado, 2014; Wang et al., 2023). For instance, a learning management system might flag a student who begins to consistently submit assignments late at night, avoids collaborative online forums, and uses increasingly negative self-referential language in discussion posts. This data-driven insight allows for proactive, timely outreach from a teacher or counsellor, shifting the support model from crisis-responsive to preventive (Kooli, 2025).

However, the empirical foundation requires nuanced interpretation. While meta-analyses of digital interventions show promise, their real-world effectiveness in school settings is moderated by crucial factors. Engagement and adherence are persistent challenges; without integration into the school routine and teacher facilitation, standalone apps often suffer from high dropout rates (Fleming et al., 2019). Furthermore, most tools are validated in controlled research settings or with self-selecting users, raising questions about their efficacy for the broader, more diverse student population experiencing school anxiety, particularly those with comorbid difficulties or from marginalized backgrounds (Essau et al., 2020c). Crucially, AI-driven tools must be viewed as adjunctsto, not replacements for, comprehensive school mental health frameworks. Their greatest value lies in extending the reach and responsiveness of human support, not in automating care. Ethical deployment requires transparent communication about the tool's limitations, robust data governance to protect sensitive student information, and clear pathways to escalate care to a human professional when needed (Holmes et al., 2021; Shapiro & Stolerman, 2021).

4.2. Affective Computing, Emotion Recognition, and Multimodal Anxiety Detection

Affective computing represents a frontier in AI's application to school anxiety, aiming to equip machines with the ability to recognize, interpret, and appropriately respond to human emotions. By processing multimodal data streams—such as facial expressions via computer vision, vocal prosody, keystroke dynamics, or heart rate variability from wearable sensors—these systems seek to infer emotional states like anxiety, frustration, or engagement in real-time (Calvo & D'Mello, 2010; Picard, 2015). In an educational context, this technology promises to decode the non-verbal, often subconscious, signals of student distress that may escape even the most observant educator.

The integration of affective computing with Intelligent Tutoring Systems (ITS) and learning analytics creates powerful diagnostic tools. An ITS can adapt not only to cognitive errors but also to emotional state; if a student exhibits micro-expressions of confusion and anxiety coupled with a sudden increase in problem-solving latency, the system might simplify the next problem, offer an encouraging message, or present a brief mindfulness exercise (Graesser et al., 2018; D'Mello, 2020). This affective loop aims to prevent the downward spiral where anxiety impairs cognitive processing, leading to failure, which in turn heightens anxiety. Furthermore, aggregated, anonymized affective data can provide educators with invaluable insights into the emotional climate of the classroom, identifying which topics or assessment methods provoke collective stress, thereby informing pedagogical refinement (Drigas & Mitsea, 2022).

Despite its potential, this path is fraught with ethical and technical peril. The scientific validity of algorithmic emotion recognition is hotly contested, especially regarding its cross-cultural and neurodiversity competence. Affective expressions are not universal; they are deeply shaped by cultural norms, gender socialization, and individual neurocognitive profiles (Barrett et al., 2019). An algorithm trained primarily on one demographic may systematically misread the anxiety signals of students from different backgrounds, leading to false positives (unwanted labelling) or, more dangerously, false negatives (missing students in need) (Greene et al., 2020). These risks embedding and automating bias within the school's support infrastructure. Moreover, the prospect of continuous emotional surveillance poses a profound threat to student privacy, autonomy, and trust. A school environment perceived as a panopticon of emotional monitoring could itself become an anxiety-generating space, undermining the very well-being it seeks to promote (Zembylas, 2019). Therefore, any deployment of affective computing must be preceded by rigorous, inclusive validation, governed by principles of minimal data collection and purpose limitation, and embedded within a strong ethical framework that prioritizes student consent, transparency, and agency over data collection.

4.3. Personalized, Adaptive Support and the Imperative of Fostering Student Agency

The promise of AI to deliver hyper-personalized, adaptive interventions is particularly compelling for anxiety, a heterogeneous condition with highly individualised triggers, symptoms, and effective coping mechanisms. AI systems can dynamically tailor their interactions based on a continuous stream of user data, moving beyond one-size-fits-all approaches. For example, a digital anxiety coach might learn that a student responds better to cognitive reframing techniques than to somatic relaxation exercises and adjust its protocol accordingly (Fitzpatrick & Hennessy, 2020). Similarly, a learning platform could modulate the sequence and challenge level of tasks based on real-time anxiety inferences, providing "scaffolded challenges" that build competence without triggering overwhelming stress (Graesser et al., 2018).

This personalization aligns with the educational philosophy of Universal Design for Learning (UDL), which advocates for multiple means of engagement, representation, and action to cater to learner variability (CAST, 2018). AI can operationalize UDL principles at scale, offering various pathways to learn anxiety-regulation skills—through text, interactive simulations, audio-guided exercises, or gamified practice—based on student preference and need (Pagliara et al., 2024a). This flexibility can help destigmatize support by normalizing different ways of learning to cope.

However, the drive for algorithmic personalization must be carefully balanced with the fundamental developmental need for agency. Adolescence is a critical period for developing autonomy and self-determination (Deci & Ryan, 2000). AI systems that operate as opaque "black boxes," making decisionsforthe student, risk fostering passivity and dependency, potentially eroding self-efficacy—a key protective factor against anxiety. Therefore, the design ethos must shift from "personalizationtothe student" topersonalization withthe student" (Holstein et al., 2019b). This involves creating explainable AIwhere the system's recommendations are transparent (e.g., "I'm suggesting a breathing exercise because your activity level dropped and your last journal entry mentioned worry about a test"). It requires building in user controls, allowing students to adjust privacy settings, provide feedback on recommendations, and ultimately choose whether to accept the AI's guidance (Whitaker & Bakker, 2020). In this model, the AI acts as a co-regulator—a supportive resource that the student learns to use intentionally, thereby strengthening their own self-regulatory capacities (Drigas & Mitsea, 2022; Richardson & Turner, 2019).

