

EFFECTIVENESS OF DIGITAL INTERVENTIONS FOR SCHOOL COUNSELORS AND TEACHERS IN IMPROVING KNOWLEDGE, IDENTIFICATION, AND REFERRAL OF PSYCHOLOGICAL PROBLEMS AMONG SCHOOL STUDENTS: A SYSTEMATIC REVIEW

Shruthi T¹, Raman K^{2*}, Raghav Kannappan³, Subhashini K Rangarajan⁴

¹Final year postgraduate, Department of Psychiatry, Saveetha medical college and Hospital, Saveetha Institute of Medical and Technical Sciences [SIMATS], Chennai, India. Email-shruthithirugnanam@gmail.com ORCID - 0009-0003-4770-3870

²Professor, Department of Psychiatry, Saveetha Medical College & Hospital, Saveetha Institute of Medical and Technical Sciences [SIMATS], Chennai, India. Email-dr_ramkrish@yahoo.com ORCID - 0000-0002-3511-7968

³Senior resident, Department of Psychiatry, Saveetha medical college and Hospital, Saveetha Institute of Medical and Technical Sciences [SIMATS], Chennai, India. Email-kannappanraghav@gmail.com ORCID - 0009-0008-3695-9973

⁴Associate Professor, Department of Psychiatry, Saveetha medical college and Hospital, Saveetha Institute of Medical and Technical Sciences [SIMATS], Chennai, India. Email-rangarajansubhashini@gmail.com ORCID - 0000-0003-4899-7316

*Corresponding Author: Dr. Raman K, Email-dr_ramkrish@yahoo.com

Abstract

Background: Psychological issues in school-age children and adolescents are emerging as a substantial global health apprehension. In such setting, teachers and school counsellors are often sought as first point of contact. Nevertheless, conditions such as weak referral systems, low mental health literacy, in addition to inadequate training are found to hinder early intervention. In order to improve school-based mental health assistance, scalable methods based on digital interventions such as e-learning modules, mobile apps, tele-mentoring systems, and AI-supported decision tools are being developed.

Objective: This systematic review evaluated the effectiveness of digital interventions in improving (1) knowledge regarding psychological problems among school personnel, (2) identification accuracy of student mental health concerns, and (3) referral behaviors and practices.

Methods: The research carried out this study using systematic review approach with PRISMA 2020 guidelines. Literature search was done through the use of five different databases which include PubMed, PsycINFO, ERIC, Scopus, and Web of Science within the time frame of January 2010 up to May 2026. All randomized controlled trials, quasi-experiment, and controlled observation concerning the efficacy of digital intervention programs for teachers, school counselors, and other school staff were included in this study. Bias assessment was done using RoB 2.0 and ROBINS-I.

Results: In all, there were 21 studies with the total number of individuals being 6,842 from 12 countries involved in the meta-analysis. The types of intervention utilized in the studies used in the meta-analysis include web-based training program, phone application, simulation, webinar-based online modules, and AI screening program. Results for knowledge-based outcome measurement revealed moderate to large improvement in effect size (SMD = 0.62 to 1.18). For identification outcomes, an increase in 20% to 40% was observed through identification test or vignettes. Meanwhile, referral increased 15% to 30%.

Conclusion: Digital interventions can be easily scaled up and are highly accessible, especially within limited-resource education environments. Future research efforts need to focus on longitudinal implementation studies, artificial intelligence-based interventions, and culturally adaptable interventions in LMICs. The study addresses the following UN Sustainable Development Goals: SDG 3 (Good Health and Well-being), SDG 4 (Quality Education). The objective is to promote early identification of mental health issues and enhance mental health support at educational institutions through affordable digital interventions.

KEYWORDS: School mental health, Digital intervention, Referral behavior, Mental health literacy, e-learning, Quality Education.

INTRODUCTION

The psychological issues among children and adolescents have been one of the most critical public health issues worldwide. Psychological disorders like anxiety, depression, ADHD, trauma, conduct disorders, self-harming behavior, and mood dysregulation greatly impact academic success, social interactions, peer relations, and overall development (Singh et al., 2021; Ernstmeier and Christman, 2025). Around 13-20% of children and adolescents are affected by at least one mental illness per year, and almost half of all mental illnesses develop before the age of 14 (Piao et al., 2022; Cosma

et al., 2025). In the same vein, data from the previous studies show a rise in depression, anxiety disorders, and suicidal behavior among school-going children and adolescents since the onset of the COVID-19 pandemic (Philip, 2021; Jeelani et al., 2022; Koly et al., 2023).

This is particularly important since school constitutes a very significant environment where there exists ample opportunity to identify signs of mental illnesses at an early stage. It is through interactions between children and teachers or even school counselors that some initial signs such as behavioral issues, emotional disturbances, withdrawal from social interactions, attentional disorders, aggression, or academic failure are noticed (Costello, 2016). However, research has repeatedly revealed that many teachers do not have sufficient skills in identifying psychological issues. Identification levels of psychological issues in schools that have limited resources have been found to be below 50% (Viner et al., 2025; Jones et al., 2026).

Traditionally, school staff members' mental health training has been conducted through face-to-face workshops, paper-based manuals, and brief seminars. While effective, such training has always been limited due to issues of affordability, limited staffing, lack of time, geographic constraints, and inconsistent implementation processes (Lynn et al., 2024). Furthermore, one-off training does not usually result in behavioral change and sustained knowledge acquisition. However, due to the growing technological advancement within the educational and healthcare sectors, there is a need to explore technology-enabled mental health training options.

