International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	MOBILE APPS, WEARABLES, AND eHEALTH LITERACY IN HEALTH-PROMOTING LIFESTYLES AMONG UNIVERSITY STUDENTS: AN INTEGRATIVE REVIEW
DOI	https://doi.org/10.31435/ijitss.1(49).2026.5350
RECEIVED	19 January 2026
ACCEPTED	11 March 2026
PUBLISHED	27 March 2026
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MOBILE APPS, WEARABLES, AND eHEALTH LITERACY IN HEALTH-PROMOTING LIFESTYLES AMONG UNIVERSITY STUDENTS: AN INTEGRATIVE REVIEW

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ABSTRACT

University students increasingly navigate health through digital environments, yet evidence on mobile applications, wearable devices, and eHealth literacy remains dispersed across separate literatures on physical activity, sleep, mental well-being, and online information behavior. This integrative review synthesized open-access evidence to examine how these elements jointly shape health-promoting lifestyles in university and adjacent young-adult populations. The analytical corpus comprised 13 publications published between 2018 and 2025, including systematic reviews, meta-analyses, a rapid review, broader youth-focused reviews, and 2 primary studies. Owing to heterogeneity in design, populations, and outcomes, the literature was synthesized narratively and interpreted through a student-centered pathway from digital access to lifestyle integration. Five themes emerged: digital information-seeking and source credibility; eHealth literacy and health competence; physical activity support; mental well-being and sleep; and usability, engagement, and implementation. The evidence indicates that eHealth literacy is linked to health knowledge, self-efficacy, preventive behavior, and, in longitudinal work, later health-promoting lifestyles. Digital tools show the most consistent benefits for physical activity, especially self-monitoring and step-related outcomes, while evidence for mental well-being and sleep is promising but methodologically uneven. Across domains, sustained benefit depends less on mere exposure to technology than on trust, interpretive capacity, low-burden design, and institutional fit. Mobile apps, wearables, and eHealth literacy should therefore be treated as interconnected components of student health promotion rather than as separate predictors. Future research should prioritize integrated multi-behavior interventions, standardized measures, and implementation strategies that are credible, equitable, and workable in everyday university life.

KEYWORDS

Digital Health, Mobile Applications, Wearable Devices, eHealth Literacy, University Students, Health-Promoting Lifestyle

CITATION

Martyna Szymczyk, Jagoda Pałubska, Oliwer Muller, Anna Szot, Dominik Szydełko, Katarzyna Rosa, Agata Słoma, Daria Danielczyk, Wiktor Czyżewski, Natalia Malatyńska. (2026) Mobile Apps, Wearables, and eHealth Literacy in Health-Promoting Lifestyles Among University Students: An Integrative Review. *International Journal of Innovative Technologies in Social Science*. 1(49). doi: 10.31435/ijitss.1(49).2026.5350

Introduction

University years represent a critical period of emerging adulthood in which long-term habits related to physical activity, sleep, stress regulation, help-seeking, and self-care are often consolidated. At the same time, this life stage is associated with academic pressure, financial strain, unstable routines, and increased psychological vulnerability. Because university students are highly embedded in digital environments, health promotion in this population increasingly intersects with smartphones, web-based platforms, and wearable technologies. Digital tools therefore matter not only as channels of health information, but also as mechanisms for self-monitoring, prompts, feedback, and behavior regulation within everyday student life (Lattie et al., 2019; Matos Fialho et al., 2025).

The relevance of this topic is heightened by the fact that university health is not shaped by single behaviors in isolation. Students' patterns of movement, sleep, screen exposure, eating habits, stress management, and help-seeking often change simultaneously when they enter higher education. This transition can create both risk and opportunity. On the one hand, irregular timetables, academic competition, financial pressure, commuting, and relocation may destabilize routines that support health. On the other hand, universities are one of the few social settings in which large groups of young adults can be reached through coordinated prevention and health-promotion strategies. Digital health tools are especially appealing in this context because they can be accessed outside clinic hours, scaled across large student populations, personalized without requiring constant face-to-face contact, and embedded into devices that students already use every day.