4.4. AI-Enhanced Social and Emotional Learning for Anxiety Competence

Social and Emotional Learning (SEL) provides the foundational skill set for understanding, managing, and recovering from anxiety. AI can significantly augment traditional SEL instruction by providing safe, private, and scalable spaces for deliberate practice and personalized feedback. AI-driven tools can simulate complex social-emotional scenarios that are common anxiety triggers in schools, such as giving a presentation, navigating a group conflict, or asking a teacher for help (Chernobrovkina et al., 2021b). Within these virtual environments, students can experiment with different coping responses and receive immediate feedback, building competency and confidence in a low-risk setting.

Serious games designed with AI mechanics can embed SEL principles into engaging narratives. These games can adapt their challenges in response to the player's emotional state, teaching regulation strategies in real-time. For instance, a game might become visually calmer and its tasks simpler when it detects signs of player frustration, simultaneously teaching the player to recognize their own arousal and apply calming techniques (Lister et al., 2019). Furthermore, AI can analyze student reflections or journal entries to identify maladaptive thought patterns (e.g., pervasive catastrophizing) and guide them through cognitive restructuring exercises, thereby addressing the cognitive roots of anxiety (Lee et al., 2021).

The integration of AI into SEL also demands a critical, equity-focused lens. SEL competencies and expressions of emotion are not culturally neutral; they are shaped by societal values and norms (CASEL, 2020). An AI system trained on data from majority populations may inadvertently promote a narrow, culturally specific ideal of "appropriate" emotional expression or "effective" coping, alienating students from diverse cultural or neurodiverse backgrounds (Zhu & Cheng, 2022). This could pathologies normal cultural variations and exacerbate feelings of not belonging. Therefore, the development of AI for SEL must be guided by inclusive pedagogy (Florian, 2019a). This requires co-design with diverse communities, the use of culturally heterogeneous training data, and ongoing audits for algorithmic bias. The goal must be to leverage AI to support a pluralistic model of emotional well-being—one that validates diverse ways of being and coping, thereby truly reducing anxiety by fostering inclusive, identity-safe school climates where all students feel they belong and can thrive (Ainscow, 2020; Pagliara et al., 2024a).

In conclusion, AI presents a powerful, albeit double-edged, set of tools for addressing school-related anxiety. Its capabilities in detection, personalization, and scalable intervention offer unprecedented opportunities to create more responsive and supportive educational ecosystems. However, realizing this potential ethically and equitably requires vigilant attention to the risks of surveillance, bias, and the erosion of human agency. The most promising path forward is a human-centered AIapproach, where technology is thoughtfully embedded within strong relational and ethical frameworks, always serving to enhance, not replace, the empathetic, judgement-rich support that teachers and counsellors provide.

5. AI-Driven Digital Approaches for School Anxiety: Innovation, Implementation, and Critical Analysis

The escalating challenge of school-related anxiety in adolescence demands innovative and scalable solutions. Artificial Intelligence (AI) has emerged as a transformative force, offering new paradigms for detection, intervention, and support within secondary education (Holmes et al., 2019). This chapter provides a critical synthesis of AI-driven approaches, examining their theoretical foundations, empirical support, and practical implementation challenges. The analysis is structured around four core domains that reflect the current technological landscape: intelligent monitoring for early identification, AI-guided self-regulation tools, conversational agents and virtual coaches, and immersive multimodal environments. Throughout this examination, special attention is given to how these technologies intersect with psychological theories of anxiety, inclusive pedagogical frameworks, and the ethical imperatives of educational equity.

5.1. Intelligent Monitoring and Early Identification of Anxiety

Early identification of school anxiety represents a crucial preventive strategy, yet traditional assessment methods face significant limitations. Self-report measures depend on student insight and willingness to disclose, while teacher observations may miss subtle or internalized symptoms (Essau et al., 2020a). AI-powered monitoring systems offer a complementary approach through continuous, multimodal data collection and analysis, potentially detecting anxiety indicators before they manifest as academic impairment or behavioral concerns (Calvo & D'Mello, 2010).

These systems utilize machine learning algorithms to process diverse data streams. Educational data mining techniques can analyze patterns in learning management systems, identifying behavioral markers such as decreased participation, avoidance of specific tasks, or changes in assignment submission patterns (Baker & Inventado, 2014). Natural language processing enables the analysis of written communication for linguistic features associated with anxiety, including increased use of negative emotion words, first-person singular pronouns, and tentative language (Torous & Keshavan,

2021). In research contexts, physiological sensors can provide additional data on autonomic arousal indicators like heart rate variability and electrodermal activity, which correlate with stress responses (Picard, 2015).The integration of these data sources creates comprehensive student profiles that enable predictive modeling. For instance, a system might identify a student exhibiting declining forum participation, increased latency in responding to challenging tasks, and linguistic patterns indicating negative self-evaluation (Wang et al., 2023). Such patterns could signal developing performance anxiety before it results in academic decline or withdrawal behaviors. This predictive capacity aligns with preventive mental health frameworks that emphasize early intervention (OECD, 2023a).

However, these technologies raise substantial ethical concerns that must be addressed. Continuous monitoring creates significant privacy implications, particularly for adolescents in developmental stages where autonomy and identity exploration are paramount (Zembylas, 2019). The potential for surveillance to become anxiety-provoking itself represents a paradoxical risk that requires careful consideration. Furthermore, algorithmic bias presents a serious challenge—systems trained on limited or non-representative datasets may misinterpret emotional expressions from diverse cultural, neurodiverse, or socioeconomic backgrounds, potentially pathologizing normative behaviors or overlooking genuine distress (Greene et al., 2020). This risk is particularly concerning given the vulnerability of marginalized student populations who already face barriers to equitable mental health support.