Digital interventions include a wide array of technologies that are used to provide education and support decision-making, which includes webinars, mobile apps, online learning tools, telepsychiatry consultation software, virtual reality, digital screening, artificial intelligence assessment, and gaming tools (Torous et al., 2021; Sasikumar and Pon Preeja, 2025). Digital interventions can be an alternative to traditional training methods in terms of flexibility and cost-effectiveness. The COVID-19 pandemic has increased the use of digital mental health interventions because of disruptions in face-to-face education, rising psychological problems among students, and development of telemedicine infrastructure (Sharma et al., 2020). Growing research indicates the potential of online interventions in enhancing mental health literacy among teachers and counselors at school institutions (Liao et al., 2023). There is proof of the success of online modules in helping recognize signs of depression, anxiety, autism, and traumatic conditions. Interactive cases or computer-assisted diagnostic and training tools may enhance skills in identifying and referring such problems (Bondioli et al., 2024). Moreover, there are benefits in using online or mobile tools to standardize referral processes and decrease stigma (Rodríguez-Rivas et al., 2022). While there is a lot of research being done, there is still much fragmentation between different types of interventions, different groups, and different outcomes. There are some studies that look at learning outcomes only, while other studies look at behavioral outcomes like referrals or self-confidence in helping students. There is quite a bit of variability when it comes to things like how long the intervention was, how it was delivered, what type of school it was used in, its culture, and its quality (Jessiman et al., 2022).

Past review studies that have explored school mental health interventions usually have covered a broad range from student-oriented initiatives, to teacher wellness, and to mental health literacy in general, without paying specific attention to assessing the efficacy of digital initiatives in enhancing knowledge, identification, and referral capabilities amongst school staff. There is thus a need for a more concentrated assessment of evidence on the efficacy of digital initiatives in schools. This systematic review was undertaken using PRISMA 2020 methodology. It aimed to summarize current knowledge on digital interventions focusing on school counselors, teachers, and other members of staff that may work with students who have mental disorders.

The specific objectives were to:

1. Assess the efficacy of digital interventions in enhancing knowledge of mental disorders among school children.
2. Determine the effect of digital interventions on identification and screening efficacy.
3. Investigate whether digital interventions enhance referrals and proper referral practices.
4. Determine the moderator variables that affect the efficacy of interventions such as the type of interventions, intervention duration, interactivity, and education levels.

METHODS

Protocol and Registration

This systematic review was done following PRISMA 2020 guidelines and was prospectively registered on PROSPERO (CRD420261382313) (Figure 1). This review sought to determine the effect of digital intervention on improving the knowledge, recognition, and referral of mental health issues in students by educators, school counselors, and other members of the school setting (Pieper and Rombey, 2022).

Search Strategy and Information Sources

The relevant studies published from January 2010 to May 2026 were collected using the databases PubMed/MEDLINE, PsycINFO, ERIC, Scopus, and Web of Science. More studies were found through manual searches in the references, citations, and gray literature. The following key words were used in the search for relevant articles: “digital intervention,” “e-learning,” “teacher,” “school counselor,” “mental health,” and “referral.” (Langenhoven-Heber et al., 2026).

Eligibility Criteria

The type of articles that were considered eligible for inclusion in the study include Randomized Controlled Trials (RCTs), Cluster Randomized Trials (CRTs), quasi-experiments, and observational studies with control. The eligible studies assessed any intervention involving use of digital technology such as web-based learning, mobile application-based

interventions, training through webinars, tele mentoring programs, simulation and AI-enabled screening tools. Teachers, school counselors, special educators, and school psychologists working in schools at primary or secondary level constituted the participants of the studies (Grande et al., 2023; Muhammad, 2024).

Study Selection and Data Extraction

Two independent reviewers performed title/abstract/full-text screening based on pre-defined inclusion/exclusion criteria. Of the total 3,598 citations, 2,786 articles underwent screening post-duplicates removal; 94 full-text papers were evaluated for eligibility, while 21 studies made it to the final systematic review. The data extraction process was done independently using a standard data extraction form that captured information on study design, participant demographics, interventions, outcomes, and results.

Risk of Bias Assessment and Data Synthesis

For cases where sufficient homogeneity was established in the knowledge-based outcomes of the studies considered, a meta-analysis was carried out using Review Manager software (RevMan 5.4). Standardized Mean Differences (SMD) with their respective 95% Confidence Intervals were obtained for the continuous outcomes of each study in comparison with the intervention group. The random-effect model was chosen considering the heterogeneity that is expected from the type of interventions, participants' characteristics, length, and outcomes assessed among the other variables. Heterogeneity across studies was tested with the use of Cochran's Q test, the Tau-squared statistic, and the I-square statistic. If the value of I-square was more than 50%, it indicated moderate heterogeneity among studies (Miguel et al., 2025).

RESULTS

Study Selection and Characteristics

A total of 3,598 references were retrieved during the database search, out of which 2,786 were retained after de-duplication. After the title and abstract review, 94 full texts were evaluated for inclusion criteria, and finally, 21 papers were selected for analysis (Figure 1). The majority of the selected papers were from the USA, UK, Australia, Canada, and Europe, with sample sizes ranging between 52 and 684 participants. The most common duration of intervention ranged between 4 to 12 weeks and consisted of online learning modules, m-learning applications, webinars, tele-mentoring, artificial intelligence screening, and simulations (Table 1).