Mobile applications and wearable devices are especially relevant in this context because they enable students and young adults to monitor behaviors central to health-promoting lifestyles, including physical

activity, diet, sleep, and selected indicators of mental well-being. Recent evidence from young adults aged 18 to 26 years suggests that these technologies are already used on a routine basis, particularly for physical activity tracking, and that users place high value on user-friendliness, full access to content, loading speed, and interface clarity. At the same time, these tools appear to be used more often for monitoring than for sustained, active improvement of health-related variables, indicating that technology availability alone does not guarantee behavior change (Leuzzi et al., 2025).

Yet student digital health is broader than app downloads or smartwatch ownership. Reviews of younger populations up to the age of 24 show that health-related internet use is often centered on information seeking, preventive care, and questions about specific symptoms or conditions, but perceptions of online health resources remain mixed and context dependent. Likewise, reviews of social networking site-based interventions suggest that online mental health support is not only a matter of formal treatment modules; it also involves peer exchange, community, visibility of distress, and perceptions of safety. For university students, the digital health landscape therefore includes search engines, websites, social media, app ecosystems, wearable dashboards, and institutional portals. A student may move across all of these layers in a single week, using a search engine for a symptom, a wearable for step counts, a mobile app for sleep tracking, and a social platform for emotional validation or mental health information.

A second concept central to this topic is eHealth literacy. Although university students are often assumed to be digitally competent because they use online platforms daily, routine digital use does not necessarily imply the ability to search for, critically appraise, and meaningfully apply health information from digital sources. Li et al. (2025), in a systematic review of postsecondary students, reported that eHealth literacy ranged from moderate-low to moderate-high across studies and was positively associated with cognitive, emotional, and behavioral outcomes, including health knowledge, self-efficacy, disease prevention behaviors, and some aspects of psychosocial well-being. Longitudinal evidence also suggests that eHealth literacy may precede later health-promoting lifestyles rather than simply co-occur with them (Li et al., 2022).

Seen from this wider perspective, eHealth literacy is more than a technical skill or a proxy for being comfortable online. It helps explain why the same digital tool can support one student and frustrate another. Students with stronger eHealth literacy may be better able to distinguish credible from poor-quality content, understand what kind of data a wearable can and cannot meaningfully represent, and judge whether a digital recommendation is personally relevant, exaggerated, or unsafe. Students with lower eHealth literacy may still use the same technologies, but their use may remain passive, fragmented, or overly dependent on interface cues rather than on critical interpretation. The issue is therefore not merely access to digital tools, but the quality of appraisal and translation from digital exposure into health-promoting action.

Despite the growing evidence base, the literature remains fragmented. Some reviews focus primarily on digital mental health interventions in university populations, others on physical activity promotion, others on sleep, and others on broader digital lifestyle management or on eHealth literacy as a standalone competence. This fragmentation makes it difficult to answer a more integrated question: how do apps, wearables, and eHealth literacy interact in shaping health-promoting lifestyles among students? An integrative synthesis is therefore needed to connect behavior change, usability, digital competence, and implementation context within one framework (Buja et al., 2024; Chatterjee et al., 2021; Ferrari et al., 2022; Lattie et al., 2019; Lu et al., 2025).

An integrative synthesis is particularly useful because the field has developed in parallel silos. Physical activity reviews often foreground sensors, self-monitoring, and step counts; mental health reviews emphasize structured web-based therapies, peer support, or symptom reduction; sleep reviews focus on insomnia and sleep quality; and eHealth literacy studies concentrate on knowledge, self-efficacy, and preventive behavior. Universities, however, do not implement health promotion in separate silos. A student may use a wearable to monitor activity, a digital sleep program during examination periods, online information for health questions, and an app or social platform for stress management at the same time. A review that keeps these strands together is therefore more informative for campus health policy, intervention design, and the social understanding of technology in student life than a narrowly modality-specific synthesis.