Implementation requires a human-centered framework where AI serves as a decision-support tool rather than an autonomous diagnostician. The "human-in-the-loop" approach ensures that algorithmic outputs are interpreted and acted upon by trained professionals who consider contextual factors and maintain therapeutic relationships (Holmes et al., 2021). Transparency about data collection purposes, student and parental consent processes, and clear governance policies regarding data access and use are essential prerequisites for ethical deployment (Kooli, 2025). When implemented with these safeguards, intelligent monitoring can enhance early detection without compromising student autonomy or trust.

5.2. AI-Driven Interventions for Emotional Self-Regulation

Emotional dysregulation constitutes a core mechanism in anxiety disorders, making self-regulation skills a critical intervention target. AI-driven platforms translate evidence-based therapeutic approaches—particularly cognitive-behavioral and mindfulness-based techniques—into accessible, adaptive digital formats (Fitzpatrick et al., 2017). These tools extend therapeutic support beyond traditional counseling hours and settings, offering scalable options for skill development and practice.The distinctive value of AI in this domain lies in its capacity for personalization and adaptive delivery. Machine learning algorithms analyze user interaction patterns, engagement levels, and self-reported outcomes to tailor intervention components to individual needs (Fleming et al., 2019). For example, a platform might identify that a student benefits more from somatic regulation techniques than cognitive restructuring and accordingly adjust the focus and pacing of exercises. Just-in-time adaptive interventions represent an advanced application, where systems use contextual data (such as time of day, location, or preceding activities) to deliver micro-interventions at moments of identified need (Drigas & Mitsea, 2022).

Research on digital mental health interventions shows promising outcomes, with meta-analyses indicating moderate effect sizes comparable to some low-intensity face-to-face interventions (Grist et al., 2019). Specific applications focusing on anxiety demonstrate reductions in symptom severity and improvements in coping self-efficacy (Inkster et al., 2020). The accessibility and reduced stigma associated with digital tools may be particularly beneficial for adolescents reluctant to seek traditional counseling services, potentially serving as a gateway to further support (Torous & Keshavan, 2021).Nevertheless, significant limitations warrant consideration. Engagement and adherence present persistent challenges, with many users discontinuing use after initial novelty fades (Fleming et al., 2019). The therapeutic alliance—a well-established factor in treatment effectiveness—cannot be authentically replicated by AI systems, potentially limiting their impact for students with complex or severe anxiety (Shapiro & Stolerman, 2021). Furthermore, most evidence comes from controlled research settings rather than real-world school implementations, where competing demands, technological barriers, and varying levels of support may affect outcomes.

Successful integration into school contexts requires strategic implementation. These tools should be framed not as replacements for human support but as complements that extend skill-building opportunities. Teacher and counselor facilitation can enhance engagement by integrating tool use into existing routines and providing encouragement and contextual application (Whitaker & Bakker, 2020). Alignment with school-wide social-emotional learning initiatives ensures coherence and reinforces skill development across multiple contexts (CASEL, 2023). When implemented as part of a comprehensive support system, AI-driven self-regulation tools can provide valuable opportunities for practice and reinforcement of coping strategies.

5.3. Conversational Agents, Chatbots, and Virtual Coaches

Conversational AI agents represent one of the most accessible forms of digital mental health support, utilizing natural language processing to simulate therapeutic dialogue and provide psychoeducation, mood tracking, and intervention guidance (Fitzpatrick et al., 2017). These agents, often available through mobile applications, offer 24/7 availability and anonymity, potentially lowering barriers to help-seeking among adolescents concerned about stigma or confidentiality.These systems typically employ cognitive-behavioral principles, guiding users through identification of anxious thoughts, behavioral activation, and development of coping strategies (Inkster et al., 2020). The conversational format aligns with adolescent communication preferences and provides immediate responsiveness that can be particularly valuable during acute anxiety episodes outside school hours. Research on specific agents like Woebot demonstrates significant reductions in anxiety and depressive symptoms among young adults, with effects maintained over several weeks (Fitzpatrick et al., 2017).

The strengths of conversational agents include their scalability, consistency, and capacity to normalize help-seeking behavior. By providing a low-threshold entry point to anxiety support, they may serve as a stepping stone to more intensive interventions for students who might otherwise avoid services (Grist et al., 2019). Their automated nature ensures uniform delivery of evidence-based content, eliminating variability that can occur with different human providers.However, significant limitations constrain their application. Natural language processing, while advancing, still struggles with nuanced communication, cultural variations in expression, and complex emotional states (Greene et al., 2020). The absence of genuine empathy and clinical intuition limits their effectiveness in crisis situations or with severe presentations. Most critically, their capacity to appropriately recognize and escalate risk situations (such as suicidal ideation) remains inadequate compared to trained human professionals (Shapiro & Stolerman, 2021).

Ethical deployment in educational settings therefore requires careful boundaries and clear communication. These tools should be explicitly presented as well-being aids rather than therapeutic replacements, with transparent information about their limitations. Schools must establish protocols for monitoring usage patterns and ensuring seamless pathways to human support when needed (Holmes et al., 2021). Integration with school counseling services allows professionals to identify students who may benefit from additional support based on their engagement with these tools. When positioned appropriately within a tiered support system, conversational agents can provide valuable supplementary support while maintaining necessary safeguards.

