

Digital Mental Health Interventions for Generation Z Social Anxiety: A Review of Cognitive Behavioral Therapy, Artificial Intelligence, and Virtual Reality Approaches

Intervensi Kesihatan Mental Digital untuk Kebimbangan Sosial Generasi Z: Tinjauan Terapi Tingkah Laku Kognitif, Kepintaran Buatan dan Pendekatan Realiti Maya

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ABSTRACT

Generation Z faces a growing mental health burden linked to intensive social media use, with social anxiety disorder among the most prevalent conditions in this population. Digital mental health interventions have expanded to address this gap, drawing on three major technological approaches: cognitive behavioral therapy (CBT), artificial intelligence (AI), and virtual reality (VR). Digital CBT improves accessibility and scalability but struggles with sustained engagement and the formation of a therapeutic alliance. AI-based conversational agents demonstrate a measurable capacity for digital therapeutic alliance (DTA), with Working Alliance Inventory-Short Revised (WAI-SR) scores comparable to early-stage human therapy benchmarks. VR exposure therapy achieves meta-analytically supported effect sizes for social anxiety disorder through presence-driven emotional activation, yet shows weaker outcomes at follow-up due to limited relational continuity. Across all three approaches, Bordin's (1979) goals-tasks-bond model has been extended into the construct of DTA, which recurs as a central explanatory framework. This review synthesizes current evidence and identifies engagement, alliance formation, and ecological validity as recurring limitations, pointing toward coordinated CBT-AI-VR integration as a direction for future research.

Keywords: cognitive behavioral therapy; artificial intelligence; virtual reality; therapeutic alliance; social anxiety disorder

ABSTRAK

Generasi Z menghadapi beban kesihatan mental yang semakin meningkat akibat penggunaan media sosial yang intensif, dengan gangguan kebimbangan sosial sebagai salah satu keadaan yang paling lazim dalam populasi ini. Intervensi kesihatan mental digital telah berkembang untuk menangani jurang ini melalui tiga pendekatan teknologi utama: terapi kognitif tingkah laku (CBT), kecerdasan buatan (AI), dan realiti maya (VR). CBT digital meningkatkan kebolehcapaian dan kebolehskalaan, tetapi menghadapi cabaran dalam penglibatan berterusan dan pembentukan perikatan terapeutik. Ejen perbualan berasaskan AI menunjukkan kapasiti terukur untuk perkhidmatan terapeutik digital (DTA), dengan skor Working Alliance Inventory-Short Revised (WAI-SR) yang setanding dengan penanda aras terapi manusia peringkat awal. Terapi pendedahan realiti maya mencapai saiz kesan yang disokong oleh meta-analisis bagi gangguan kebimbangan sosial melalui pengaktifan emosi berasaskan kehadiran, namun menunjukkan hasil yang lebih lemah pada susulan akibat kesinambungan perhubungan yang terhad. Merentasi ketiga-tiga pendekatan ini, model matlamat-tugas-ikatan Bordin (1979) telah dikembangkan menjadi konstruk DTA yang berulang sebagai kerangka penjelasan utama. Tinjauan ini mensintesis bukti semasa dan mengenal pasti penglibatan, pembentukan perikatan, dan ketulenan ekologi sebagai batasan berulang yang menghala ke arah integrasi CBT-AI-VR yang diselaraskan sebagai arah penyelidikan pada masa hadapan.

Kata kunci: terapi kognitif tingkah laku; kecerdasan buatan; realiti maya; perikatan terapeutik; gangguan keseimbangan sosial

INTRODUCTION

Generation Z, the first cohort to mature entirely within a digital environment, shows heightened susceptibility to social media-induced psychological harm (Kullolli & Trebicka 2023). Prolonged, high-intensity social media use is associated with increased anxiety, diminished emotion regulation, and elevated stress responses (Vannucci et al. 2017). Social anxiety disorder (SAD) is among the most prevalent mental health conditions in this population. Yet, traditional services remain inaccessible for many young people due to cost, stigma, and service gaps (Ebert et al. 2015). To address these barriers, digital mental health interventions have increasingly relied on three complementary technological approaches: cognitive behavioral therapy (CBT) for structured content, artificial intelligence (AI) for relational interactivity, and virtual reality (VR) for immersive exposure. A construct that recurs across all three approaches is therapeutic alliance—the collaborative relationship between an individual and an intervention system (Bordin 1979). The primary objective of this review is to synthesize current evidence on these three modalities and to examine how the therapeutic alliance has been extended into digital and automated contexts, identifying pathways for future integrated interventions.

RELATED WORK

Digital CBT has evolved from early computerized modules into mobile applications and AI-guided interactive formats, improving consistency and reach (Ebert et al. 2015). Despite broad adoption, digital CBT continues to face three persistent challenges: low engagement with self-guided formats, difficulty establishing a therapeutic alliance in the absence of genuine interpersonal interaction, and insufficient ecological validity in transferring learned skills to daily life (Ebert et al. 2015; Kaveladze & Schueller 2023).