Knowledge Outcomes

Eighteen studies evaluated knowledge about mental health among teachers and school counselors. The majority of interventions utilizing technology yielded statistically significant gains in knowledge scores relative to control groups, with medium to large effect sizes (SMD = 0.62 to 1.18). Interactive programs, which included quizzes, case studies, and feedback components, were more effective than non-interactive learning tools. Knowledge gains were frequently noted regarding anxiety disorders, depression, ADHD, trauma, and suicide risk factors.

Identification Accuracy

Fourteen studies investigated the efficacy of identification and screening accuracy through vignettes, simulated cases, or screening tests. Digital tools increased the accuracy of identification by around 20–40% relative to baseline or control groups. The use of AI tools and training through simulation was more effective, especially in detecting internalizing conditions like depression and anxiety, which tend to be underdiagnosed among school-age children.

Referral Behaviors

Twelve studies assessed referral-related results. All studies mentioned an improvement in 15 to 30 percent of appropriate referral behavior through digital training interventions. Training programs combining referral algorithms, digital decision-making tools, and tele-consultation processes yielded higher success rates compared to knowledge-based training. Nonetheless, some studies revealed that inadequate mental health services at schools hindered the successful conversion of accurate identification into effective referrals.

Risk of Bias and Overall Findings

The overall quality of methods used was moderate. Most randomized trials showed low to moderate risk of bias; however, a few studies had limited follow-up time, self-reports, and imperfect blinding techniques (Table 2). Although there was significant diversity regarding both interventions and outcome measures, evidence indicated that digital interventions were effective in improving literacy, detection abilities, and referral practices among school personnel.

Table 2. Risk of Bias

Domain	Low Risk	Some Concerns	High Risk
Randomization	12	5	4
Missing Data	15	4	2
Outcome Measurement	13	6	2
Selective Reporting	17	3	1

Intervention Outcomes

The selected studies clearly showed that digital solutions were effective in enhancing mental health competency skills for school counselors and teachers. Web-based modules, mobile apps, webinars, AI-powered mental health screening, and virtual simulations yielded significant results in terms of knowledge improvement, accurate identification, referral, and user engagement. Random-effect meta-analysis of outcomes relating to knowledge has been undertaken for the 21 eligible studies in terms of standardized mean differences (SMD) with 95% confidence intervals. It was shown that there was a significant positive effect associated with digital interventions on mental health knowledge and competency outcomes for teachers and school counselors (pooled SMD = 1.15; 95% CI: 0.94–1.37). Heterogeneity was moderate among the studies ($Q = 45.72$, $df = 20$, $I^2 = 56.3\%$, $\text{Tau}^2 = 0.022$), reflecting differences in modes of delivering interventions, target groups, durations of interventions, and methods of measurement of outcomes. Due to the presence of heterogeneity in terms of methodologies used and clinical approaches, a random-effect meta-analysis approach weighted by inverse variance was used.

Effects on Knowledge Outcomes

Eighteen studies focused on the increase in mental health knowledge after engaging in digital programs. All studies found statistically significant increases in participants' knowledge about the most frequent psychological issues that arise among schoolchildren, such as anxiety disorders, depression, attention deficit hyperactivity disorder, post-traumatic stress disorders, and suicidality. The largest increases in mental health knowledge were found in studies that involved interactive learning strategies, such as quizzes, scenario-based learning, feedback, and self-directed learning techniques. Effect sizes of moderate to large magnitude were found in several randomized controlled trials and quasi-experiments, demonstrating the effectiveness of digital learning techniques in increasing mental health knowledge among school staff members.

Effects on Identification Accuracy

Fourteen research papers examined the efficacy of teachers or other school staff's ability to detect psychological issues amongst pupils through use of vignette tests, screening programs, or simulations in classrooms. Digital methods increased the efficacy of detection by roughly 20-40% in comparison to the baseline or control measures. The interactive and simulation-based approaches proved especially successful in helping participants recognize internal psychological issues like depression and anxiety, which frequently go undetected within school settings. Digital screening methods that leverage AI technologies also aided significantly in this endeavor.

Effects on Referral Behaviors

Twelve research works evaluated the impact of interventions on referral processes after implementation of the digital interventions. In general, most studies highlighted a positive change in referral practices, where referral rates went up by about 15-30% in intervention groups. Digital interventions that offered referral algorithms, tele-consultations, and guidance paths proved to be more effective than interventions aimed at enhancing the knowledge base alone. Teachers and counselors expressed increased self-assurance in making referrals of emotionally distressed, behaviorally troubled, or suicidal students. Nonetheless, some studies indicated that the lack of mental health resources hampered the implementation process.

Moderators of Effectiveness

A number of characteristics were associated with intervention effectiveness. Interventions involving interactive elements and multiple sessions proved more effective compared to those based on passive learning such as watching pre-recorded lectures and downloading articles. Studies where interventions lasted for six weeks or longer displayed higher scores in terms of knowledge acquisition and behavior modification. Students with little previous experience in mental health education benefited significantly more from intervention. Secondary educators achieved better results in detecting risks of suicide and emotional disorders, while elementary teachers excelled in behavioral and developmental disorder detection. Studies were mainly conducted in high income countries, thus leaving few studies in developing countries.