Accordingly, the aim of this review was to synthesize current evidence on the roles of mobile apps, wearable devices, and eHealth literacy in health-promoting lifestyles among university students. Three questions guided the review: (1) Which lifestyle domains are most commonly supported by apps and wearables in student and adjacent young-adult populations? (2) What is currently known about the relationship between eHealth literacy and health-promoting behavior among postsecondary students? and (3) Which design, engagement, and implementation factors appear to influence the usefulness of digital health tools in university settings?

What differentiates the present review is not only its topic combination but also its analytical stance. Rather than asking whether one digital modality is superior to another, the review interprets student digital health as a pathway that runs from access to information, through appraisal and engagement, to actual lifestyle integration. This framing is especially relevant for a social-science-oriented journal because it foregrounds credibility, digital inequality, institutional mediation, and the practical conditions under which technologies become meaningful in student life.

Methodology

This paper was prepared as a focused integrative review. An integrative design was selected because the final evidence base was intentionally composed of mixed evidence types rather than one uniform family of studies. The core corpus included systematic reviews, meta-analyses, a rapid review, and primary empirical studies. Under these conditions, a narrative thematic synthesis was methodologically more appropriate than a de novo meta-analysis. This approach also reflects the logic used in several influential reviews within the selected literature, where heterogeneity in study design, intervention format, and measured outcomes limited the feasibility of quantitative pooling across all included evidence (Ferrari et al., 2022; Lattie et al., 2019; Li et al., 2025).

The analytical corpus comprised 13 publications published between 2018 and 2025. These included review-level studies by Park and Kwon (2018), Ridout and Campbell (2018), Lattie et al. (2019), Chatterjee et al. (2021), Ferrari et al. (2022), Ding et al. (2023), Buja et al. (2024), Bi et al. (2024), Li et al. (2025), Matos Fialho et al. (2025), and Lu et al. (2025), together with two primary studies by Li et al. (2022) and Leuzzi et al. (2025). Studies were prioritized when they addressed at least one of the following domains within university, postsecondary, or closely related young-adult populations: eHealth literacy, health-related internet use, social networking support, mobile applications, wearable devices, physical activity, sleep, mental well-being, or broader health-promoting lifestyles.

The review focused on recent English-language, open-access literature. Studies were retained when they were conceptually close to the review question and could contribute directly to understanding how digital tools and eHealth literacy relate to student lifestyle promotion. Studies focused exclusively on clinical inpatient monitoring, disease-specific treatment outside a student health-promotion context, purely technical device validation, or populations unrelated to university students or adjacent young adults were not prioritized in the synthesis. Additional contextual sources were consulted during interpretation, but they were not weighted equally in the final analytical structure.

In determining relevance, greater weight was given to publications directly involving university or postsecondary students, but adjacent youth reviews were retained when they clarified information-seeking behavior, online trust, or design features likely to remain relevant in late adolescence and emerging adulthood. Evidence was also interpreted with attention to whether a publication primarily addressed efficacy, usage behavior, acceptability, or implementation, since these dimensions answer different questions. A program can demonstrate short-term symptom improvement in a controlled setting yet remain unsuitable for campus-scale deployment if its usability, uptake, or sustained engagement are weak.

For each publication, the following information was extracted: publication year, study type, target population, digital modality, lifestyle domain, and principal findings relevant to the review question. The synthesis proceeded in three stages. First, the literature was summarized descriptively in terms of scope, design, geography, and outcome emphasis. Second, the findings were organized into five thematic domains: (1) digital information-seeking and source credibility; (2) eHealth literacy and health competence; (3) digital support for physical activity; (4) digital support for mental well-being and sleep; and (5) usability, engagement, and implementation. Third, an integrative interpretation examined how these themes connect within a broader student health ecosystem. This structure was selected because it matched the actual shape of the corpus and allowed the review to move beyond a weak study-by-study description.

