

Emotional intelligence of children and adolescents: Effects of virtual reality programs and simulation training for nursing students on mental health measurement and development

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<https://doi.org/10.5281/zenodo.19761713>

Abstract:

Emotional intelligence (EI) is a fundamental determinant of psychological resilience, social competence, and overall well-being among children and adolescents. It encompasses essential skills such as self-awareness, emotional regulation, empathy, motivation, and interpersonal communication, all of which significantly influence developmental trajectories and mental health outcomes. In recent years, the rising incidence of mental health disorders including anxiety, depression, and behavioural disturbances has underscored the urgent need for innovative, evidence-based approaches to early assessment and intervention. Virtual reality (VR) has emerged as a transformative technology in mental health education and clinical training, offering immersive, controlled, and interactive environments that simulate real-life scenarios. This article examines the integration of EI development frameworks with VR-based simulation in nursing education, highlighting how such approaches enhance students' clinical competence in assessing and managing paediatric mental health conditions. VR enables nursing students to engage in realistic patient interactions, practice emotional and behavioural assessment skills, and receive immediate feedback in a safe, repeatable setting. This experiential learning fosters improved empathy, critical thinking, decision-making, and communication skills.

Keywords:

Emotional Intelligence (EI), Virtual Reality (VR), Nursing Education, Mental Health, Children and Adolescents, Simulation-Based Learning.

1. Introduction:

Mental health disorders among children and adolescents have risen significantly over the past decade, becoming a major public health concern across both developed and developing countries. Epidemiological evidence indicates that approximately one in seven individuals aged 10–19 years experiences a diagnosable mental health condition, with anxiety, depression, and behavioural disorders being the most prevalent (World Health Organization et al., 2021). This increasing burden is attributed to a complex interplay of biological, psychological, and social factors, including academic pressure, family dynamics, exposure to digital media, and socio-economic instability (Patel et al., 2018, Racine et al., 2021). The early onset of these disorders not only affects immediate well-being but also has long-term consequences, often persisting into adulthood and contributing to reduced quality of life, impaired functioning, and increased risk of substance abuse and suicide (Thapar et al., 2022). Consequently, early identification and timely intervention have become critical priorities in mental health care systems worldwide. In this context, emotional intelligence (EI) has emerged as a significant protective factor that can buffer against the development and progression of mental health problems. Emotional intelligence refers to the ability to perceive, understand, regulate, and effectively use emotions in oneself and others (Mayer et al., 2016). It encompasses a range of competencies, including emotional awareness, self-regulation, empathy, and social skills, all of which are essential for adaptive functioning. Children and adolescents with higher levels of EI are better equipped to manage stress, navigate

social relationships, and cope with challenging situations, thereby reducing their vulnerability to psychological distress (Zeidler et al., 2019).

The role of EI in emotional regulation is particularly important during adolescence, a developmental stage characterized by heightened emotional reactivity and ongoing maturation of neural systems. Neurodevelopmental research suggests that the imbalance between the limbic system, which governs emotional responses, and the prefrontal cortex, responsible for executive control, contributes to increased emotional volatility in adolescents (Casey et al., 2019). In such a context, the development of emotional intelligence skills can facilitate more effective regulation of emotions, enabling individuals to respond to stressors in a constructive manner rather than resorting to maladaptive coping strategies such as avoidance, aggression, or self-harm (Mitrovic et al., 2017). Furthermore, emotional intelligence is closely linked to social competence, which plays a vital role in mental health outcomes. Adolescents with strong interpersonal skills and empathy are more likely to form supportive relationships with peers and family members, which serve as protective buffers against stress and adversity (Schobert-Reichl, 2017). Social connectedness has been consistently associated with lower levels of depression and anxiety, highlighting the importance of fostering EI in early developmental stages. Educational settings, in particular, provide a critical platform for promoting emotional intelligence through structured programs such as social-emotional learning (SEL), which have demonstrated effectiveness in improving emotional regulation, academic performance, and overall well-being (Durlach et al., 2022). In addition to its preventive role, emotional intelligence also contributes to early identification of mental health issues. Individuals with higher EI are more likely to recognize and articulate their emotional experiences, making it easier for caregivers, educators, and healthcare professionals to detect signs of distress and initiate appropriate interventions (Keefer et al., 2018). This self-awareness not only facilitates help-seeking behaviour but also enhances the effectiveness of therapeutic interventions, as individuals are better able to engage in reflective processes and apply coping strategies.

Despite its benefits, the development of emotional intelligence is not uniform and can be influenced by various environmental factors, including parenting styles, cultural norms, and educational opportunities. Supportive and responsive caregiving has been shown to promote emotional competence, whereas adverse childhood experiences such as neglect or trauma can hinder EI development and increase the risk of mental health disorders (Luo et al., 2020). Therefore, interventions aimed at enhancing emotional intelligence must adopt a holistic approach, addressing both individual skills and environmental contexts. In recent years, innovative approaches such as digital interventions, including virtual reality and simulation-based training, have been explored to enhance emotional intelligence and mental health outcomes. These technologies provide immersive and interactive environments where children and adolescents can practice emotional regulation and social interactions in a safe and controlled setting (Riva et al., 2019). Such approaches also hold promise for training healthcare professionals, particularly nursing students, in recognizing and managing emotional and psychological conditions effectively. Figure 1 illustrates the global distribution and prevalence of major mental health disorders among adolescents, with a particular focus on anxiety disorders, depressive disorders, and behavioural conditions. The figure highlights that anxiety and depression constitute the largest proportion of mental health issues in this age group, followed by conduct and behavioural disorders. It also demonstrates variation across age subgroups within adolescence, typically showing an increase in prevalence from early adolescence (10–14 years) to late adolescence (15–19 years). Additionally, the figure may reflect regional disparities, where low- and middle-income countries often report higher unmet mental health needs due to limited access to healthcare resources (World Health Organization et al., 2021, Racine et al., 2021). The upward trend depicted emphasizes not only the growing burden but also the widening gap between mental health needs and available services. This visualization underscores the importance of early screening, prevention strategies, and the adoption of innovative, scalable interventions such as virtual reality-based programs, which can enhance accessibility and engagement in mental health care among young populations.

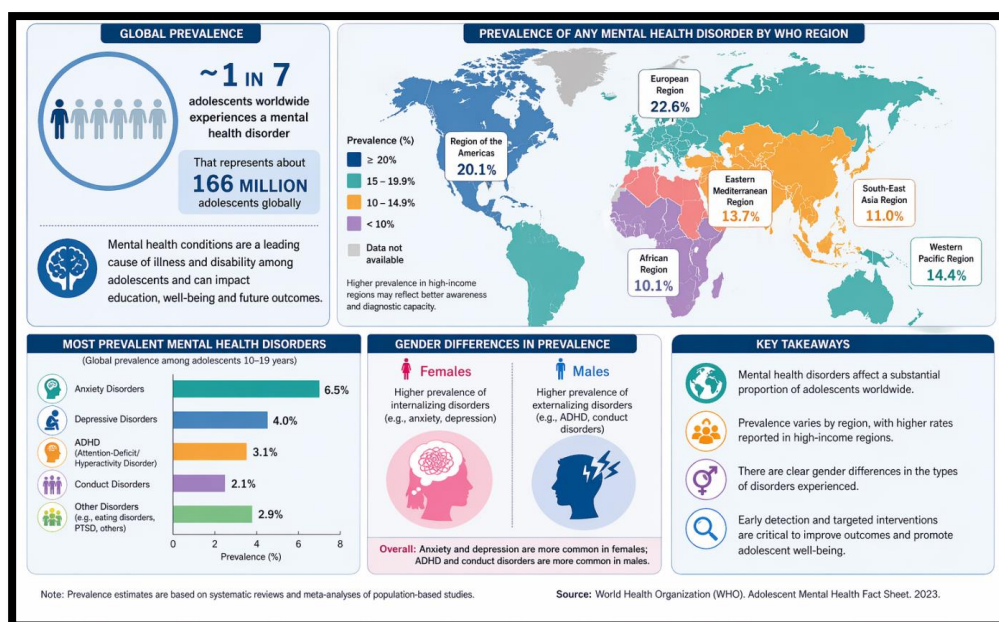


Figure. 1: Global Prevalence and Distribution of Mental Health Disorders among Adolescents