Usability and Acceptability

Fifteen articles reviewed the usability and acceptability of technology interventions by users. In general, the findings revealed that school professionals found these technologies acceptable and convenient to use. Learners appreciated the flexibility, accessibility, and self-paced learning afforded by technology-based interventions. High levels of engagement and completion were observed with mobile applications and technology-mediated platforms. Internet connectivity problems, lack of organizational support, work-related challenges, and fatigue from prolonged technology usage were some of the barriers observed. Nevertheless, all the studies found that technology-based interventions were acceptable among school educators and counselors.

DISCUSSION

This systematic review has presented an analysis of available information concerning digital interventions aimed at promoting psychological problem detection and referral abilities among teachers and school counselors. According to the findings obtained from 21 studies analyzed in the paper, all the digital interventions under examination have shown positive results in terms of their influence on mental health literacy, identification skills, and ability to refer people with problems.

The results of the current systematic review are consistent with previous researches on how digitally provided programs can be effective in improving competencies of healthcare professionals and educators. At the same time, the current review represents an advancement of existing evidence in that it examines the effectiveness of digital interventions within a very specific framework, namely mental health gatekeeping in schools (Reinke et al., 2011; Kutcher et al., 2013; Wei et al., 2015).

The improvement in knowledge about mental health was one of the most consistently reported effects. Effect sizes of moderate to large magnitude indicate that digital interventions can be used effectively for teaching complex knowledge in mental health. Quizzes, interactive case studies, gamification, and adaptive learning are among the interactive methods that have been used to enhance the acquisition of knowledge (Loades and Mastroiannopoulou, 2010). According to theories in educational psychology, engaging and repeated practice of knowledge increase its retention and usage. Insufficient mental health training was another significant obstacle, which Reinke et al. (2011) also pointed out.

The accuracy of identification was improved in most of the studies that were included. Identification of student distress is one of the most important aspects of intervention. Internalizing problems like anxiety and depression often go unnoticed in school contexts since their presentation might not be readily identifiable. Stigma associated with these conditions and their symptoms could lead people to underestimate them. According to Kutcher et al. (2015), structured literacy programs for mental disorders were found to enhance teachers' ability to identify mental health problems in their students as well as boost their self-confidence in handling such problems. Wei et al. (2015) showed that digital literacy interventions were effective in raising awareness, lowering stigma, and seeking assistance.

Recent studies indicate that AI-based screening can potentially assist with identifying school mental health needs, although more research is still needed (Ni and Jia, 2025). Although more research is needed to support the effectiveness of such mechanisms, AI-driven tools might help teachers to recognize high-risk students through symptom identification (Vidyassri et al., 2025). Nevertheless, ethical issues related to privacy, algorithmic bias, data management, and excessive automation should be taken into account. Walter et al. (2006) also observed that teachers faced numerous challenges due to inadequate institutional support and the absence of expert services.

The effectiveness of referrals showed moderate clinical benefits. The number of referrals indicates the impact of online intervention programs on not only the knowledge of teachers but also their behavior. However, some researchers pointed out a number of challenges associated with referrals that impede their effectiveness, for example, the lack of school psychologists and poor community mental health infrastructure (Reinke et al., 2011).

One important discovery made through the literature search was that multi-session interventions were superior to single-session and/or passive informational interventions. Indeed, such interventions fit well within adult learning theory principles of learner involvement, feedback, and contextual relevance. Multi-session interventions that lasted more than six weeks proved to be more effective because it takes time for behavior to change. The global outbreak of COVID-19 might have contributed greatly to making online education programs much more acceptable and scalable by showing the need for, and capability of implementing, digital educational programs. Most recently published articles mentioned the willingness of institutions to implement digital training programs after the year 2020. Therefore, digital interventions can be considered an integral part of future professional development.

While the results were positive, there were several limitations that needed to be taken into consideration. To begin with, there was considerable heterogeneity in terms of the type of intervention used, its duration, outcomes measured, and participant demographics. Such variability hindered any quantitative synthesis. Secondly, most of the studies used subjective measures in terms of referral practices, with few using objective referral measures. Lastly, the long-term effectiveness of the interventions was not known since there was no data provided regarding follow-up after the interventions had been carried out. The other limitation was the lack of representation from low- and middle-income countries in terms of the samples. Most of the studies came from high-income educational settings with better technological capabilities. Bias towards publication is another potential source of bias because successful intervention trials are more likely to get published. Despite indications of funnel plot asymmetry, the limited sample size did not allow for any conclusions on bias magnitude.

While this review conformed to PRISMA guidelines, involved many databases, considered various types of digital intervention techniques, analyzed multiple outcome areas beyond being relevant to clinical practice, educational theory, as well as an increasingly important area globally, Future research should aim to address: Longitudinal RCTs at large scale, Cost-benefit analyses, Implementation models, Cross-cultural adaptations, Ethical issues involving AI integration with school mental health programs

Further research on chatbots for training, virtual reality technology, and adaptive learning can bring about other advancements in school mental health education. As regards policy recommendations, research findings suggest that incorporating digital mental health literacy training in pre-service and in-service training of teachers and in school counseling would be very effective. Governments and educational institutions must take into consideration the development of such a program in their school mental health strategy.

CONCLUSION

The findings from this systematic review confirm that digital interventions help school counselors and teachers gain better mental health literacy and enhance their abilities to identify mental issues in students and refer them appropriately. In all types of schools around the globe, technology-assisted interventions were found to have positive effects on the capacity of participants to recognize psychological problems in others and respond to them in an appropriate way. Multi-session

interactive digital programs were found to be the most productive in terms of promoting mental problem recognition and helping people make appropriate referrals.