An additional interpretive question guided the synthesis: at which point does digital exposure fail to become health-promoting practice? During reading and comparison, attention was therefore paid not only to whether outcomes improved, but also to the mechanisms that appeared to support or interrupt change. These included source credibility, literacy demands, monitoring burden, personalization, social reinforcement, and campus fit. This analytic lens helped the review generate a more original cross-cutting account of the literature than a purely descriptive catalogue of apps, outcomes, and effect sizes.

No ethics approval was required because the review used only previously published literature and did not involve human participants, identifiable data, or original data collection.

Results

Study characteristics

The final corpus was intentionally compact but methodologically diverse. Of the 13 analytical publications, 11 were review-level sources and 2 were primary empirical studies. The literature was strongest in four overlapping domains: digital information-seeking, eHealth literacy, physical activity promotion, and mental well-being, with sleep emerging as a growing but still narrower field. Compared with these areas, diet, substance use, and explicitly integrated multi-behavior lifestyle interventions were less consistently represented. This distribution suggests that digital health research in university and adjacent young-adult populations has developed most rapidly in areas where outcomes are highly salient to student life or relatively easy to monitor, such as step counts, symptom scales, or sleep-related indices.

The evidence base also varied by delivery mode and geography. Web-based platforms remained highly visible, especially in mental health and broader public health interventions. Lattie et al. (2019) reported that 71 of 89 college mental health studies used website-based delivery, whereas only 8 used mobile-phone-based formats. Matos Fialho et al. (2025) likewise found that 18 of 24 university public health interventions used web-based platforms and 6 used smartphone applications. By contrast, wearables appeared most prominently in physical activity research, where continuous self-monitoring is technically easier to implement. This pattern matters because the term digital health is often used as though it were synonymous with mobile apps, while the actual evidence base is distributed across several digital modalities.

Another noteworthy pattern concerns context and transferability. Ding et al. (2023), reviewing youth mental health mHealth studies, found that 95% of included studies originated in developed countries. This raises a broader interpretive issue for the present review. What is currently known about student digital health is shaped not only by student needs, but also by where research funding, app markets, and institutional infrastructures are strongest. As a result, the literature may overrepresent students in resource-rich settings and underrepresent questions of affordability, language, digital inequality, and institutional capacity that are crucial for real-world implementation.

Table 1 provides an overview of the analytical corpus included in the synthesis.

Table 1. Analytical corpus included in the integrative review.

Study	Study type	Population	Digital focus	Main contribution
Lattie et al. (2019)	Systematic review	College students	Digital mental health interventions	Most interventions were effective or partially effective for depression, anxiety, and psychological well-being; usability and campus implementation were inconsistently reported.
Chatterjee et al. (2021)	Systematic review	Broad health populations	Digital lifestyle interventions	Identified self-monitoring, goal setting, personalized feedback, engagement, and credibility as common ingredients of effective digital lifestyle support.
Ferrari et al. (2022)	Systematic review and meta-analysis	University students	Digital well-being interventions	Reported a small but significant improvement in psychological well-being among university students.
Li et al. (2025)	Systematic review	Postsecondary students	eHealth literacy	Showed that eHealth literacy was associated with health knowledge, self-efficacy, preventive behaviors, and psychosocial outcomes.
Li et al. (2022)	Longitudinal study	College students	eHealth literacy and lifestyle	Suggested that eHealth literacy may precede later health-promoting lifestyles.