2. Concept of emotional intelligence:

Emotional intelligence (EI) refers to the capacity to recognize, understand, interpret, and manage emotions effectively in oneself and others. It is a multidimensional construct that integrates emotional awareness with cognitive processing, enabling individuals to navigate social environments, build relationships, and respond adaptively to challenges. Over the past decade, emotional intelligence has gained significant attention in developmental psychology and mental health research, particularly in the context of children and adolescents, where emotional competencies play a foundational role in shaping personality, behaviour, and overall well-being (Mayer et al., 2016, Keefer et al., 2018). At its core, emotional intelligence begins with self-awareness, which involves the ability to accurately perceive and identify one's own emotions. This includes recognizing subtle emotional states, understanding their causes, and acknowledging their impact on thoughts and behaviour. Self-awareness is considered the cornerstone of emotional intelligence because it forms the basis for other emotional competencies. Children and adolescents who develop strong self-awareness are better equipped to understand their emotional triggers and patterns, which in turn facilitates effective emotional regulation (Brackett et al., 2019). For example, an adolescent who can identify feelings of frustration in academic settings is more likely to seek constructive solutions rather than react impulsively. Closely linked to self-awareness is self-regulation, which refers to the ability to manage and control emotional responses in a constructive manner. This component involves skills such as impulse control, emotional modulation, and the capacity to remain calm under stress. During adolescence, when emotional reactivity is heightened due to ongoing neurodevelopmental changes, self-regulation becomes particularly critical. Research suggests that effective emotional regulation is associated with reduced levels of anxiety, depression, and aggressive behaviour (Gross, 2015, Mitrovic et al., 2017). Individuals with strong self-regulation skills are able to delay gratification, adapt to changing circumstances, and maintain emotional balance even in challenging situations. Another essential component of emotional intelligence is motivation, specifically intrinsic motivation, which refers to the drive to pursue goals for personal satisfaction and growth rather than external rewards. Emotionally intelligent individuals tend to exhibit higher levels of persistence, optimism, and resilience. In children and adolescents, intrinsic motivation is closely associated with academic achievement and positive mental health outcomes. It enables young individuals to overcome setbacks and maintain focus despite difficulties, thereby fostering a sense of competence and self-efficacy (Durlach et al., 2022). Motivation, in the context of EI, also involves emotional commitment to goals and the ability to channel emotions in a productive direction. Empathy, another critical dimension of emotional intelligence, involves the ability to understand and share the feelings of others. It encompasses both cognitive empathy (understanding another person's perspective) and affective empathy (experiencing emotional resonance with others). Empathy is fundamental to social functioning, as it facilitates compassionate behaviour, cooperation, and conflict resolution. In developmental contexts, children and adolescents with higher levels of empathy are more likely to form meaningful relationships and exhibit prosocial behaviours such as helping and sharing (Schobert-Reichl, 2017). Empathy also plays a protective role in mental health by reducing social isolation and promoting a sense of belonging.

Social skills, the final key component of emotional intelligence, refer to the ability to interact effectively with others, communicate clearly, and build healthy relationships. These skills include verbal and non-verbal communication, active listening, conflict management, and teamwork. Social competence is particularly important during adolescence, a period characterized by increased reliance on peer relationships and social identity formation. Strong social skills enable adolescents to navigate complex social situations, establish supportive networks, and avoid interpersonal conflicts that may contribute to stress and psychological distress (Jones et al., 2019). Importantly, these components of emotional intelligence do not function in isolation, rather, they are interconnected and mutually reinforcing. For instance, self-awareness enhances self-regulation, while empathy supports the development of social skills. Together, they form a comprehensive framework that supports emotional and social functioning. In recent years, emotional intelligence has been increasingly incorporated into educational and clinical interventions, particularly through social-emotional learning (SEL) programs. These programs aim to systematically develop EI competencies and have been shown to improve academic performance, emotional well-being, and behavioural outcomes among children and adolescents (Durlach et al., 2022). Furthermore, advances in neuroscience have provided insights into the biological underpinnings of emotional intelligence. Brain regions such as the prefrontal cortex and amygdala play a crucial role in emotional processing and regulation. The maturation of these neural systems during adolescence influences the development of EI skills, highlighting the importance of supportive environments and targeted interventions during this critical period (Casey et al., 2019). Emotional intelligence is a vital construct that encompasses self-awareness, self-regulation, motivation, empathy, and social skills. These components collectively contribute to adaptive functioning, mental health, and overall development in children and adolescents. By fostering emotional intelligence through educational, familial, and technological interventions, it is possible to equip young individuals with the skills necessary to navigate emotional challenges, build meaningful relationships, and achieve long-term well-being. Figure 2 illustrates the five core components of emotional intelligence self-awareness, self-regulation, motivation, empathy, and social skills and highlights their dynamic and interconnected nature. The figure emphasizes that these domains do not operate independently, rather, they interact continuously to shape emotional competence and behavioural outcomes in children and adolescents. For instance, self-awareness enables individuals to recognize their emotional states, which in turn facilitates effective self-regulation. Similarly, empathy enhances social skills by allowing individuals to understand and respond appropriately to others' emotions. The figure may be conceptualized as a circular or network model, where each component is linked to the others, reflecting a synergistic relationship. This interconnected framework supports adaptive functioning by enabling young individuals to manage stress, build positive relationships, and respond constructively to social challenges.

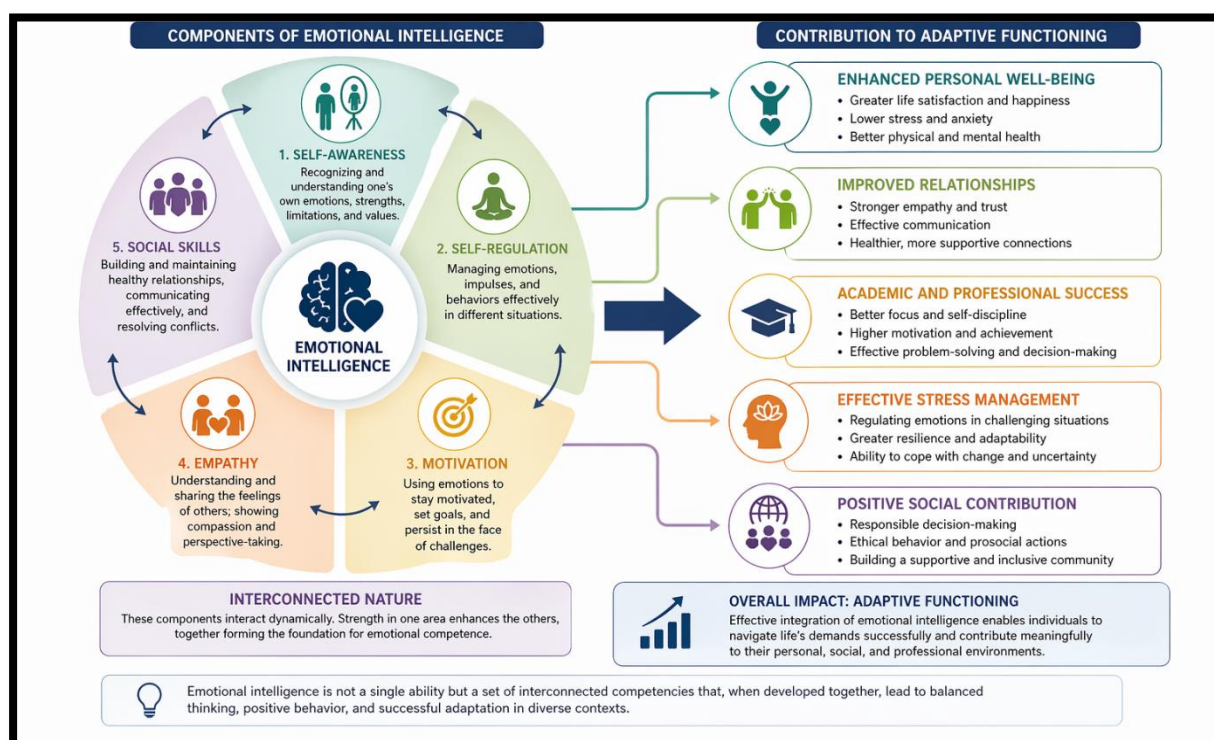


Figure. 2: Interconnected Components of Emotional Intelligence and Their Contribution to Adaptive Functioning