5.4. Immersive and Multimodal AI Environments

Immersive technologies, particularly virtual reality (VR) and augmented reality (AR) enhanced by AI, create controlled environments for experiential learning and exposure-based intervention (Maples-Keller et al., 2017). For school anxiety, these environments can simulate anxiety-provoking situations—such as public speaking, test-taking, or social interactions—allowing students to practice coping skills in progressively challenging yet safe contexts (Chernobrovkina et al., 2021b).The integration of AI enables dynamic adaptation of these environments based on user responses. Physiological monitoring within VR systems can adjust scenario difficulty in real-time, ensuring that students remain within an optimal range of anxiety for therapeutic exposure (Parsons et al., 2020). This biofeedback loop, where users can observe and learn to regulate their physiological arousal, provides powerful experiential learning that transcends cognitive understanding alone. AI-driven scenario branching can create varied social situations for practice, enhancing generalization of skills beyond specific practiced scenarios.

Research on VR exposure therapy demonstrates efficacy for specific anxiety disorders, particularly social anxiety (Chernobrovkina et al., 2021b). Applied to school contexts, these technologies offer unique opportunities for skills practice that would be difficult, impractical, or ethically questionable to arrange in real school environments. The immersive nature may enhance engagement and emotional processing compared to traditional imaginal or in-vivo exposure (Maples-Keller et al., 2017).Despite this potential, implementation barriers are substantial. The high cost of quality VR equipment and the need for technical support create significant equity concerns, potentially exacerbating existing disparities in access to mental health resources (OECD, 2023a). Physical side effects like cybersickness may limit usability for some students, and the intensity of immersive experiences requires careful facilitation and debriefing to ensure psychological safety (Parsons et al., 2020). Furthermore, the transfer of skills from virtual to real-world contexts cannot be assumed and requires explicit programming and support.

These technologies are best conceptualized as specialized tools within comprehensive intervention plans rather than standalone solutions. Their most appropriate application may be within school counseling centers or specific therapeutic programs where trained professionals can facilitate the experience, provide contextualization, and support generalization (Drigas & Mitsea, 2022). Integration with social-emotional learning curricula could provide structured opportunities for all students to practice anxiety-management skills in simulated environments, though this would

require substantial investment and professional development. As with all AI applications in education, the pedagogical purpose must drive technological adoption, ensuring these tools serve clearly defined educational goals rather than functioning as technological novelties.

5.5. Synthesis and Critical Considerations

The AI-driven approaches examined in this chapter collectively represent a significant evolution in how schools might address student anxiety. Their common strengths include potential for early identification, personalized adaptation, extended accessibility, and opportunities for safe, repetitive practice of coping skills. These advantages align well with both psychological models of anxiety treatment and educational principles of differentiation and universal design for learning (CAST, 2018).However, a critical analysis reveals persistent challenges that must inform implementation decisions. The tension between surveillance and support, the risk of algorithmic bias, questions of long-term engagement, and the fundamental limitations of non-human interaction in therapeutic contexts all warrant careful consideration. The most significant concern may be the potential for these technologies to widen rather than narrow equity gaps in mental health support, particularly if access depends on school resources or individual socioeconomic status (Florian, 2019a).

A principled way forward requires that AI applications be subservient to educational values and professional expertise. This necessitates co-design processes involving diverse stakeholders, including students, parents, educators, and mental health professionals (Zhu & Cheng, 2022). It demands robust professional development so educators can effectively mediate and integrate these tools within relational pedagogy (Ertmer & Ottenbreit-Leftwich, 2010). Most fundamentally, it requires that technological applications be evaluated not only by their technical capabilities but by their contribution to creating more inclusive, responsive, and humane educational environments where all students can develop the resilience to manage anxiety and thrive academically and personally.

6. Inclusion, Ethics, and Equity in AI-Mediated Emotional Support for School Anxiety

The integration of Artificial Intelligence (AI) into systems addressing adolescent school anxiety presents a complex intersection of technological promise and profound ethical responsibility. While AI-driven tools offer unprecedented capabilities for personalized detection and intervention, their implementation within secondary education necessitates rigorous scrutiny through the lenses of inclusive pedagogy, social justice, and ethical governance (Holmes et al., 2021; Florian, 2019a). This chapter critically examines the constitutive elements of responsible AI deployment, arguing that without deliberate attention to equity, cultural responsiveness, and the preservation of human agency, these technologies risk exacerbating the very disparities and harms they aim to ameliorate. The analysis is structured around four interconnected domains: the alignment of AI with inclusive education principles; the ethical imperatives of data privacy and algorithmic fairness; the necessity of cultural and contextual responsiveness; and the indispensable role of teacher mediation within human-centered implementation models.

6.1. AI and the Imperatives of Inclusive Secondary Education

Inclusive education is fundamentally concerned with removing barriers to participation and success for all learners, recognizing that emotional well-being is a prerequisite for meaningful academic engagement (Ainscow, 2020). Within this framework, school anxiety is not viewed as an individual deficit but as a relational phenomenon often exacerbated by inflexible pedagogical practices, high-stakes assessment cultures, and unsupportive social environments (Arslan, 2022b). AI-mediated support systems, therefore, must be evaluated by their capacity to foster inclusive practices rather than merely manage symptoms within an unchanged system.Theoretically, AI holds significant potential for advancing inclusion. Tools grounded in Universal Design for Learning (UDL) principles can provide multiple means of engagement, representation, and action/expression for anxiety regulation (CAST, 2018). For instance, an AI platform might offer a menu of coping strategies—from cognitive restructuring exercises and interactive biofeedback to mindfulness audio guides and gamified social scenario practice—allowing students to select and refine approaches that align with their preferences and strengths (Pagliara et al., 2024a). This moves beyond a one-size-fits-all model to a flexible support system that honors neurodiversity and varied learning profiles.