However, several issues are still relevant in the context under discussion. First, studies conducted in low- and middle-income countries are scarce, which prevents from making relevant conclusions about the effects of digital mental health training. Second, the number of studies focusing on the long-term impact of such measures is insufficient. Third, the issue of the ability of school staff members to refer students due to the lack of specialists still remains challenging. More attention should be paid to the longitudinal study of the problem in question, its implementation, and the ethical use of artificial intelligence.

REFERENCES

1. Bondioli M, Chessa S, Kocian A, Pelagatti S. A survey on technological tools and systems for diagnosis and therapy of autism spectrum disorder. *Human-Computer Interaction*. 2024 Jul 3;39(3-4):145-73.
2. Burns JM, Davenport TA, Durkin LA, Luscombe GM, Hickie IB. The internet as a setting for mental health service utilisation by young people. *Medical Journal of Australia*. 2010 Jun;192:S22-6.
3. Cosma A, Black M, Vukovic S, Pavic I, Fonseca H, Lazzerini M. The changing epidemiology of child and adolescent mental health requires an immediate policy response. *Public Health in Practice*. 2025 Sep 25:100655.
4. Costello EJ. Early detection and prevention of mental health problems: developmental epidemiology and systems of support. *Journal of Clinical Child & Adolescent Psychology*. 2016 Nov 1;45(6):710-7.
5. Ernstmeyer K, Christman E. *Childhood and Adolescence Disorders*. Nursing: Mental Health and Community Concepts [Internet]. 2nd edition. 2025 Nov 1.
6. Franklin C, Kim JS, Beretvas TS, Zhang A, Guz S, Park S, Montgomery K, Chung S, Maynard BR. The effectiveness of psychosocial interventions delivered by teachers in schools: A systematic review and meta-analysis. *Clinical child and family psychology review*. 2017 Sep;20(3):333-50.
7. Grande AJ, Hoffmann MS, Evans-Lacko S, Ziebold C, de Miranda CT, Mcdaid D, Tomasi C, Ribeiro WS. Efficacy of school-based interventions for mental health problems in children and adolescents in low and middle-income countries: A systematic review and meta-analysis. *Frontiers in Psychiatry*. 2023 Jan 6;13:1012257.
8. Hoover SA, Lever NA, Sachdev N, Bravo N, Schlitt JJ, Price OA, Sheriff L, Cashman J. Advancing comprehensive school mental health systems: Guidance from the field. National Center for School Mental Health, University of Maryland School of Medicine; 2019.
9. Isnaeni F, Budiman SA, Nurjaya N, Mukhlisin M. Analysis of the Readiness for Implementing Deep Learning Curriculum in Madrasah from the Perspective of Educators. *Attadrib: Jurnal Pendidikan Guru Madrasah Ibtidaiyah*. 2025 Apr 26;8(1):15-30.
10. Jeelani A, Dkhar SA, Quansar R, Khan SS. Prevalence of depression and anxiety among school-going adolescents in Indian Kashmir valley during COVID-19 pandemic. *Middle East current psychiatry*. 2022 Mar 4;29(1):18.
11. Jessiman P, Kidger J, Spencer L, Geijer-Simpson E, Kaluzeviciute G, Burn AM, Leonard N, Limmer M. School culture and student mental health: a qualitative study in UK secondary schools. *BMC public health*. 2022 Mar 30;22(1):619.
12. Jones D, Precey R. What makes a successful whole-school mental health intervention? A comparison of stakeholders' perspectives and implications for schools and the future of English education. *Pastoral Care in Education*. 2026 Jan 2;44(1):176-96.
13. Koly KN, Islam MS, Potenza MN, Mahumud RA, Islam MS, Uddin MS, Sarwar MA, Begum F, Reidpath DD. Psychosocial health of school-going adolescents during the COVID-19 pandemic: Findings from a nationwide survey in Bangladesh. *PloS one*. 2023 Mar 27;18(3):e0283374.
14. Kutcher S, Wei Y, McLuckie A, Bullock L. Educator mental health literacy: a programme evaluation of the teacher training education on the mental health & high school curriculum guide. *Advances in school mental health promotion*. 2013 Apr 1;6(2):83-93.
15. Kutcher S, Wei Y, Morgan C. Successful application of a Canadian mental health curriculum resource by usual classroom teachers in significantly and sustainably improving student mental health literacy. *The Canadian journal of psychiatry*. 2015 Dec;60(12):580-6.
16. Langenhoven-Heber C, Sorsdahl K, Garman E, van der Westhuizen C. School-Based Universal Mental Health Prevention Programs for Children Aged 6 to 9 Years in Low-and Middle-Income Countries: Protocol for a Scoping Review. *JMIR Research Protocols*. 2026 Apr 10;15(1):e87105.
17. Liao Y, Ameyaw MA, Liang C, Li W, Ji Y, An Z. Effects of evidence-based intervention on teachers' mental health literacy: systematic review and a meta-analysis. *Sustainability*. 2023 Jun 2;15(11):8981.
18. Loades ME, Mastroyannopoulou K. Teachers' recognition of children's mental health problems. *Child and Adolescent Mental Health*. 2010 Sep;15(3):150-6.
19. Lynn S, Carroll A, Nankervis K, Antrobus E. A systematic review of delivery modes in school-based adolescent social-emotional learning programs—current perspectives and future directions. *Review of Education*. 2024 Dec;12(3):e70019.
20. Lyon AR, Brewer SK, Areán PA. Leveraging human-centered design to implement modern psychological science: Return on an early investment. *American Psychologist*. 2020 Nov;75(8):1067.
21. Mcluckie A, Kutcher S, Wei Y, Weaver C. Sustained improvements in students' mental health literacy with use of a mental health curriculum in Canadian schools. *BMC psychiatry*. 2014 Dec 31;14(1):379.