Study	Study type	Population	Digital focus	Main contribution
Buja et al. (2024)	Systematic review	University students	Social media and text messaging for physical activity	Fifteen of 19 studies reported improved physical activity outcomes.
Bi et al. (2024)	Systematic review and meta-analysis	College students	Digital physical activity interventions	Found significant increases in steps but limited effects on light activity, MVPA, and sedentary behavior.
Leuzzi et al. (2025)	Cross-sectional study	Young adults aged 18-26 years	Apps and wearables	Showed that physical activity was the most frequently monitored domain and that usability strongly influenced continued use.
Lu et al. (2025)	Systematic review and meta-analysis	College students and young adults	Digital sleep interventions	Reported improvements in sleep quality, insomnia severity, sleep hygiene, and sleep knowledge.
Matos Fialho et al. (2025)	Rapid review	University students	Digital public health interventions	Found promising but heterogeneous evidence across mental well-being and health behavior outcomes, with frequent methodological limitations.
Ding et al. (2023)	Scoping review	Youth aged 12-24 years	mHealth and youth mental health	Highlighted rapid growth in youth mHealth, developed-country bias, lack of standardized guidance, and the need for youth-centered implementation.
Park and Kwon (2018)	Systematic review	Children, adolescents, and young adults up to 24 years	Health-related internet use	Showed that online health use was largely information-seeking and prevention-oriented, with mixed perceptions of credibility and strong relevance for self-care.
Ridout and Campbell (2018)	Systematic review	Young people up to 25 years	Social networking site-based mental health interventions	Reported high engagement, usability, and perceived safety; expert moderation and mobile-friendly formats appeared especially important.

Digital information-seeking and source credibility

Before students encounter a formal intervention, many already use digital environments informally for questions about symptoms, prevention, stress, nutrition, or mental health. Park and Kwon (2018), in a systematic review of health-related internet use among people aged 24 years and younger, found that information seeking was a major purpose of online health use, often focused on preventive care and specific medical issues. Their review also emphasized that young people's perceptions of online health resources were not uniformly positive: the internet was valued for convenience and accessibility, yet concerns remained about trust, interpretation, and uneven quality. For university students, this suggests that digital health promotion begins in a pre-intervention zone where search behavior, social media exposure, and informal information appraisal already shape later engagement with more structured tools.

Ridout and Campbell (2018) extend this point from information seeking to socially networked support. In their review of social networking site-based mental health interventions for young people up to 25 years, the number of rigorously tested interventions was still small, yet acceptability, engagement, perceptions of usefulness, and perceived safety were generally high. The review suggested that interventions tended to work better when platforms included professional or clinician oversight, and when participants could choose between delivery modes, app-based formats were often favored over standard web interfaces. These findings

indicate that students and young adults do not encounter digital health as isolated consumers of static content. They move through networked spaces where information, support, visibility, and platform culture interact.

Taken together, these reviews suggest that source credibility is not a peripheral issue but part of the causal pathway through which digital health may or may not support health-promoting lifestyles. Whether a student trusts what they read, who appears to stand behind it, and whether the platform feels safe and moderated can influence the likelihood that information turns into self-care, help-seeking, or sustained behavioral change.

eHealth literacy as a foundation for health-promoting lifestyles

Across the reviewed literature, eHealth literacy emerged as a foundational competence rather than a peripheral background characteristic. Li et al. (2025), in a systematic review of 89 cross-sectional studies, found that eHealth literacy among postsecondary students was positively associated with cognitive outcomes such as health knowledge and self-efficacy, emotional outcomes such as better psychosocial well-being and more positive emotions, and behavioral outcomes such as disease prevention practices and health-related decision-making. At the same time, the review also noted that associations with healthy living, health service engagement, and some psychosocial variables remained complex and context-dependent. This means that digital competence appears important, but it does not operate in isolation from motivation, context, and broader lifestyle conditions.

The strongest evidence for a directional relationship came from the longitudinal study by Li et al. (2022), which tested cross-lagged links among eHealth literacy, lifestyle-related behaviors, and quality of life in a college sample. The study concluded that eHealth literacy may function as an antecedent of later health-promoting lifestyles. Within the present review, this finding is particularly important because it strengthens the argument that eHealth literacy is not merely descriptive, but may represent a meaningful intervention target for student health promotion.