Furthermore, AI can potentially democratize access to support by extending the reach of overburdened school counseling services. Conversational agents and self-guided digital therapeutics can provide immediate, low-stigma assistance to students who might otherwise wait weeks for an appointment or avoid help-seeking altogether due to fear of judgment (Grist et al., 2019; Torous & Keshavan, 2021). This is particularly relevant for students in under-resourced schools or remote areas where specialist provision is scarce.However, this inclusive potential is contingent upon intentional, equity-focused design and implementation. A primary risk is that AI systems, if trained on narrow datasets reflecting majority cultural norms and expressions of anxiety, will fail to accurately recognize or appropriately respond

to the distress of students from marginalized backgrounds—including racial and ethnic minorities, neurodivergent students, and those from low socioeconomic status households (Greene et al., 2020). An algorithm that interprets limited eye contact as a sign of social anxiety, for example, may pathologize a culturally normative behavior or miss alternative indicators of distress. Consequently, the development and validation of AI tools must involve participatory design with diverse student populations and continuous auditing for bias to ensure they do not perpetuate or amplify existing educational inequities (Florian, 2019a). True inclusivity requires that AI serves to dismantle barriers, not create new, technologically mediated ones.

6.2. Data Privacy, Surveillance, and Algorithmic Bias: Foundational Ethical Concerns

The ethical deployment of AI for mental health support is predicated on navigating a triad of interconnected risks: threats to data privacy, the psychological impact of surveillance, and the perpetuation of algorithmic bias. These concerns are especially acute in the school context, where students are a captive population with limited power to opt out of institutional systems (Shapiro & Stolerman, 2021).Data collection is intrinsic to AI functionality. Intelligent monitoring systems may process highly sensitive information, including physiological data (e.g., heart rate via wearables), granular behavioral logs (keystrokes, clickstreams), and intimate textual or verbal disclosures to conversational agents. The aggregation of this data creates detailed emotional and psychological profiles, raising severe privacy concerns. Schools and technology providers must implement robust, transparent data governance frameworks that adhere to principles of minimal data collection, clear purpose limitation, and secure, time-limited storage (Kooli, 2025). Critically, informed consent processes must be meaningful, involving both parents and adolescents in age-appropriate ways, and students must retain rights to access, correct, and request deletion of their data.

Beyond privacy, the experience of being persistently monitored for emotional signs can itself be antithetical to psychological well-being. A school environment perceived as a panopticon of affective surveillance may induce anxiety, undermine trust, and inhibit the authentic self-expression necessary for healthy adolescent development (Zembylas, 2019). This creates a paradoxical situation where the tool of support becomes a source of stress. Ethical design must therefore prioritize transparency about what data is collected and how it is used, provide user controls over monitoring levels where feasible, and ensure that the primary outcome of data collection is supportive outreach, not punitive consequences.

Perhaps the most insidious ethical challenge is algorithmic bias. Machine learning models learn patterns from historical data, which often reflects societal prejudices and structural inequalities. An anxiety detection algorithm trained predominantly on data from white, middle-class adolescents may systematically under-detect anxiety in students of color or from different cultural backgrounds, whose manifestations of distress may differ (Greene et al., 2020). Conversely, it may over-pathologize normative behaviors in these groups. Such biases can lead to misallocation of support resources, reinforcing existing care disparities. Mitigating this requires technical strategies like diverse training datasets and bias-detection algorithms, but also structural ones: independent algorithmic audits, transparency in model performance across subgroups, and maintaining human oversight to challenge and contextualize algorithmic outputs (Holmes et al., 2021).

6.3. Cultural Responsiveness and Elevating Student Voice

The effectiveness and ethics of AI-mediated support are inextricably linked to cultural responsiveness. Emotional expression, help-seeking behaviors, and concepts of mental well-being are deeply culturally embedded (CASEL, 2020). An AI tool that promotes direct verbal assertion as an anxiety coping strategy, for instance, may be ineffective or even counterproductive for a student from a cultural background that values indirect communication and collective harmony.Developing culturally responsive AI necessitates moving beyond superficial translation of content to deep engagement with cultural models of emotion and distress. This involves co-designing systems with communities, employing culturally diverse development teams, and validating tools across a wide range of demographic and cultural contexts (Zhu & Cheng, 2022). Culturally responsive AI should accommodate pluralistic notions of coping and recovery, avoiding the imposition of a single, culturally specific ideal of emotional health.

Central to cultural responsiveness is the authentic integration of student voice. Adolescents are not merely end-users but must be recognized as experts in their own lived experience. Participatory design methodologies—where students contribute to defining problems, prototyping solutions, and evaluating tools—are essential for creating interventions that are relevant, engaging, and respectful (Drigas & Mitsea, 2022). This engagement fosters a sense of agency and ownership over the support process, which is itself therapeutic and empowering. When students help shape the AI tools intended to support them, it transforms the dynamic from one of passive receipt to active collaboration, aligning with empowerment-based models of mental health support and inclusive pedagogical practice.

6.4. Teacher Mediation and Human-in-the-Loop Models: The Indispensable Human Element

Amidst the technological promise of AI, the role of the teacher, counselor, and educational professional remains irreplaceable. The most ethically sound and pedagogically effective model for AI in schools is a "human-in-the-loop" (HILT) approach, where AI augments rather than automates professional judgment and human connection (Whitaker & Bakker, 2020).AI excels at pattern recognition and data analysis, but it lacks contextual understanding, empathy, and ethical reasoning. A teacher mediates AI outputs by interpreting them within the rich context of the classroom: Is a student's detected "disengagement" a sign of anxiety, boredom, hunger, or a conflict at home? Is a suggested "exposure task" developmentally appropriate for this particular student at this moment? Teachers provide the relational glue, offering reassurance, building trust, and adapting generalized algorithmic suggestions into personalized, compassionate action (Ertmer & Ottenbreit-Leftwich, 2010).

Furthermore, teachers are essential for ensuring that AI tools are integrated meaningfully into the pedagogical and pastoral fabric of the school. They can facilitate discussions about digital well-being, help students interpret feedback from AI systems, and connect insights from digital tools to broader social-emotional learning (SEL) curricula (Schunk & DiBenedetto, 2020). This mediation ensures technology serves educational goals, not the reverse.