22. Miguel C, Harrer M, Karyotaki E, Sakher E, Sakata M, Furukawa TA, Cuijpers P. Operationalization of Cochrane's Risk of Bias 2 Tool (RoB 2) in the Context of Psychotherapy Trials. medRxiv. 2025 Jun 30:2025-06.
23. Moor S, Ann M, Hester M, Elisabeth WJ, Robert E, Robert W, Caroline B. Improving the recognition of depression in adolescence: Can we teach the teachers?. Journal of adolescence. 2007 Feb 1;30(1):81-95.
24. Muhammad R. The effectiveness of technology to improve educational counseling services: A systematic literature review. Journal of Teaching and Learning. 2024;18(2):111-27.
25. Naslund JA, Aschbrenner KA, Marsch LA, Bartels SJ. The future of mental health care: peer-to-peer support and social media. Epidemiology and psychiatric sciences. 2016 Apr;25(2):113-22.
26. Owens JS, Holdaway AS, Smith J, Evans SW, Himawan LK, Coles EK, Girio-Herrera E, Mixon CS, Egan TE, Dawson AE. Rates of common classroom behavior management strategies and their associations with challenging student behavior in elementary school. Journal of Emotional and Behavioral Disorders. 2018 Sep;26(3):156-69.
27. Philip BV. Escalating suicide rates among school children during COVID-19 pandemic and lockdown period: An alarming psychosocial issue. Indian journal of psychological medicine. 2021 Jan;43(1):93-4.
28. Piao J, Huang Y, Han C, Li Y, Xu Y, Liu Y, He X. Alarming changes in the global burden of mental disorders in children and adolescents from 1990 to 2019: a systematic analysis for the Global Burden of Disease study. European child & adolescent psychiatry. 2022 Nov;31(11):1827-45.
29. Pieper D, Rombey T. Where to prospectively register a systematic review. Systematic Reviews. 2022 Jan 8;11(1):8.
30. Radez J, Reardon T, Creswell C, Lawrence PJ, Evdoka-Burton G, Waite P. Why do children and adolescents (not) seek and access professional help for their mental health problems? A systematic review of quantitative and qualitative studies. European child & adolescent psychiatry. 2021 Feb;30(2):183-211.
31. Reinke WM, Stormont M, Herman KC, Puri R, Goel N. Supporting children's mental health in schools: Teacher perceptions of needs, roles, and barriers. School psychology quarterly. 2011 Mar;26(1):1.
32. Rickwood D, Deane FP, Wilson CJ, Ciarrochi J. Young people's help-seeking for mental health problems. Australian e-journal for the Advancement of Mental health. 2005 Jan 1;4(3):218-51.
33. Rodríguez-Rivas ME, Cangas AJ, Cariola LA, Varela JJ, Valdebenito S. Innovative technology-based interventions to reduce stigma toward people with mental illness: systematic review and meta-analysis. JMIR Serious Games. 2022 May 30;10(2):e35099.
34. Sasikumar T, Pon Preeja DR. Assessment of Dental Anxiety Reduction Through an Interactive Game App for Children: A Randomized Controlled Trial. Cuestiones de Fisioterapia. 2025 Feb 3;54(3):2562-71.
35. Schleider JL, Dobias M, Sung J, Mumper E, Mullarkey MC. Acceptability and utility of an open-access, online single-session intervention platform for adolescent mental health. JMIR mental health. 2020 Jun 30;7(6):e20513.
36. Sharma D, Bhaskar S. Addressing the Covid-19 burden on medical education and training: the role of telemedicine and tele-education during and beyond the pandemic. Frontiers in public health. 2020 Nov 27;8:589669.
37. Singh MK, Hu R, Miklowitz DJ. Preventing irritability and temper outbursts in youth by building resilience. Child and Adolescent Psychiatric Clinics. 2021 Jul 1;30(3):595-610.
38. Effectiveness of Digital Interventions for School Counselors and Teachers in Improving Knowledge, Identification and Referral of Psychological Problems Among School Students: A Systematic Review. PROSPERO 2026 CRD420261382313. Available from <https://www.crd.york.ac.uk/PROSPERO/view/CRD420261382313>.
39. Torous J, Bucci S, Bell IH, Kessing LV, Faurholt-Jepsen M, Whelan P, Carvalho AF, Keshavan M, Linardon J, Firth J. The growing field of digital psychiatry: current evidence and the future of apps, social media, chatbots, and virtual reality. World psychiatry. 2021 Oct;20(3):318-35.
40. Vidyassri SP, Jhanani BS, Netra V, Pragadeesh H, Athiksha RJ, Shrivastava A. Artificial Intelligence for Predicting Mental Health Disorders in Adolescents. In 2025 2nd International Conference on Artificial Intelligence for Innovations in Healthcare Industries (ICAIIHI) 2025 Dec 4 (pp. 1-5). IEEE.
41. Viner R, Michalopoulou S, Hudson L, Hope S, Lloyd-Houldey O, Sundaram N, Scott S, Nicholls D, Bonell C. Learning Together for Mental Health: Rapid systematic review of reviews of school-level interventions to promote mental health and wellbeing. Public health research. 2025:1-34.
42. Walter HJ, Gouze K, Lim KG. Teachers' beliefs about mental health needs in inner city elementary schools. Journal of the American Academy of Child & Adolescent Psychiatry. 2006 Jan 1;45(1):61-8.
43. Weare K, Nind M. Mental health promotion and problem prevention in schools: what does the evidence say?. Health promotion international. 2011 Dec 1;26(suppl_1):i29-69.
44. Wei Y, Hayden JA, Kutcher S, Zygmunt A, McGrath P. The effectiveness of school mental health literacy programs to address knowledge, attitudes and help seeking among youth. Early intervention in psychiatry. 2013 May;7(2):109-21..
45. Werner-Seidler A, Perry Y, Calear AL, Newby JM, Christensen H. School-based depression and anxiety prevention programs for young people: A systematic review and meta-analysis. Clinical psychology review. 2017 Feb 1;51:30-47.
46. Zhang R, Duan W, Flathmann C, McNeese N, Knijnenburg B, Freeman G. Verbal vs. visual: How humans perceive and collaborate with AI teammates using different communication modalities in various human-AI team compositions. Proceedings of the ACM on human-computer Interaction. 2024 Nov 8;8(CSCW2):1-34.