Taken together, these findings suggest that students' ability to interpret and apply digital health information may shape how effectively they use digital tools for self-care, prevention, and lifestyle management. Apps and wearables are therefore unlikely to be equally useful for all students unless they are accompanied by sufficient eHealth literacy or are designed in ways that compensate for differences in digital health competence.

Li et al. (2025) also documented considerable heterogeneity in how eHealth literacy was measured. The eHealth Literacy Scale was the most common instrument, but other measures captured functional, interactive, or critical dimensions in different ways, producing ranges from lower-middle to upper-middle or moderate to above-moderate levels. This measurement diversity is not merely a technical nuisance. It complicates cross-study comparison and can obscure whether students are being assessed for operational digital skills, critical appraisal, or a broader form of digital health competence. For university health promotion, the implication is practical: interventions may fail if they assume that students who are technologically fluent also possess strong evaluative judgment.

Mobile apps and wearables in physical activity promotion

The clearest benefits of digital tools were found in the area of physical activity. Buja et al. (2024), in a systematic review of interventions using social media or text messaging among university students, reported that 15 of 19 included studies demonstrated improved physical activity, while only 3 found no improvement and 1 reported worsening from baseline. This suggests that technology-mediated activity promotion can be effective in student populations, particularly when interventions are built around social interaction, structured messaging, or repeated prompts.

However, evidence becomes more nuanced when physical activity outcomes are measured more strictly. Bi et al. (2024), in a systematic review and meta-analysis focused on objectively measured physical activity among college students, concluded that digital health interventions significantly increased steps but had limited or nonsignificant effects on light physical activity, moderate-to-vigorous physical activity, and sedentary behavior. This pattern suggests that digital interventions may be more successful in shifting simple, easily monitored behaviors than in producing broader and more sustained changes across all dimensions of physical activity.

The broader healthy-lifestyle literature helps explain why some digital interventions appear more effective than others. Chatterjee et al. (2021) identified self-monitoring, self-motivation, goal setting, personalized feedback, participant engagement, persuasion, digital literacy, efficacy, and credibility as core ingredients of successful digital lifestyle interventions. These mechanisms are directly relevant to student

health promotion because they describe how digital tools move from passive tracking devices to behavior change supports.

Primary evidence from Leuzzi et al. (2025) complements this picture from the user perspective. In their sample of young adults, physical activity was by far the most frequently monitored domain, and both apps and wearables were often checked on a daily basis. At the same time, participants reported that these tools were used more for monitoring than for actively improving health variables. Wearables and apps were judged most favorably when they were easy to use, free, fast, and visually clear. These findings suggest that physical activity is currently the lifestyle domain in which digital tracking is most normalized, but also that normalization does not automatically translate into deeper behavior change.

Importantly, the physical activity evidence is not uniform across intervention types. Buja et al. (2024) reviewed social media and text messaging interventions that often emphasized reminders, peer interaction, goal visibility, and motivational reinforcement, whereas Bi et al. (2024) restricted quantitative synthesis to objectively measured outcomes and found a clearer but narrower signal: digital interventions significantly increased steps, yet effects on light activity, moderate-to-vigorous activity, and sedentary time were limited. Rather than contradicting each other, these findings illuminate different levels of behavioral change. Motivational and socially supported formats may broaden engagement, while device-based meta-analysis shows that the most reproducible impact may still occur at the level of incremental ambulatory behavior.

This distinction matters for how universities interpret success. A program that increases steps may still be valuable, particularly in sedentary student populations, but step growth should not be conflated with full lifestyle transformation. Higher-intensity movement, exercise identity, time structure, and sustained habit formation may require additional ingredients such as human coaching, peer accountability, environmental support, or deliberate integration with campus routines. The review by Chatterjee et al. (2021) supports this interpretation by showing that self-monitoring becomes more useful when it is combined with goal setting, personalized feedback, participant engagement, credibility, and motivational architecture. Wearables can make behavior visible, but they do not automatically make it meaningful.