Table 1 illustrates the multidimensional nature of emotional intelligence by expanding its core components and linking them with underlying processes, outcomes, and real-life applications. Emotional intelligence is not a single skill but a combination of interrelated abilities that work together to influence how individuals perceive, understand, and manage emotions in themselves and others. Self-awareness forms the foundation, as recognizing one's emotions is essential for effective regulation and decision making. Building upon this, self-regulation enables individuals to manage emotional responses, particularly in stressful or challenging situations, thereby promoting emotional stability. Empathy and emotional perception extend this understanding to others, facilitating meaningful interpersonal connections and enhancing social harmony. Social skills translate these emotional competencies into effective communication and relationship management, which are crucial in both personal and professional contexts. Additionally, motivation plays a significant role in sustaining goal directed behaviour and fostering resilience, especially when individuals face obstacles or setbacks. Emotional expression further complements these components by ensuring that feelings are conveyed clearly and appropriately, reducing the likelihood of misunderstandings. Together, these components demonstrate that emotional intelligence is a dynamic and integrative construct that contributes to psychological wellbeing, social competence, and overall life success

Table 1: Expanded Components of Emotional Intelligence

Component	Description	Key Processes	Outcome	Practical Example
Self-awareness	Recognizing and understanding one's own emotions and their effects	Emotional recognition, introspection, reflection	Better self-understanding, improved decision making	Noticing stress before an exam and adjusting preparation
Self-regulation	Managing and controlling emotional responses in various situations	Impulse control, adaptability, stress management	Emotional stability, reduced impulsive reactions	Staying calm during an argument and responding thoughtfully
Empathy	Understanding and sharing the feelings of others	Perspective taking, emotional attunement	Strong relationships, increased trust	Comforting a friend who is feeling upset
Social skills	Effectively interacting and communicating with others	Communication, teamwork, conflict resolution	Social competence, effective collaboration	Resolving group conflicts through discussion
Motivation	Internal drive to achieve goals and remain positive despite challenges	Goal setting, perseverance, optimism	Higher productivity, resilience	Continuing to work hard despite setbacks
Emotional expression	Appropriately expressing emotions through verbal and nonverbal means	Verbal communication, body language awareness	Better communication, reduced misunderstandings	Clearly expressing appreciation or concern
Emotional perception in others	Accurately identifying emotions in others through cues	Observation, interpretation of expressions and tone	Improved social awareness, stronger interpersonal bonds	Noticing subtle signs of discomfort in others

3. Development of emotional intelligence in children and adolescents:

The development of emotional intelligence (EI) begins in early childhood and continues to evolve throughout adolescence, shaped by a dynamic interaction of biological maturation and environmental influences. In the early years of life, children start to recognize basic emotions such as happiness, sadness, anger, and fear. This initial stage of emotional awareness is largely influenced by caregivers, who play a crucial role in modelling emotional expression and regulation. Responsive parenting, characterized by warmth, consistency, and emotional support, helps children label their emotions accurately and develop a sense of emotional security. When caregivers acknowledge and validate a child's feelings, it fosters self-awareness and lays the groundwork for more complex emotional competencies (Denham et al., 2015). As children grow into middle childhood, their emotional understanding becomes more sophisticated. They begin to recognize that individuals can experience multiple emotions simultaneously and that emotions can vary in intensity. At this stage, children also develop greater self-regulation skills, learning to control impulses, delay gratification, and adapt their emotional responses to different social contexts. Schools play a significant role during this period by providing structured environments where children can practice social interactions, cooperation, and conflict resolution. Educational programs that emphasize social-emotional learning (SEL) have been shown to enhance emotional intelligence by teaching skills such as empathy, problem-solving, and emotional regulation in a systematic manner (Durlach et al., 2022). Peer interactions further contribute to the development of EI by offering opportunities to understand diverse perspectives and navigate social relationships. Friendships, in particular, serve as important contexts for practicing empathy and communication skills. Positive peer relationships reinforce prosocial behaviour and emotional competence, while negative experiences such as bullying or social exclusion can hinder emotional development and increase the risk of psychological distress. Thus, the social environment during childhood acts as both a facilitator and a potential barrier to the development of emotional intelligence. The transition into adolescence marks a critical period for EI development, characterized by rapid cognitive, emotional, and

social changes. Neurologically, adolescence involves significant maturation of brain regions associated with emotional processing and regulation, particularly the prefrontal cortex and limbic system. The heightened activity of the limbic system, which is responsible for emotional reactivity, combined with the still-developing regulatory functions of the prefrontal cortex, often results in increased emotional intensity and variability (Casey et al., 2019). This neurodevelopmental imbalance makes adolescents more sensitive to emotional stimuli and social feedback, emphasizing the importance of well-developed emotional intelligence skills during this stage. Cognitively, adolescents develop advanced abilities such as abstract thinking, perspective-taking, and self-reflection. These capabilities allow them to better understand complex emotional experiences, including mixed emotions and moral dilemmas. As a result, adolescents become more capable of empathy and are better equipped to navigate interpersonal relationships. However, this increased cognitive capacity also makes them more vulnerable to overthinking and emotional distress, particularly in the context of social pressures and identity formation. Emotional intelligence helps mitigate these challenges by enabling adolescents to interpret and manage their emotions effectively, thereby promoting resilience and psychological well-being (Zeidler et al., 2019). Family dynamics continue to play a significant role during adolescence, although the nature of influence shifts. While younger children rely heavily on parental guidance, adolescents seek greater autonomy and may turn to peers for emotional support. Nevertheless, supportive family relationships remain essential for healthy EI development. Open communication, emotional validation, and appropriate boundaries contribute to a secure environment where adolescents can explore their emotions and develop self-regulation skills. Conversely, family conflict, neglect, or lack of emotional support can disrupt EI development and increase the risk of mental health problems (Luo et al., 2020). Educational settings also remain influential during adolescence, particularly through programs that integrate emotional intelligence training into the curriculum. Schools that promote emotional literacy, mindfulness, and conflict resolution provide adolescents with practical tools to manage stress and build positive relationships. Teachers, as role models, can influence EI development by demonstrating empathy, effective communication, and emotional regulation. Such environments not only enhance emotional competence but also contribute to improved academic performance and social adjustment.

In addition to traditional influences, the digital environment has emerged as a significant factor in adolescent emotional development. Social media and online interactions can both support and challenge EI development. On one hand, digital platforms provide opportunities for social connection and self-expression, on the other hand, they may expose adolescents to cyberbullying, social comparison, and emotional overload. Developing emotional intelligence in this context involves learning to navigate digital interactions responsibly, regulate emotional responses to online stimuli, and maintain a healthy balance between virtual and real-world relationships. Overall, the development of emotional intelligence is a continuous and multifaceted process that evolves from early childhood through adolescence. It is shaped by a combination of familial, educational, social, and biological factors. During adolescence, in particular, the rapid cognitive and emotional changes present both opportunities and challenges for EI development. By fostering supportive environments and providing targeted interventions, it is possible to enhance emotional intelligence and promote positive developmental outcomes. Strengthening EI during these formative years not only improves immediate well-being but also equips individuals with essential skills for lifelong emotional and social functioning. Figure 3 illustrates the progressive development of emotional intelligence across different stages of childhood and adolescence, highlighting the gradual enhancement of emotional awareness, self-regulation, and interpersonal skills over time. In early childhood, the figure typically shows the emergence of basic emotional recognition and expression, largely influenced by caregiver interactions and environmental stimuli. As development progresses into middle childhood, there is a noticeable improvement in emotional understanding and regulation, along with the ability to navigate social situations more effectively. During adolescence, the figure reflects a more advanced level of emotional competence, including heightened self-awareness, complex emotional reasoning, and improved empathy and social interaction skills. This upward trajectory emphasizes that emotional intelligence evolves continuously through experience, cognitive maturation, and social engagement. The visualization underscores how these competencies build upon one another, ultimately supporting adaptive functioning, resilience, and healthy psychological development in increasingly complex social environments.