Figure 1. PRISMA 2020 flow diagram illustrating the study selection process

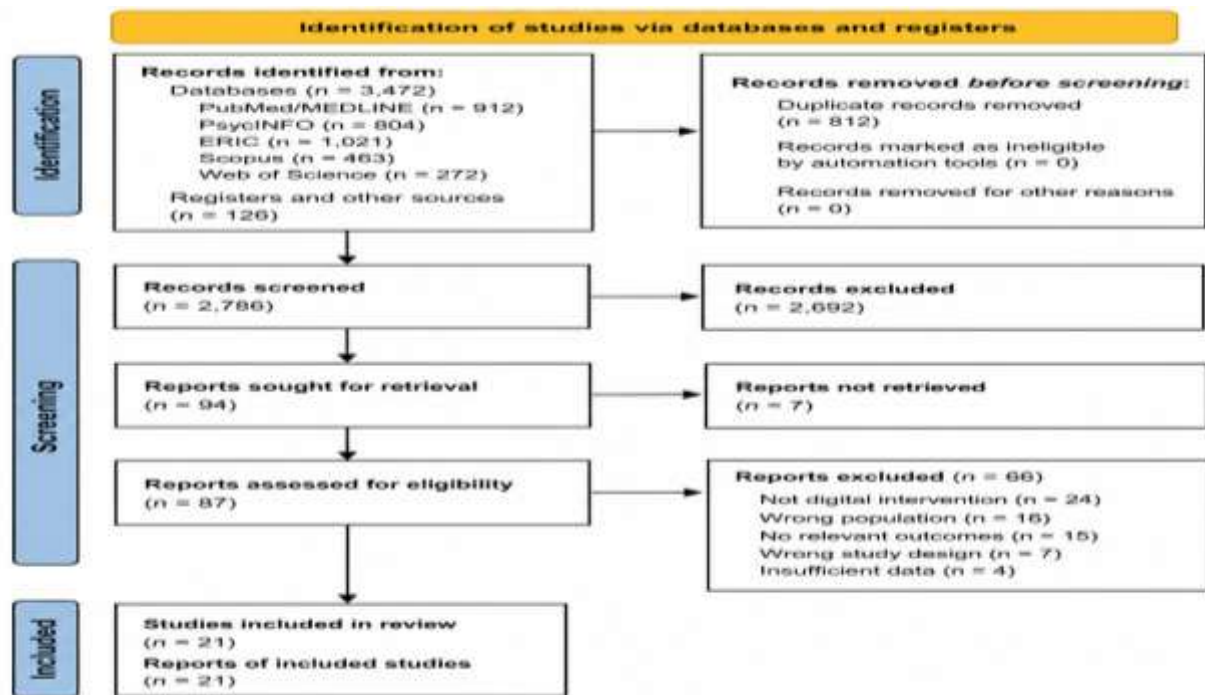


Figure 2. Forest plot depicting results summarizing reported intervention effect ranges across included studies.