The HILT model also acts as a critical ethical safeguard. It ensures a human professional reviews high-stakes algorithmic decisions, provides a check against bias, and maintains accountability. Ultimately, the goal is not to create autonomous AI therapists but to equip educators with sophisticated tools that enhance their capacity to notice, understand, and respond to student anxiety with greater timeliness and precision. This symbiotic relationship—where AI handles scalable data processing and humans provide nuanced judgment and care—represents the most promising path for harnessing technology to create more inclusive, responsive, and humane school environments where all students can manage anxiety and thrive.

7. Discussion

This integrative review has systematically examined the burgeoning intersection of Artificial Intelligence (AI) and school-related anxiety in adolescent populations, revealing a complex landscape of technological promise, pedagogical challenge, and ethical tension. The findings collectively suggest that AI-driven approaches hold significant potential to transform how secondary education systems identify, understand, and support student anxiety, moving from reactive, generic models to proactive, personalized ecosystems of care. However, this potential is neither automatic nor guaranteed. It is contingent upon the deliberate alignment of technological innovation with robust psychological theory, inclusive pedagogical frameworks, and stringent ethical governance. This discussion synthesizes the core findings through the critical lenses of inclusive education and developmental psychology, explicates their implications for contemporary school practice, and rigorously confronts the persistent risks and unresolved tensions that must guide future implementation and research.

7.1. Synthesizing Findings Through Inclusive and Psychological Lenses

The analysis confirms that AI is not a neutral tool but a pedagogical intervention whose impact is mediated by the theoretical frameworks guiding its design and use. From a psychological perspective, primarily informed by cognitive-behavioral and self-determination theories, the reviewed evidence highlights AI's capacity to operationalize key therapeutic principles at scale. The early detection capabilities of intelligent monitoring systems align with preventive mental health models, offering the possibility of intercepting anxiety before it crystallizes into chronic avoidance or academic impairment (Essau et al., 2020a; Wang et al., 2023). Similarly, AI-guided self-regulation tools and conversational agents provide scalable platforms for delivering and reinforcing core CBT components—cognitive restructuring, exposure, and behavioral activation—in accessible, low-stigma formats that can augment traditional counseling (Fitzpatrick et al., 2017; Inkster et al., 2020). Crucially, the personalization enabled by machine learning speaks directly to the psychological need for autonomy and competence emphasized in self-determination theory (Deci & Ryan, 2000). When AI systems adapt support pathways based on individual response patterns, they can foster a sense of agency and mastery over anxiety, which is foundational for intrinsic motivation and emotional resilience.

However, a purely psychological lens is insufficient. Interpreting these findings through the framework of inclusive education reveals both the transformative potential and the profound pitfalls of AI applications. Inclusive pedagogy, as articulated by scholars like Florian (2019a) and Ainscow (2020), rejects deficit-oriented models of student difficulty, instead locating challenges within the interaction between the learner and their environment. From this viewpoint, AI tools aligned with Universal Design for Learning (UDL) principles can be powerful instruments for removing barriers (CAST, 2018). For example, an AI system that offers multiple means of engaging with anxiety-management content—through text, interactive simulation, audio, or game—accommodates neurodiverse learning preferences and reduces

the stigma of a one-size-fits-all approach (Pagliara et al., 2024a). AI can thus help operationalize inclusion by providing differentiated, flexible support that responds to emotional variability as a normal aspect of human diversity, not a pathology to be corrected.

The synthesis of these perspectives yields a critical insight: AI's greatest value for school anxiety may lie in its ability to reconfigure the ecology of support. Instead of positioning the anxious student as the primary site of intervention, well-designed AI can provide data and tools that empower schools to examine and adapt their own practices. Learning analytics that reveal how specific assessment methods spike anxiety across a cohort, or affective computing that highlights which classroom interactions provoke stress, can inform systemic changes towards more psychologically safe and equitable learning environments (OECD, 2019a; Zembylas, 2019). In this model, AI serves not merely as a treatment for individual pathology but as a mirror and a lever for institutional self-reflection and change, aligning technological capability with the social justice imperatives of inclusive education.

7.2. Implications for Secondary School Practice and Policy

The transition from research findings to effective school practice requires careful, staged implementation guided by clear principles. First, AI integration must be pedagogically led, not technologically driven. Schools should avoid adopting off-the-shelf AI tools without a prior analysis of their specific needs, existing support structures, and ethical readiness. The primary question must be: What anxiety-related challenge are we trying to solve, and is AI the most appropriate, equitable, and ethical means to solve it? This necessitates the development of AI literacy among educational leaders and mental health professionals, enabling them to critically evaluate tools for algorithmic bias, data privacy standards, and alignment with pedagogical values (Holmes et al., 2021; Kooli, 2025).

Second, teacher mediation and professional development are non-negotiable. The review consistently underscores that AI's effectiveness is maximized within a "human-in-the-loop" model (Whitaker & Bakker, 2020). Teachers and counselors require training not just to use AI tools, but to interpret their outputs contextually, to integrate digital insights into relational practice, and to safeguard against the uncritical delegation of professional judgment to algorithms (Ertmer & Ottenbreit-Leftwich, 2010). Professional development should focus on fostering "pedagogical data fluency"—the ability to blend AI-generated data about student anxiety with deep, contextual knowledge of the student as a whole person.

Third, implementation must be governed by robust ethical and data governance frameworks. Schools must develop transparent policies, co-created with students, parents, and staff, that address consent (especially for minors), data ownership, security, retention periods, and the right to explanation (Shapiro & Stolerman, 2021). These policies should explicitly guard against surveillance creep, ensuring that anxiety monitoring is framed as a consensual support mechanism, not a disciplinary or performance-management tool. Furthermore, schools have an obligation to audit and select tools that demonstrate efforts to mitigate algorithmic bias through diverse training data and transparent validation reports (Greene et al., 2020).