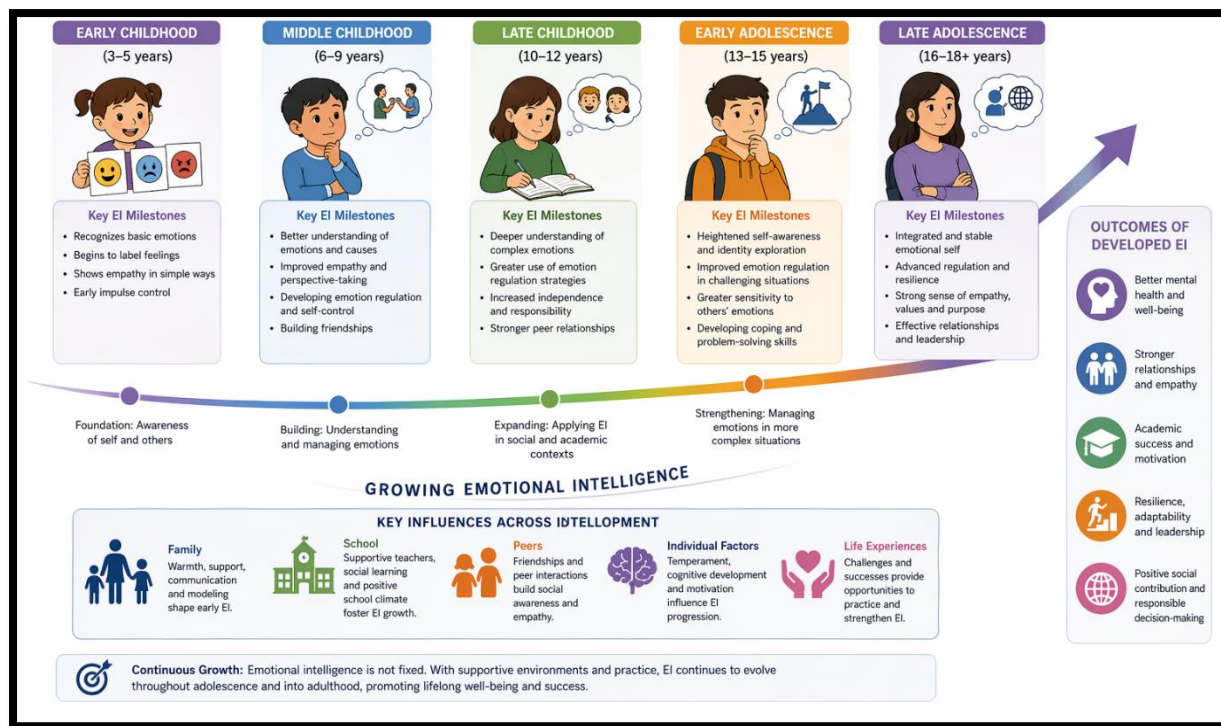


Figure. 3: Developmental Trajectory of Emotional Intelligence from Childhood to Adolescence

4. Mental health challenges in adolescence:

Adolescence represents a pivotal transitional stage between childhood and adulthood, characterized by rapid biological, cognitive, and psychosocial changes. During this period, individuals experience significant hormonal fluctuations, brain maturation, and evolving social roles, all of which contribute to heightened emotional sensitivity and vulnerability. These developmental shifts make adolescents particularly susceptible to mental health challenges, including anxiety, depression, and behavioural disorders. According to global estimates, a substantial proportion of mental health conditions emerge during adolescence, underscoring the importance of early identification and intervention (World Health Organization, 2021). One of the central features of adolescence is the ongoing development of the brain, particularly the prefrontal cortex, which is responsible for executive functions such as decision-making, impulse control, and emotional regulation. In contrast, the limbic system, which governs emotional responses and reward processing, develops earlier and is highly active during this stage. This imbalance between emotional reactivity and regulatory capacity often results in increased impulsivity, risk-taking behaviours, and emotional instability (Steinberg, 2014). Consequently, adolescents may struggle to effectively manage intense emotions, making them more prone to emotional dysregulation. Emotional dysregulation refers to difficulties in understanding, processing, and managing emotional experiences in a socially appropriate and adaptive manner. During adolescence, factors such as identity exploration, peer pressure, academic stress, and family dynamics can exacerbate emotional challenges. When adolescents lack adequate coping mechanisms or supportive environments, emotional dysregulation may manifest in maladaptive behaviours such as aggression, substance use, self-harm, or social withdrawal (Gross, 2015). These behaviours not only affect immediate well-being but can also have long-term implications for mental health and social functioning. Furthermore, the increasing influence of social relationships during adolescence plays a crucial role in emotional development. Peer acceptance and social belonging become highly significant, and negative experiences such as bullying, rejection, or social comparison particularly in the context of social media can intensify feelings of inadequacy and distress. Research indicates that exposure to chronic stressors during adolescence can disrupt emotional regulation processes and increase the risk of developing mood disorders (Patton et al., 2016). In this context, emotionally vulnerable adolescents may internalize negative experiences, leading to symptoms of anxiety and depression.

Another critical aspect is the role of family environment and parenting styles in shaping emotional regulation abilities. Supportive, responsive, and communicative parenting fosters emotional competence and resilience, whereas harsh, neglectful, or inconsistent parenting can impair emotional development. Adolescents who grow up in adverse environments, including those exposed to trauma or conflict, are at a higher risk of emotional dysregulation and associated psychological difficulties (Morris et al., 2007). These environmental influences interact with biological predispositions, further complicating the developmental trajectory.

Importantly, emotional dysregulation during adolescence is not merely a transient phase but can serve as a precursor to more severe mental health disorders. Persistent difficulties in managing emotions are strongly associated with conditions such as borderline personality traits, major depressive disorder, and anxiety disorders (Aldao et al., 2010). Without appropriate intervention, these issues may extend into adulthood, affecting interpersonal relationships, academic achievement, and occupational functioning. Figure 4 demonstrates the Neurobiological Mechanisms of Emotional Regulation Interaction Between the Amygdala, Prefrontal Cortex, and Limbic System. Despite these risks, adolescence also presents a critical window of opportunity for promoting emotional well-being and resilience. Interventions that focus on enhancing emotional intelligence, coping strategies, and social skills have shown promising outcomes in reducing psychological distress. School-based programs, counselling services, and family-cantered interventions can equip adolescents with the tools needed to navigate emotional challenges effectively (Durlach et al., 2011). Early support not only mitigates the risk of maladaptive behaviours but also fosters adaptive functioning and long-term mental health.