Digital support for mental well-being and sleep

Evidence for mental well-being was generally promising, although more heterogeneous than the evidence for basic activity tracking. Lattie et al. (2019), in a large systematic review of digital mental health interventions among college students, found that most programs were either effective or partially effective in improving depression, anxiety, and psychological well-being. At the same time, approximately half of the included studies did not report usability or acceptability outcomes, and very few examined large-scale implementation on college campuses. These findings suggest that digital mental health interventions may work, but their real-world sustainability and scalability remain underexamined.

Ferrari et al. (2022) offered a more focused synthesis by examining digital interventions for psychological well-being among university students specifically. Their meta-analysis found a small but statistically significant improvement in psychological well-being, with stronger signals in interventions using acceptance and commitment therapy elements. This result is important because it indicates that digital student interventions may contribute not only to symptom reduction, but also to broader dimensions of positive functioning and flourishing.

Sleep emerged as another promising but still developing area. Lu et al. (2025), in a systematic review and meta-analysis of digital sleep interventions for college students and young adults, concluded that these interventions improved sleep quality and reduced insomnia severity, with additional benefits for sleep hygiene, sleep knowledge, and dysfunctional beliefs about sleep. For student populations, this finding is highly relevant because sleep is deeply entangled with stress, concentration, academic performance, and emotional regulation. The literature therefore suggests that digital health promotion in universities should not be reduced to exercise apps alone.

A broader perspective is provided by the rapid review of Matos Fialho et al. (2025), which examined digital public health interventions targeting mental well-being and health behaviors among university students. The review concluded that digital public health interventions show both potential and limitation and that many studies carried at least moderate risk of bias. Within the present synthesis, this reinforces the view that digital approaches are promising, but that the evidence base remains uneven across lifestyle domains.

The mental well-being literature also suggests that delivery mode is less important than intervention logic. Lattie et al. (2019) observed that internet-based cognitive behavioral therapy was the most common model in college populations, while Ferrari et al. (2022) found particularly promising effects among acceptance

and commitment therapy-based interventions for psychological well-being. This indicates that digital delivery alone is not the active ingredient. Rather, evidence-based therapeutic structure remains central, while digital formats function as vehicles through which support can become more accessible, timely, or scalable.

Ridout and Campbell (2018) provide a complementary perspective by focusing on socially networked mental health environments rather than structured therapeutic modules alone. Their review suggested that social networking site-based interventions could improve mental health knowledge and selected emotional outcomes, but the evidence base remained small and methodologically limited. Still, the high engagement reported across these studies is noteworthy. It suggests that young people may respond to interventions that feel familiar, conversational, and socially embedded, provided they are safely moderated.

Usability, engagement, and implementation

Across the reviewed literature, the practical value of digital tools depended strongly on usability and engagement. Leuzzi et al. (2025) showed that young adults placed especially high value on ease of use, unrestricted content access, quick performance, and a visually clear interface when judging apps and wearables. These seemingly simple features matter because they influence repeated use, trust, and perceived burden. In a student population already exposed to high levels of digital saturation, convenience becomes a precondition for health-related engagement rather than a minor design preference.

Lattie et al. (2019) similarly argued that strong user experience and continued engagement are essential if digital mental health tools are to be adopted and maintained across college campuses over time. Their review also highlighted that uptake, acceptability, and adoption had been studied much less consistently than efficacy. This matters because it shifts the discussion away from a purely clinical question of whether a tool works and toward a broader social-technological question of under what conditions it is used, sustained, and meaningful in everyday life.

Implementation gaps also appeared in the wider youth mHealth literature. Ding et al. (2023), in a scoping review on youth mental health, reported that most studies were conducted in developed countries, that outcome measures were highly varied, and that the field lacked standardized guidance and youth-centered implementation approaches. Although this review was broader than university students alone, it is relevant to the present synthesis because it highlights structural challenges that often remain invisible in technology-positive narratives: uneven geographical evidence, weak standardization, insufficient youth engagement, and limited attention to inclusion.