Fourth, equity of access must be a primary design and implementation criterion. The digital divides in infrastructure, connectivity, and digital literacy are well-documented (OECD, 2023a). An AI-based anxiety initiative that is only available to students with the latest devices or reliable home internet will exacerbate existing mental health disparities. Solutions may include school-based access points, low-bandwidth options, and ensuring that AI supports are part of universal, school-wide provision rather than an optional add-on. This aligns with the inclusive education principle that support for emotional well-being is a universal right, not a privileged service.

Finally, AI should be leveraged to strengthen, not replace, comprehensive Social and Emotional Learning (SEL) curricula. AI tools for anxiety can be most powerful when embedded within a broader, whole-school commitment to SEL (CASEL, 2020). For instance, data from an AI mood-tracking tool could inform SEL circle discussions; a virtual reality exposure module could be debriefed with a counselor to build metacognitive awareness. This integrated approach ensures that technology enhances the human-relational core of SEL, rather than creating a parallel, technological track for mental health.

7.3. Confronting Persistent Risks and Unresolved Tensions

Despite the promising avenues outlined, this discussion must foreground significant risks that could undermine the responsible use of AI for school anxiety. The surveillance- support tensionremains paramount. The very infrastructure of continuous monitoring designed to "help" can foster atmospheres of perpetual evaluation, potentially increasing student anxiety and eroding trust (Zembylas, 2019). There is a thin line between a supportive check-in prompted by an algorithm and a student feeling perpetually watched and judged. Navigating this requires absolute transparency,

student agency over their data, and clear boundaries on how data is used.Algorithmic bias and the justice gap constitute perhaps the most severe threat. If AI systems are trained on data that under-represents certain cultures, neurotypes, or socioeconomic groups, they will inevitably fail those populations (Greene et al., 2020). This could lead to a dangerous scenario where AI-mediated mental health support, touted as a progressive innovation, actively widens the well-being gap by providing superior, personalized support to majority-group students while misdiagnosing or ignoring marginalized peers. Combating this requires a commitment to participatory, co-design methodologies that center the voices of diverse students from the outset, not as an afterthought (Zhu & Cheng, 2022).

The commercialization of student well-beingpresents another critical tension. Many AI tools are developed by for-profit entities whose primary accountability is to shareholders, not to educational ethics or child welfare. This can lead to conflicts of interest, data exploitation, and features designed for engagement and retention (e.g., gamification, notifications) that may not align with therapeutic best practices. Schools must exercise due diligence and advocate for an "edtech ethics" that prioritizes student welfare over commercial gain.Furthermore, long-term efficacy and developmental appropriatenessare unresolved questions. Most studies on AI mental health tools are short-term trials. The longitudinal impact of growing up with algorithmically mediated emotional support is unknown. There is a risk that over-reliance on digital coping tools could impede the development of intrinsic self-regulation skills or the ability to seek and navigate complex human support. Research must investigate not just if these tools reduce anxiety symptoms in the short term, but what kind of emotional subjects they help form in the long term.

In conclusion, the path forward is not one of naive adoption or blanket rejection, but of critical implementation. AI offers a new set of powerful instruments for addressing the endemic challenge of school anxiety. However, these instruments must be wielded with wisdom, anchored in inclusive and psychological theory, guided by unwavering ethical principles, and constantly evaluated for their real-world impact on equity and student well-being. The ultimate goal is not to create "smart schools" filled with sensing technology, but to foster wise, responsive, and humane school communities where technology serves to deepen care, understanding, and justice for every adolescent.

8. Future Directions

This integrative review has systematically charted the emerging and complex landscape of Artificial Intelligence (AI) applications for addressing school-related anxiety in adolescence. Through an analysis spanning psychological foundations, technological mechanisms, pedagogical integration, and ethical imperatives, a central thesis emerges: AI possesses a significant, yet conditional, potential to reshape how secondary education systems support student emotional well-being. This potential is not inherent to the technology itself but is wholly dependent on its alignment with human-centered values, inclusive principles, and rigorous ethical governance. This concluding chapter consolidates the core insights derived from the review, articulates their concrete implications for educational policy and professional practice, and proposes a critical roadmap for future research that must guide the responsible evolution of this field.

8.1. Principal Contributions of the Review

The analysis presented in this paper makes several distinct contributions to the interdisciplinary discourse on AI in education and adolescent mental health. Primarily, it advances a relational and ecological model of AI integration, moving decisively beyond narratives of technological substitution. The evidence synthesized consistently demonstrates that the most effective and ethically sound applications of AI are those that augment and enhance human capacities for care and perception. Whether through intelligent monitoring systems that refine a teacher's awareness of student distress, conversational agents that offer low-stigma practice for social-emotional skills later reinforced by a counselor, or learning analytics that provide data to inform school-wide climate initiatives, the value of AI is realized when it strengthens the human relationships and systemic supports at the core of education. This reframing positions AI not as an autonomous solution to anxiety, but as a sophisticated tool for fostering more attentive, responsive, and data-informed educational ecosystems where technology serves to deepen human connection rather than replace it.