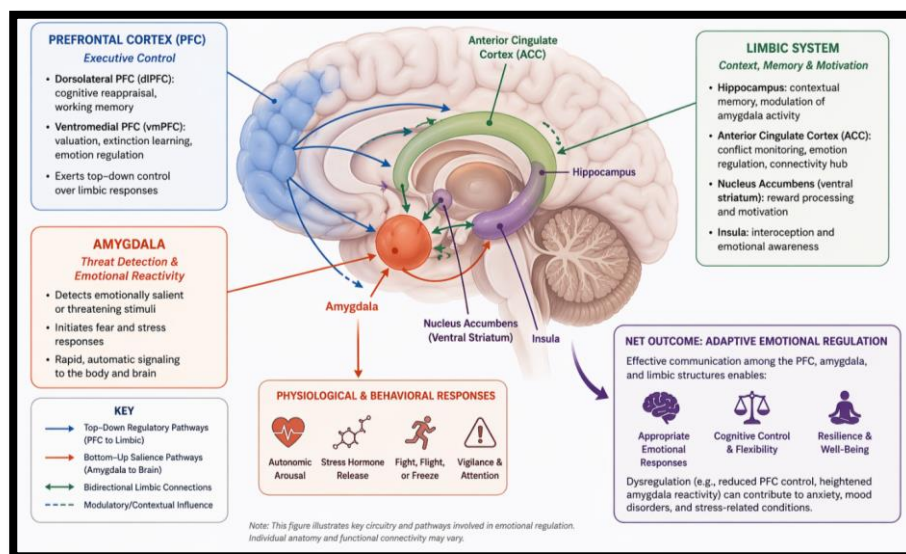


Figure. 4: Neurobiological Mechanisms of Emotional Regulation Interaction Between the Amygdala, Prefrontal Cortex, and Limbic System

5. Role of virtual reality in emotional intelligence development:

Virtual reality (VR) has emerged as a powerful tool for experiential learning, particularly in domains involving emotional processing, decision making, and behavioural adaptation. By creating immersive and interactive environments, VR allows users to engage with simulated scenarios that closely resemble real life situations, thereby eliciting authentic emotional responses. Unlike traditional learning approaches that rely on passive observation or theoretical instruction, VR places individuals within the experience itself, enhancing both emotional engagement and cognitive processing. This immersive exposure activates neural mechanisms associated with emotional memory, thereby improving retention and facilitating deeper learning outcomes. Research indicates that emotional arousal significantly contributes to memory consolidation, and VR effectively integrates emotional and experiential components to strengthen this process (Marinsky and Petersen, 2019). Furthermore, VR enables active participation, allowing users to interact with virtual environments, make decisions, and observe the consequences of their actions in real time. This interactivity promotes reflective learning and supports the development of critical emotional and social skills, particularly in fields such as healthcare, education, and psychological training (Radiant et al., 2020).

In therapeutic contexts, VR has proven especially valuable in providing controlled exposure to emotionally challenging situations. For example, VR based exposure therapy allows individuals to confront feared stimuli in a gradual and safe manner, which has been shown to be effective in treating anxiety disorders, phobias, and post-traumatic stress disorder (Maples Keller et al., 2017). The ability to manipulate environmental variables and tailor experiences to individual needs enhances both the safety and effectiveness of such interventions. Additionally, the concept of presence, defined as the subjective feeling of being physically present in a virtual environment, plays a critical role in amplifying emotional engagement and behavioural responses, thereby increasing the overall impact of the learning experience (Slater and Sanchez Vives, 2016). Despite its advantages, VR also presents certain limitations, including high costs, technical challenges, and potential user discomfort such as motion sickness. Ethical considerations must also be addressed when designing emotionally intense simulations to ensure psychological safety and prevent adverse effects.

Nevertheless, as technological advancements continue to improve accessibility and realism, VR is expected to play an increasingly important role in experiential learning. Its ability to provide immersive, emotionally rich, and controlled learning environments makes it a valuable tool for enhancing emotional intelligence, resilience, and adaptive behaviour across diverse domains (Freeman et al., 2017, Parsons and Rizzo, 2008). The process illustrated in Figure 5 presents a structured framework for understanding how virtual reality facilitates emotional learning through a sequence of interconnected stages. The first stage, immersion, places the user within a realistic and engaging virtual environment, creating a strong sense of presence that enhances attention and emotional involvement. This is followed by interaction, where individuals actively engage with the virtual scenario, make decisions, and respond to emotionally relevant stimuli. These interactions trigger the stage of emotional processing, during which users experience, interpret, and regulate their emotional responses in real time. This stage is crucial as it links cognitive understanding with emotional experience, allowing individuals to reflect on their reactions and develop adaptive coping strategies.

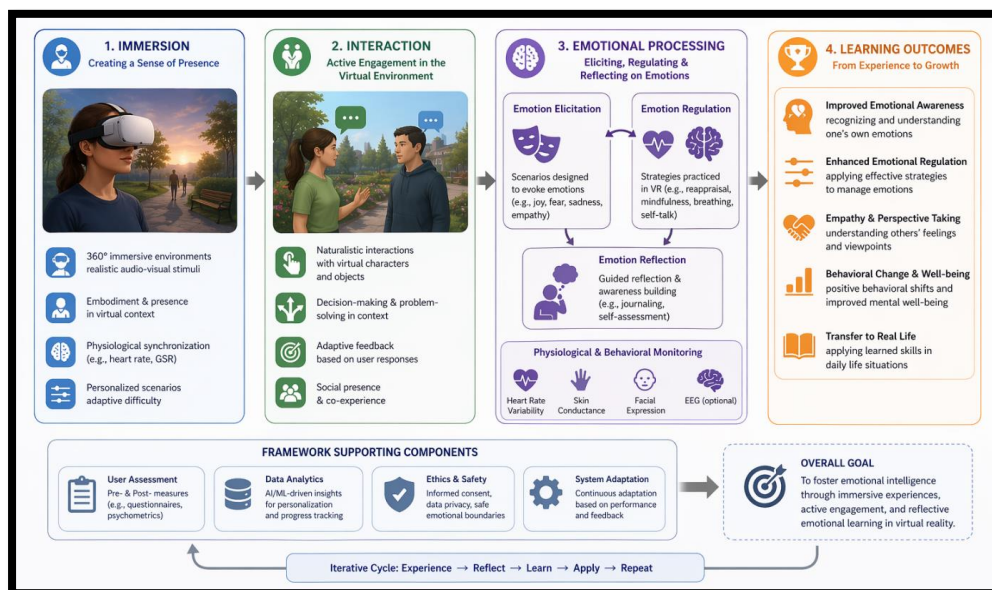


Figure. 5: Virtual Reality Based Emotional Learning Framework Involving Immersion Interaction Emotional Processing and Learning Outcomes

6. Simulation training for nursing students:

Simulation based training has become an essential component of modern nursing education, addressing the long-standing challenge of bridging the gap between theoretical knowledge and real-world clinical practice. Traditional teaching methods, while effective for building foundational knowledge, often fall short in preparing students for the complexity, unpredictability, and emotional demands of clinical environments. In this context, simulation-based learning, particularly through virtual reality, offers a transformative approach by providing immersive, interactive, and safe learning experiences that closely replicate real clinical scenarios. These simulations allow nursing students to apply theoretical concepts in practice, thereby enhancing clinical reasoning, decision making, and patient care skills (Can't and Cooper, 2017). Virtual reality simulations, in particular, have introduced a new level of realism and engagement in nursing education. By placing students in lifelike clinical settings, VR enables them to interact with virtual patients who exhibit a range of physical symptoms and emotional responses. This dynamic interaction helps students develop not only technical competencies but also essential soft skills such as communication, empathy, and emotional sensitivity. For example, students may encounter a virtual patient experiencing pain, anxiety, or distress, requiring them to respond appropriately through both verbal and nonverbal communication. Such experiences foster emotional awareness and encourage students to consider the psychological and emotional needs of patients alongside their physical conditions (Foronda et al., 2020). One of the key strengths of VR based simulation is its ability to provide a safe and controlled learning environment. Nursing students can practice complex or high-risk procedures without the fear of causing harm to real patients. This reduces anxiety and allows for repeated practice, which is critical for skill mastery. Mistakes made during simulations become valuable learning opportunities, as students can reflect on their actions, receive immediate feedback, and improve their performance. This iterative learning process enhances confidence and competence, preparing students for real clinical situations (Padilla et al., 2019). Moreover, VR simulations support experiential learning by actively engaging students in the learning process. Instead of passively

receiving information, learners are required to make decisions, prioritize care, and respond to evolving clinical scenarios. This active involvement strengthens critical thinking and clinical judgment, which are essential skills in nursing practice.