To address the absence of interpersonal interaction in traditional digital CBT, AI-based conversational agents extend these interventions by offering real-time responsiveness and personalized interaction (Tong et al. 2023). A retrospective study of 36,070 Woebot users reported a mean WAI-SR score of 3.36 and a bond subscale mean of 3.84 within five days, comparable to early-stage human therapy benchmarks (Darcy et al. 2021). Consistent responsiveness, non-judgmental environments, and on-demand availability are the three mechanisms most frequently identified as underlying these alliance-like relationships (Darcy et al. 2021; Xu et al. 2025). AI-based alliances, however, remain bounded by limited empathic depth and cannot substitute for complex clinical work (Arbanas et al. 2025).

Meanwhile, to address ecological validity concerns, VR provides a strong presence through interactive three-dimensional environments, and VR exposure therapy (VRET) delivers controlled, graduated exposure while preserving CBT mechanisms (Freeman et al. 2017). A meta-analysis of 22 studies reported a post-treatment effect size of $g = -0.86$ for SAD (Horigome et al. 2020). VRET's effectiveness derives from presence-driven emotional activation, and its integration with CBT supports graded exposure calibrated to individual responses (Maples-Keller et al. 2017). Key limitations include dependence on individual differences in immersion proneness and weaker outcomes at follow-up, attributed to insufficient relational continuity between sessions.

Therapeutic alliance, as defined by Bordin (1979), comprises goal agreement, task agreement, and an emotional bond. As services expanded into digital formats, this construct evolved into digital therapeutic alliance (DTA), describing relational dynamics between users and automated systems (Tong et al. 2022). DTA has emerged as a recurring explanatory construct across all three approaches, linking engagement, retention, and perceived helpfulness (Huang et al. 2025). Because evaluating automated systems requires distinguishing between human-mediated remote therapy and autonomous digital interventions, Table 1 summarizes the key differences between digital alliance and DTA.

TABLE 1. Key Differences Between Digital Alliance and Digital Therapeutic Alliance.

Dimension	Digital Alliance (DA)	Digital Therapeutic Alliance (DTA)
Relational object	Human therapist via digital medium	Automated system (app, chatbot, AI)
Therapist presence	Present (remote delivery)	Absent or supplementary
Theoretical basis	Bordin's Goals-Tasks-Bond model	Adapted model for human-technology interaction
Reference	Tong et al. (2022)	Tong et al. (2022)

METHODOLOGY

This study adopts a narrative review design. Literature was identified through Google Scholar, PsycINFO, IEEE Xplore, PubMed, and Scopus-indexed databases using the search terms: social anxiety disorder, digital mental health, cognitive-behavioral therapy, artificial intelligence, virtual reality, and therapeutic alliance. Studies were included if they reported empirical findings or systematic evidence on digital or AI-mediated mental health interventions with anxiety-related outcomes. Priority was given to meta-analyses, randomized controlled trials, and systematic reviews published between 2015 and 2025. By applying these rigorous inclusion criteria, a highly selective sample of 16 sources was synthesized across four thematic areas: digital CBT, AI-based mental health support, VR exposure therapy, and therapeutic alliance in digital contexts.

RESULTS AND DISCUSSION

The evidence indicates that each approach addresses a distinct aspect of anxiety intervention while leaving distinct gaps unresolved. Digital CBT provides structured content and broad reach but consistently struggles with engagement, alliance formation, and ecological validity (Ebert et al. 2015; Kaveladze & Schueller 2023). AI-based systems form bounded but measurable alliance-like relationships through consistency and non-judgmental interaction, yet cannot substitute for complex clinical care (Darcy et al. 2021; Arbanas et al. 2025). VR achieves strong effect sizes through presence-driven activation but shows weaker durability at follow-up due to limited relational continuity (Horigome et al. 2020).

A recurring theme across all three literatures is the centrality of DTA as a mechanism shaping engagement and outcomes (Huang et al. 2025). CBT contributes goal and task structure; AI contributes relational responsiveness; VR contributes experiential depth. No single approach currently combines all three dimensions in a sustained, validated manner. This gap points toward an open research question: how might CBT structure, AI-based relational interaction, and VR immersive exposure be coordinated within a single intervention pathway? For instance, future interventions could employ an architecture in which an AI conversational agent serves as the primary relational interface, delivering structured CBT modules and seamlessly guiding the user through targeted VR exposure exercises. While developing such an integrated system poses practical challenges related to technological friction and development costs, evaluating this coordinated approach using validated measures such as the WAI-SR (Hatcher & Gillaspy 2006) represents a vital next step for the field.

CONCLUSION

This review synthesized evidence on digital CBT, AI, and VR as approaches to anxiety intervention for Generation Z. Each approach contributes to the evidence base while facing recognizable limitations in engagement, alliance formation, or ecological validity. Digital therapeutic alliance, grounded in Bordin's (1979) goals-tasks-bond model, provides a unifying framework for understanding these limitations across approaches. Future research should examine whether CBT structure, AI-based relational responsiveness, and VR immersive exposure can be coordinated within an integrated intervention, applying validated measures such as the WAI-SR to assess effects on engagement and outcomes.

Ultimately, developing cohesive, technology-native solutions is essential to providing accessible, engaging mental health care that resonates with the unique digital realities of Generation Z.

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