A second, critical contribution lies in the foregrounding of equity and justice as central analytical lenses. By applying frameworks from inclusive pedagogy and critical data studies, this review explicitly argues that the risks associated with AI—particularly algorithmic bias, surveillance, and the digital divide—are not peripheral concerns but fundamental issues of educational justice. The review posits that for an AI tool to be considered truly inclusive, it must be designed and validated through participatory, co-design processes that actively center the voices and experiences of marginalized students, including those from diverse cultural, neurodivergent, and socioeconomic backgrounds. This establishes equity not as an optional add-on or a post-hoc evaluation metric, but as a non-negotiable design prerequisite and a core criterion for ethical legitimacy in public education settings.Furthermore, this work provides a nuanced and

balanced synthesis of the empirical evidence regarding efficacy. It acknowledges the promising results from controlled studies on AI-driven interventions such as cognitive-behavioral therapy chatbots, virtual reality exposure, and adaptive self-regulation platforms, which show modest-to-moderate effects in reducing anxiety symptoms. Simultaneously, it introduces necessary critical realism by highlighting the significant "efficacy-effectiveness gap." Challenges such as low long-term user engagement, difficulties in integrating digital tools into the complex daily routines of schools, and the irreplaceable role of the therapeutic alliance mean that real-world outcomes in diverse school settings are likely to be more variable and contingent than initial research suggests. This tempered perspective is vital for managing stakeholder expectations and guiding prudent implementation.

Finally, the review codifies a set of essential prerequisites for the responsible adoption of AI in schools. Distilled from a wide-ranging literature, these include the imperative of human-in-the-loop oversight to maintain professional judgment and contextual interpretation; the necessity of transparent, robust data governance policies that protect student privacy and affirm agency; the requirement for tools to align with Universal Design for Learning principles to accommodate learner variability; and the overarching need for alignment with the relational and social justice values of inclusive education. By consolidating these principles, this analysis offers a foundational framework to guide educators, administrators, and policymakers.

8.2. Implications for Policy and Professional Development

The insights generated necessitate deliberate and structured responses at both systemic and practitioner levels. For educational policy, the advent of AI in student well-being calls for the development of new, specific governance frameworks. Education ministries and school districts should mandate Algorithmic Impact Assessments as part of any procurement process, requiring technology providers to transparently disclose the composition of their training data, the results of bias testing across relevant student subgroups, and the clear limitations of their models. Concurrently, schools must develop Student Data Charters—rights-based policies co-created with students, parents, and staff—that explicitly govern data collection purposes, ownership, security, retention, and students' right to access, correct, and request deletion of their personal information. Policy must also ensure equitable access, allocating resources to bridge digital divides so that AI-enabled support does not become a privilege for well-resourced schools but a universally available component of a comprehensive student support system.

Equally critical is the transformation of professional development for educators and support staff. Moving beyond general digital literacy, training must cultivate specialized competencies for the AI-augmented school. This includes fostering Relational Data Literacy—the ability for teachers and counselors to skillfully interpret AI-generated insights (e.g., "patterns suggest rising test anxiety") within the rich, personal context they hold for each student, leading to nuanced and compassionate interventions rather than algorithmic prescriptions. Professional learning must also build Ethical Foresight, empowering staff to anticipate and navigate dilemmas, such as resisting the misuse of emotional data for disciplinary purposes or challenging algorithmic recommendations that lack cultural sensitivity. Furthermore, educators need skills in Participatory Design Facilitationto lead co-creation workshops with students, ensuring that the tools implemented genuinely reflect user needs and voices. For school-based mental health professionals, training in Digital Therapeutic Integrationis essential to safely and effectively prescribe, monitor, and blend evidence-based AI tools into broader therapeutic plans.

9. Conclusion

To build a more robust, equitable, and practical evidence base, future research must pivot towards several priority agendas. First, there is an urgent need for longitudinal studies with high ecological validity. Research must move beyond short-term efficacy trials to investigate the multi-year impact of AI tools on academic pathways, the development of intrinsic self-regulation skills, and long-term mental health outcomes. These studies must be conducted in authentic, under-resourced, and diverse school settings to understand how these tools function amidst the real-world constraints of education.

Second, research must be explicitly equity-centric in both design and evaluation. The paramount question must shift from "Does this tool work?" to "For whom does this tool work, under what conditions, and for whom does it fail or cause harm?" Methodologies from justice-oriented design, such as community-based participatory research, should be employed to co-design studies and interventions with marginalized youth communities. Success metrics should include the reduction of well-being disparities, not just aggregate symptom reduction.

Third, deep qualitative and mixed-methods inquiry is needed to unpack the nuanced dynamics of human-AI interaction in schools. How do teachers, in the hectic reality of the school day, perceive, trust, and act upon an AI-generated alert?

How do adolescents subjectively experience a chatbot as a confidant or a coach? Understanding these lived experiences and micro-processes is fundamental to designing AI systems that are not only technically effective but also socially integrated and accepted.A fourth crucial avenue is policy and governance research. Comparative studies examining the implementation and outcomes of AI under different regulatory regimes (e.g., the EU's GDPR versus more fragmented approaches) can yield critical insights for global policy development. Research should also evaluate the effectiveness of various school-level governance models, such as student data ethics boards or algorithmic audit committees.

Finally, a proactive research agenda must diligently investigate unintended consequences and potential harms. Scholars should explore whether constant emotional self-tracking might promote excessive rumination, whether gamified interventions could trivialize emotional suffering, or whether predictive risk modeling might lead to the unfair pre-emptive labeling of students. Responsible innovation in this sensitive domain requires a vigilance equal to the pursuit of benefit, ensuring that the drive to help does not inadvertently cause new forms of distress or injustice.In conclusion, the integration of AI into the support of adolescent school anxiety represents a profound juncture for education. This review argues that the path forward must be navigated with a commitment to wisdom over mere intelligence. The objective is not to create schools populated by sensing machines, but to foster empathetically intelligent school communities—environments that harness technology judiciously to expand their capacity for understanding, connection, and equitable care. Realizing this vision demands sustained, interdisciplinary collaboration among educators, psychologists, ethicists, technologists, and, most essentially, the adolescents themselves. Their well-being and flourishing will ultimately depend not on the sophistication of the algorithms we deploy, but on the humanity, justice, and wisdom we demonstrate in their use.

Compliance with ethical standards

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The Authors proclaim no conflict of interest.

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