The immersive nature of VR also contributes to a heightened sense of presence, making the experience more realistic and emotionally impactful. Studies have shown that such immersive experiences can lead to better knowledge retention and improved transfer of skills to real world settings (Marinsky and Petersen, 2019). Another significant advantage of VR in nursing education is its ability to standardize learning experiences. In traditional clinical training, students may be exposed to different types of cases depending on availability, leading to variability in learning outcomes. VR simulations ensure that all students encounter a consistent set of clinical scenarios, including rare or complex cases that may not be frequently observed in real practice. This standardization helps ensure that all learners achieve a certain level of competency before entering clinical settings (Shorey and Ng, 2021). In addition to technical and cognitive skills, VR simulations play a crucial role in developing emotional intelligence among nursing students. By simulating patient interactions that involve emotional distress, cultural differences, or ethical dilemmas, VR encourages students to practice empathy, active listening, and compassionate care. These experiences are particularly valuable in preparing students to handle sensitive situations, such as delivering bad news or managing end of life care. As a result, students become more emotionally attuned and better equipped to provide holistic patient centered care (Liwa et al., 2020). Despite its numerous benefits, the integration of VR into nursing education is not without challenges. High costs, technological limitations, and the need for faculty training can hinder widespread adoption. Additionally, some students may experience discomfort or motion sickness during VR sessions, which can affect their learning experience. However, as technology continues to advance and become more accessible, these challenges are gradually being addressed, making VR a more feasible option for educational institutions. VR simulations prepare nursing students to meet the complex demands of modern healthcare, ultimately contributing to improved patient outcomes and quality of care (Foronda et al., 2020, Shorey and Ng, 2021). Figure 6 illustrates a structured simulation training model that enhances clinical competence through four interconnected stages: pre briefing, active simulation, debriefing, and reflective learning. The process begins with pre briefing, where learners are oriented to the clinical scenario, objectives, roles, and expectations, helping to establish psychological safety and reduce anxiety before engagement. This stage ensures that students are cognitively prepared and understand the context of the simulation. The next stage, active simulation, involves direct interaction with a realistic clinical environment, often through virtual or high-fidelity simulations, where students assess patients, make decisions, and apply clinical knowledge in real time. This hands-on experience strengthens critical thinking, communication, and teamwork skills. Following this, the debriefing stage provides an opportunity for guided reflection and discussion, where learners analyse their actions, evaluate outcomes, and receive constructive feedback from facilitators. This stage is crucial for identifying strengths and areas for improvement, thereby deepening learning.

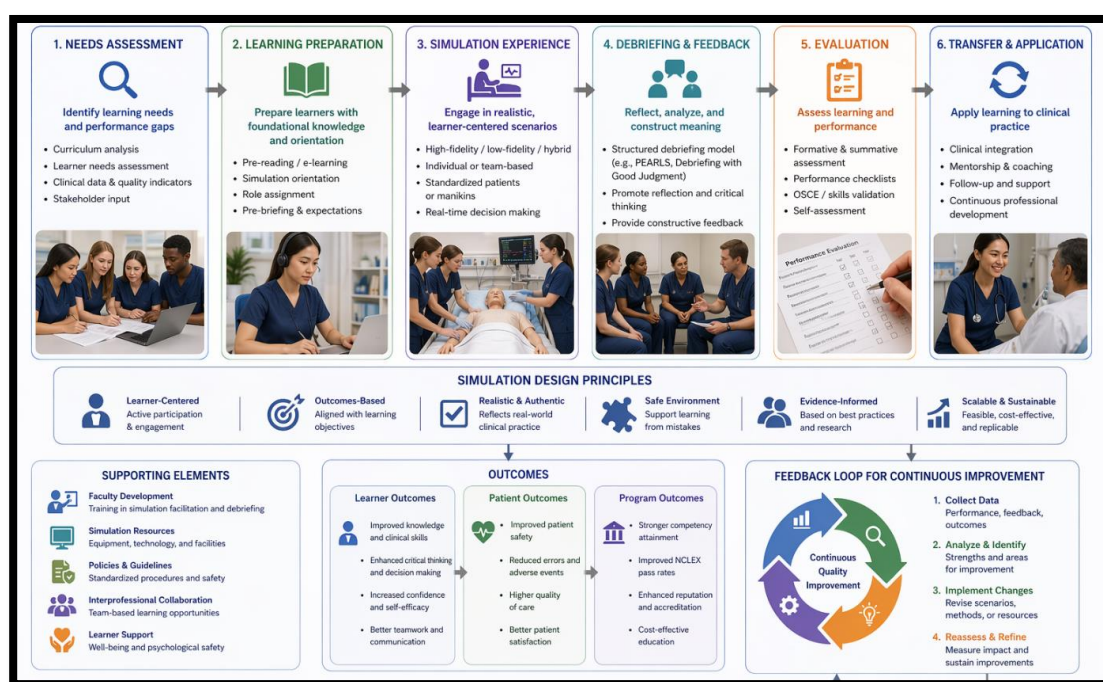


Figure. 6: Simulation Training Model in Nursing Education

The table 2 highlights how virtual reality–based simulation serves as a comprehensive educational tool in nursing training. By integrating immersive, interactive, and emotionally engaging scenarios, VR not only strengthens clinical and technical competencies but also enhances essential soft skills such as communication, empathy, and confidence. These outcomes are particularly significant in mental health care, where understanding patient emotions and maintaining therapeutic relationships are crucial. Furthermore, the safe and controlled virtual environment allows learners to make mistakes and learn from them without real-world consequences, thereby promoting critical thinking, emotional regulation, and patient safety awareness.

Table. 2: Benefits of Virtual Reality Simulation in Nursing Education

Domain	Key Outcomes	Description
Clinical Skills	Improved procedural accuracy	VR simulations provide repeated, risk-free practice, enhancing hands-on clinical competence and decision-making abilities.
Communication Skills	Enhanced patient interaction	Learners engage in realistic patient scenarios, improving verbal and non-verbal communication, especially in sensitive mental health contexts.
Confidence	Increased self-efficacy	Exposure to diverse clinical situations builds confidence in handling real-life patient care challenges.
Empathy	Greater emotional understanding	Immersive environments allow students to experience patient perspectives, fostering empathy and compassionate care.
Critical Thinking	Better clinical judgment	Scenario-based learning enhances analytical thinking and the ability to respond effectively u

7. Measurement of mental health using vr and simulation:

The use of virtual reality (VR) in mental health assessment represents a significant advancement over traditional diagnostic and observational methods. Conventional approaches, such as self-report questionnaires, clinical interviews, and standardized rating scales, often rely heavily on subjective reporting and retrospective recall, which can introduce bias and limit ecological validity. In contrast, VR offers a dynamic, immersive, and interactive platform that allows clinicians to observe patients' emotional and behavioural responses in real time within controlled yet realistic environments. This shift from static assessment to experiential evaluation enhances both the accuracy and depth of psychological assessment. One of the most important advantages of VR-based assessment is its ability to simulate real-life scenarios while maintaining experimental control. For example, individuals can be exposed to virtual social situations, stressful environments, or emotionally triggering contexts that would be difficult, unsafe, or unethical to recreate in real life. These simulations enable clinicians to directly observe behavioural patterns such as avoidance, emotional reactivity, decision-making, and coping strategies as they unfold. According to research by Riva et al. (2019), VR provides “ecologically valid environments” that bridge the gap between laboratory settings and real-world experiences, allowing for more authentic assessment of psychological functioning. Moreover, VR facilitates the measurement of real-time physiological and behavioural data, which enhances the objectivity of mental health assessments. Parameters such as heart rate variability, skin conductance, eye tracking, and movement patterns can be integrated into VR systems to provide continuous feedback on an emotional state. This multimodal data collection allows clinicians to detect subtle changes in anxiety, stress, or emotional arousal that may not be captured through self-report alone. Parsons (2015) highlights that VR-based assessments enable “performance-based evaluation,” where an individual's behaviour in simulated tasks serves as a direct indicator of cognitive and emotional functioning. Another key strength of VR in mental health assessment is its adaptability and personalization. Virtual environments can be tailored to the specific needs, triggers, or conditions of each individual. For instance, a patient with social anxiety disorder can be gradually exposed to increasingly complex social interactions, while a patient with post-traumatic stress disorder (PTSD) can engage with trauma-related cues in a controlled and graded manner. This flexibility not only improves diagnostic precision but also allows clinicians to assess symptom severity and progression over time. Freeman et al. (2017) emphasize that VR enables “graded exposure and controlled manipulation of stimuli,” making it a powerful tool for both assessment and intervention.