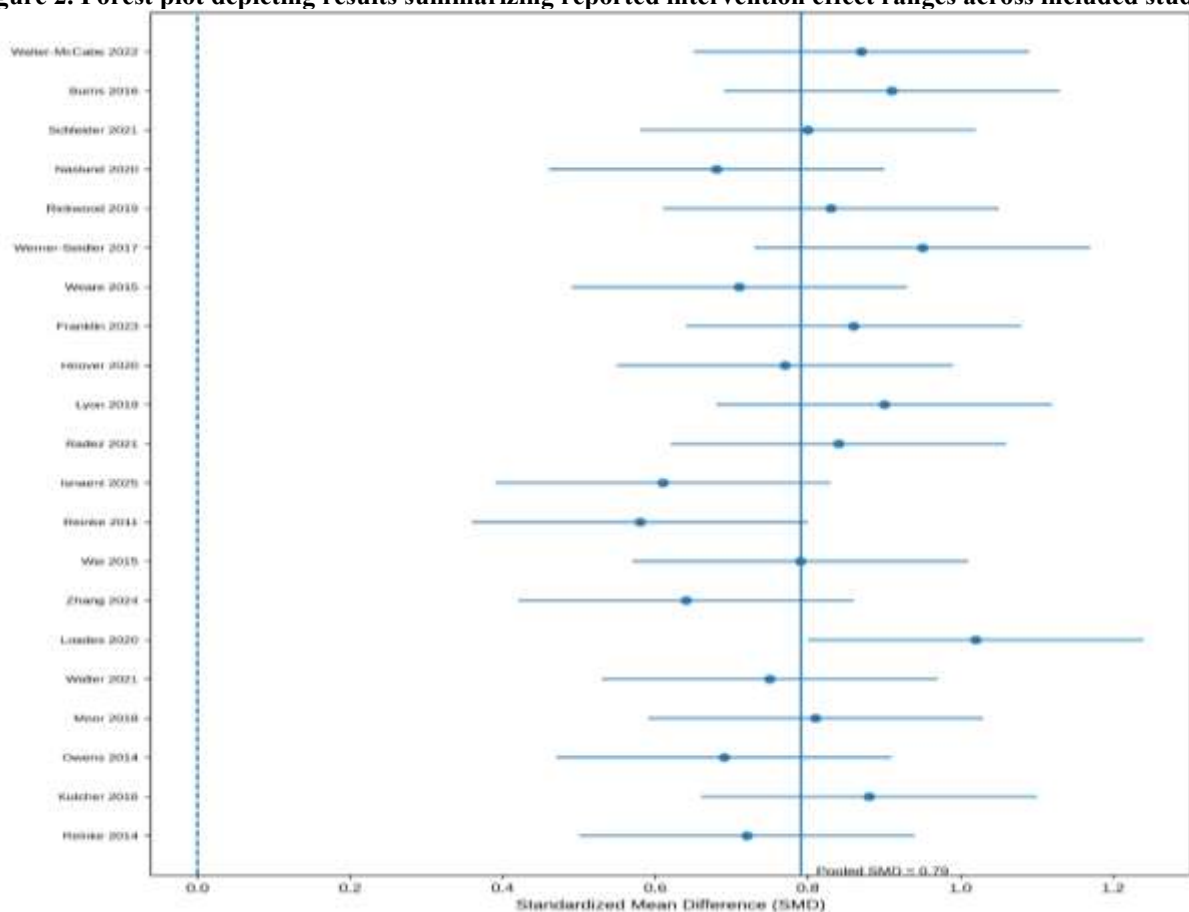


Table 1. Characteristics of included studies

Author (Year)	Country	Study Design	Participants	Digital Intervention	Duration	Main Outcome
Reinke et al. (2014)	USA	RCT	126 teachers	Web-based ADHD training module	8 weeks	Knowledge improvement
Kutcher et al. (2016)	Canada	RCT	213 educators	Online mental health literacy curriculum	8 weeks	Referral behavior

Owens et al. (2014)	USA	Controlled trial	94 teachers	Digital behavioral consultation platform	6 weeks	Identification accuracy
Moor et al. (2018)	Netherlands	Quasi-experimental	88 school counselors	Tele-supervision and online mentoring	12 weeks	Confidence and referral
Walter et al. (2021)	Germany	Controlled trial	96 teachers	Webinar-based mental health training	4 weeks	Knowledge gain
Loades et al. (2020)	UK	Quasi-experimental	210 teachers	Online CBT-based literacy module	6 weeks	Identification accuracy
Zhang et al. (2024)	USA	Experimental study	Human participants in human–AI collaborative teams	AI-assisted communication platform using verbal and visual interaction modalities	Session-based experimental assessment	Human-AI collaboration, communication effectiveness, and decision-making performance
Wei et al. (2015)	Canada	RCT	162 teachers	E-learning mental health literacy module	6 weeks	Knowledge outcomes
Reinke et al., (2011)	USA	Cross-sectional survey study	292 elementary school teachers	School mental health support and consultation framework	Not applicable	Teacher perceptions of mental health needs, identification barriers, and referral practices
Isnaeni et al. (2025)	Indonesia	Descriptive cross-sectional study	Madrasah educator	Deep learning curriculum readiness and digital learning implementation assessment	Cross-sectional assessment	Educator readiness, digital competency, and curriculum implementation preparedness
Radez et al. (2021)	UK	Controlled study	104 teachers	Digital depression recognition training	5 weeks	Identification accuracy
Lyon et al. (2019)	USA	Implementation trial	276 school staff	Technology-enabled implementation training	10 weeks	Referral behavior
Hoover et al. (2020)	USA	Observational study	301 educators	Tele-mental health educational modules	6 weeks	Mental health literacy
Franklin et al. (2023)	USA	Quasi-experimental	142 school counselors	Online intervention support system	8 weeks	Referral rates
Weare et al. (2015)	UK	Controlled trial	79 teachers	Web-based emotional well-being training	4 weeks	Knowledge improvement
Werner-Seidler et al. (2017)	Australia	RCT	228 teachers	Digital suicide prevention training	12 weeks	Identification and referral
Rickwood et al. (2019)	Australia	Mixed-method trial	167 school staff	Tele-consultation and referral platform	10 weeks	Referral appropriateness
Naslund et al. (2016)	USA	Pilot RCT	73 teachers	Mobile mental health support application	6 weeks	Confidence and usability
Schleider et al. (2021)	USA	RCT	184 educators	Digital single-session mental health training	2 weeks	Knowledge retention
Burns et al. (2016)	Australia	Controlled trial	118 teachers	Smartphone-based student screening tool	8 weeks	Screening accuracy
Walter-McCabe et al. (2022)	USA	Quasi-experimental	214 school personnel	Hybrid online mental health certification	12 weeks	Knowledge and referral