In addition, VR enhances patient engagement and reduces some of the barriers associated with traditional assessment methods. Many individuals, particularly adolescents and young adults, may find immersive technologies more engaging and less intimidating than conventional clinical settings. This increased engagement can lead to more natural responses and improved cooperation during assessment. Furthermore, VR can reduce social desirability bias, as individuals may respond more authentically within a virtual environment compared to face-to-face interviews. Maples-Keller et al. (2017) note that VR can create a “safe psychological space” where individuals feel more comfortable expressing emotions and behaviours. Despite its advantages, the use of VR in mental health assessment also raises important considerations. Issues related to cost, accessibility, technical expertise, and ethical concerns such as data privacy must be addressed before widespread implementation. Additionally, while VR provides valuable real-time data, it should be used as a

complementary tool rather than a complete replacement for traditional clinical judgment. The integration of VR with established assessment methods can offer a more comprehensive understanding of an individual's mental health. As technology continues to evolve, VR is likely to play an increasingly important role in transforming mental health assessment and improving patient outcomes. Figure 7 illustrates a structured model of mental health assessment using virtual reality, highlighting the sequential process through which immersive stimuli evoke emotional and behavioural responses that can be objectively evaluated. In this model, individuals are exposed to carefully designed virtual environments that simulate real-life or clinically relevant situations, such as social interactions, stress-inducing scenarios, or emotionally charged contexts. These stimuli act as triggers that elicit immediate emotional responses, including anxiety, fear, empathy, or stress, which are experienced in a controlled and safe setting. As individuals interact within the virtual environment, their responses manifest as observable behaviours, such as verbal communication, decision-making patterns, avoidance tendencies, or physiological reactions. These behaviours are continuously monitored and recorded using integrated technologies, including motion tracking, eye movement analysis, and biometric sensors. The collected data are then evaluated using standardized assessment metrics and clinical frameworks to determine emotional regulation, cognitive functioning, and behavioural patterns. This model emphasizes the dynamic and real-time nature of VR-based assessment, allowing clinicians to move beyond subjective self-reports toward more objective, performance-based evaluation.

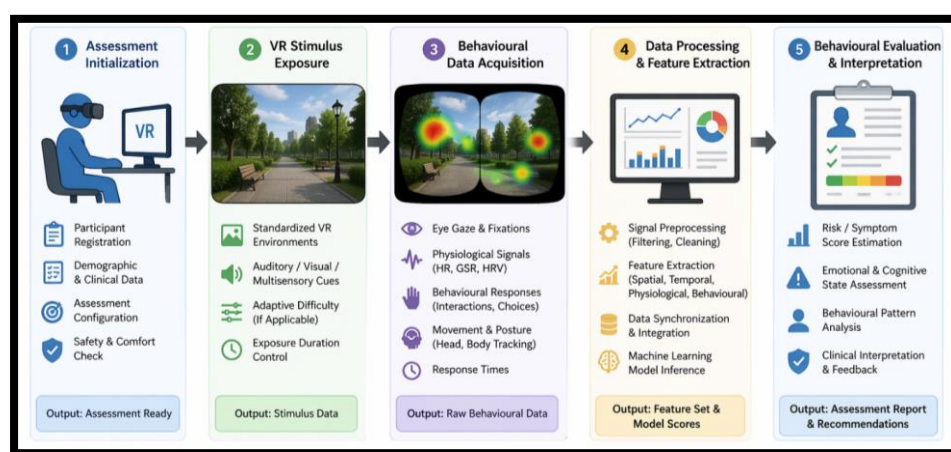


Figure. 7: VR-Based Mental Health Assessment Model from Stimulus Exposure to Behavioural Evaluation

8. Integration of emotional intelligence training and vr:

The integration of emotional intelligence (EI) training with virtual reality (VR) simulation represents a comprehensive and forward-thinking approach to both nursing education and mental health intervention. Traditional nursing education has often emphasized clinical knowledge and technical proficiency, sometimes leaving limited scope for the structured development of emotional and interpersonal competencies. However, in contemporary healthcare, particularly in mental health settings, the ability to understand, regulate, and respond to emotions is just as critical as clinical expertise. By combining EI training with immersive VR simulation, educators can create a holistic learning environment that simultaneously targets cognitive, emotional, and behavioural domains (Salovey and Mayer, 1990, Goleman, 1995). Virtual reality serves as an ideal platform for embedding emotional intelligence training because it provides experiential learning opportunities that closely mimic real-life clinical encounters. Through immersive scenarios, nursing students can engage with virtual patients exhibiting a wide range of emotional states, psychological conditions, and behavioural challenges. These interactions allow students to practice recognizing emotional cues, interpreting non-verbal communication, and responding with empathy and professionalism. Unlike traditional classroom methods, VR enables repeated exposure to diverse and complex situations, ensuring that learners can refine their emotional and clinical responses over time without risking patient safety (Riva et al., 2019, Kyaw et al., 2019). One of the most significant outcomes of this integrated approach is the enhancement of empathy among nursing students. Empathy is a cornerstone of effective patient care, particularly in mental health, where patients often require emotional validation and understanding. VR simulations can be designed to place students in the perspective of patients, allowing them to experience symptoms such as anxiety, hallucinations, or cognitive distortions. This perspective-taking fosters a deeper emotional understanding and reduces stigma, enabling future nurses to approach patients with greater compassion and sensitivity (Herrera et al., 2018, Maples-Keller et al., 2017). As a result, students trained under this model are more likely to establish therapeutic relationships that promote trust and patient

engagement. In addition to empathy, the integration of EI training with VR significantly improves diagnostic abilities. Emotional intelligence equips students with the skills to accurately perceive and interpret emotional signals, which are often critical indicators of underlying mental health conditions. When combined with VR-based scenarios, students can observe how symptoms manifest in real time and practice clinical reasoning in a dynamic context. For instance, they may learn to differentiate between anxiety and depression based on behavioural cues, speech patterns, and emotional expressions within a simulated interaction. This experiential learning enhances critical thinking and supports more accurate and timely clinical decision-making (Parsons, 2015, Freeman et al., 2017).

Furthermore, VR-based EI training contributes to the development of superior patient interaction skills. Effective communication in healthcare involves not only conveying information but also actively listening, demonstrating empathy, and responding appropriately to patient needs. VR simulations provide a safe environment for students to practice these skills, receive immediate feedback, and adjust their approach. They can experiment with different communication strategies, observe the consequences of their actions, and learn how to manage challenging interactions, such as dealing with agitated or withdrawn patients. Over time, this iterative process builds confidence and competence in handling real-world clinical situations (Foronda et al., 2020, Liwa et al., 2020). Another important advantage of this integrated model is its ability to enhance emotional regulation and resilience among nursing students. Healthcare professionals frequently encounter stressful and emotionally demanding situations, which can lead to burnout if not managed effectively. EI training within VR environments allows students to practice coping strategies such as mindfulness, cognitive reappraisal, and stress management techniques in response to simulated challenges. By learning to regulate their own emotions, students become better equipped to maintain professionalism and provide high-quality care even under pressure (Gross, 1998, Rus-Cala fell et al., 2018). Moreover, the use of VR enables standardized and scalable training, ensuring consistency in educational outcomes. Unlike traditional clinical placements, which may vary in quality and exposure, VR simulations can be carefully designed to meet specific learning objectives and competencies. This standardization ensures that all students receive equal opportunities to develop essential emotional and clinical skills. Additionally, performance data collected during simulations can be used for objective assessment, allowing educators to track progress and provide targeted feedback (Lateef, 2010, Padilla et al., 2019). Despite its many advantages, the integration of EI training with VR simulation should be viewed as a complement to, rather than a replacement for, traditional teaching methods and real-world clinical experience. Human interaction, mentorship, and hands-on practice remain essential components of nursing education. However, when used in conjunction with these methods, VR-based EI training offers a powerful tool for bridging the gap between theory and practice. Integrating emotional intelligence training with virtual reality simulation creates a comprehensive educational framework that enhances empathy, diagnostic accuracy, and patient interaction skills among nursing students. By providing immersive, interactive, and emotionally engaging learning experiences, this approach prepares future nurses to meet the complex demands of mental health care with competence, compassion, and confidence. Figure 8 presents a comprehensive model illustrating how the integration of emotional intelligence (EI) development with virtual reality (VR)-based simulation contributes to improved clinical competence and mental health outcomes. In this framework, EI training forms the foundational layer, focusing on the development of core competencies such as emotional awareness, self-regulation, empathy, and interpersonal skills. These competencies are then actively applied and reinforced within immersive VR environments, where learners engage in realistic clinical scenarios that simulate complex patient interactions and mental health conditions. The VR component provides experiential learning through controlled exposure to emotionally challenging situations, enabling students to practice decision-making, communication, and coping strategies in real time. As learners navigate these simulations, their emotional and behavioural responses are continuously refined through feedback and reflection, creating a dynamic cycle of learning and improvement. The model highlights the synergistic relationship between EI and VR, where emotional skills enhance the effectiveness of simulation-based learning, and immersive experiences further strengthen emotional competencies. Ultimately, this integrated approach leads to measurable outcomes such as increased empathy, improved diagnostic accuracy, enhanced patient interaction, and better emotional resilience, all of which contribute to higher quality mental health care and overall clinical proficiency.

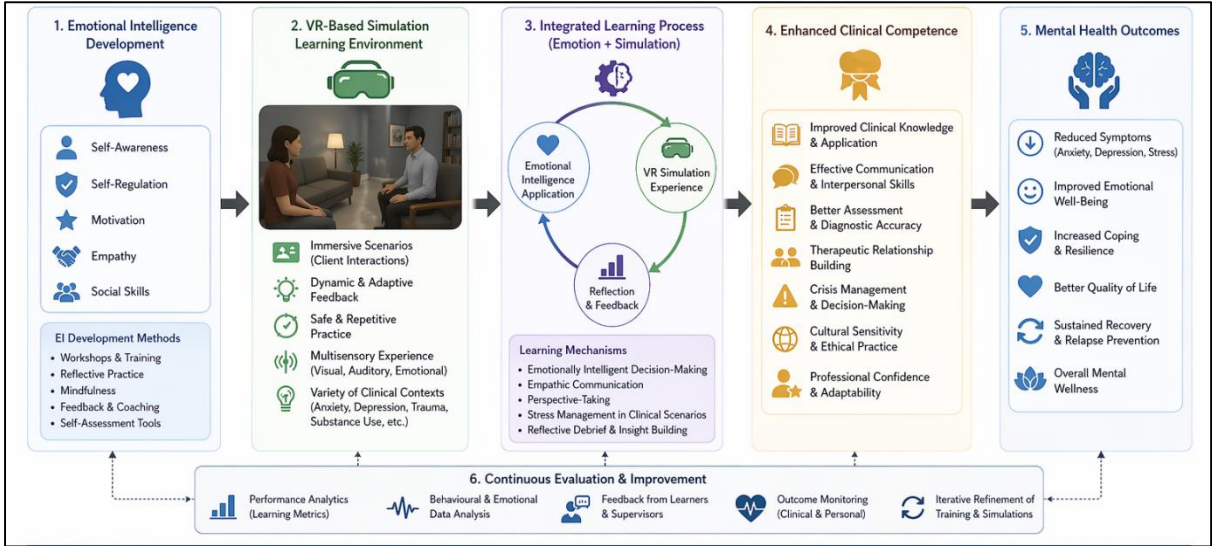


Figure. 8: Integrated Model of Emotional Intelligence Development and VR-Based Simulation for Enhanced Clinical Competence and Mental Health Outcomes

The comparison presented in Table 3 highlights the transformative impact of virtual reality in nursing education when contrasted with traditional training methods. While conventional approaches rely heavily on theoretical instruction and limited clinical exposure, they often fall short in fostering active engagement and long-term skill retention. In contrast, VR-based training creates immersive, interactive environments that promote experiential learning, enabling students to actively participate in realistic clinical scenarios. This not only improves knowledge retention but also enhances critical thinking and decision-making skills. A key distinction lies in emotional learning, where VR provides a unique advantage by simulating emotionally complex situations that help develop empathy and emotional intelligence, which are essential in mental health care. Furthermore, VR ensures a safe and standardized training environment, eliminating risks to patients while offering consistent learning experiences across all learners. Immediate and objective feedback mechanisms further support continuous improvement.

Table. 3: Comparison between Traditional Training Methods and VR-Based Approaches in Nursing Education

Parameter	Traditional Training Methods	VR-Based Training Approaches
Learning Engagement	Passive learning through lectures and textbooks	High engagement through immersive and interactive environments
Skill Retention	Limited retention due to lack of experiential practice	Enhanced retention through repeated, hands-on simulation
Emotional Learning	Minimal focus on emotional experiences	Strong emphasis on emotional immersion and empathy development
Clinical Exposure	Dependent on availability of real patients	Controlled, diverse, and repeatable clinical scenarios
Feedback Mechanism	Delayed or subjective feedback from instructors	Immediate, data-driven and objective feedback
Risk to Patients	Potential risk during early clinical practice	No risk due to simulated, safe learning environment
Standardization	Variable learning experiences across institutions	Uniform training with consistent scenarios
Critical Thinking	Limited real-time decision-making opportunities	Enhanced through scenario-based problem-solving
Confidence Building	Gradual and sometimes inconsistent	Faster development through repeated practice
Adaptability	Less flexible to individual learning needs	Highly customizable and adaptive learning experiences

9. Conclusion:

Emotional intelligence plays a fundamental role in shaping mental health and overall development during childhood and adolescence, as these stages are marked by rapid emotional, cognitive, and social changes. The ability to recognize, understand, and regulate emotions not only supports psychological well-being but also influences academic performance, interpersonal relationships, and resilience to stress. In this context, the incorporation of virtual reality programs and simulation-based training introduces a transformative approach to both emotional development and mental health assessment. These technologies create immersive and interactive environments where young individuals can safely experience, express, and manage a range of emotions in realistic scenarios. Through guided simulations, children and adolescents can develop emotional awareness, practice coping strategies, and improve social skills in a controlled setting. At the same time, clinicians and educators can observe real-time behavioural and emotional responses, allowing for more accurate and dynamic assessment compared to traditional methods. The integration of emotional intelligence training with virtual reality not only enhances learning outcomes but also fosters empathy, self-regulation,

and adaptive behaviour. As these approaches continue to evolve, they hold significant promise for advancing healthcare education and mental health interventions, ultimately contributing to more personalized, effective, and compassionate care delivery for younger populations.

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Cite as

Jyoti Shikha, Kinjal kumari Sudarshanbhai Patel, & Salini Mondal. (2026). *Emotional intelligence of children and adolescents: Effects of virtual reality programs and simulation training for nursing students on mental health measurement and development. Emotional Intelligence of Children and Adolescents: Effects of Virtual Reality Programs and Simulation Training for Nursing Students on Mental Health Measurement and Development*, 4(1).
<https://doi.org/10.5281/zenodo.19761713>