Evidence on usability and engagement reveals a tension between promise and burden. Students and young adults want tools that are fast, intuitive, visually clear, and minimally intrusive. Yet the more a tool asks users to log data manually, interpret dashboards, respond to prompts, or remain continuously connected, the greater the risk of attrition. Lattie et al. (2019) showed that usage, acceptability, and adoption were reported far less consistently than efficacy, while Ding et al. (2023) highlighted the broader lack of youth-centered implementation science. These findings suggest that passive use, dropout, and superficial engagement should not be treated as marginal problems; they are central outcomes because a theoretically strong intervention cannot influence health-promoting lifestyles if students do not stay with it.

Usability also interacts with trust. Ridout and Campbell (2018) highlighted expert moderation as a key component of more successful social networking interventions, implying that young users are more willing to engage when the digital environment feels safe and guided rather than unbounded. In the university context, this points to a practical design principle: interventions may gain legitimacy when they are visibly connected to student health services, counseling centers, or other credible institutional actors. Authentic digital health promotion is therefore not only about interface design, but about who stands behind the intervention and how clearly safety, confidentiality, and purpose are communicated.

Toward an integrated conceptual understanding

Across the corpus, a recurring sequence can be inferred. Students first encounter digital health through a wider information environment that includes search engines, websites, social networking spaces, app stores, institutional portals, and wearable feedback. From there, the pathway becomes selective rather than automatic. eHealth literacy and perceptions of source credibility shape which signals are trusted; usability and burden shape whether a chosen tool is actually adopted; and only then can monitoring or structured support be enacted in everyday routines. The evidence therefore suggests that digital exposure is best understood as the beginning of a pathway, not as an outcome in itself.

This pathway can be summarized as movement from access to appraisal, engagement, enactment, and eventual lifestyle integration. Apps and wearables are action-oriented interfaces; eHealth literacy is the interpretive capacity that helps students use them well; source credibility and social moderation shape trust; and university context influences legitimacy, continuity, and implementation. This integrated perspective explains why the literature contains both optimism and inconsistency: benefits weaken whenever one stage is missing, whether because information is mistrusted, monitoring becomes burdensome, or use does not fit the rhythms of student life. The main thematic implications of this interpretation are summarized in Table 2.

Table 2. Thematic synthesis of the evidence and implications for student health promotion.

Theme	Main findings	Implications for university health promotion
Digital information-seeking and source credibility	Students and young adults often engage with digital health first through information seeking and socially networked support. Trust, moderation, and perceived safety influence whether digital contact becomes meaningful health action.	Universities should treat websites, social platforms, and app ecosystems as part of one student digital health environment and visibly support credible, moderated pathways.
eHealth literacy and health competence	Higher eHealth literacy was associated with health knowledge, self-efficacy, preventive behaviors, and psychosocial outcomes. Longitudinal evidence suggested that eHealth literacy may precede later health-promoting lifestyles.	Universities should combine digital tools with health-information appraisal skills and support for students with different levels of digital competence.
Digital support for physical activity	Apps, social media, messaging, and wearables most consistently supported physical activity, particularly self-monitoring and step-related outcomes. Effects on broader activity indicators were less consistent.	Low-burden monitoring and behavior-change features may be especially useful in campus-based physical activity initiatives, but step gains should not be confused with full lifestyle change.
Mental well-being and sleep	Digital mental health and sleep interventions showed promising effects on psychological well-being, sleep quality, insomnia-related outcomes, and selected knowledge or self-management indicators, but evidence quality remained uneven.	Student health services may benefit from integrating digital support for well-being and sleep alongside more traditional counseling, psychoeducation, and referral pathways.
Usability, engagement, and implementation	Ease of use, trust, cost, loading speed, visual clarity, and expert moderation strongly influenced sustained use. Adoption, scalability, and implementation conditions were underreported in many studies.	Effective digital health promotion requires user-centered design, implementation planning, institutional legitimacy, and attention to equity rather than app availability alone.

Discussion

Interpreting digital health as a student health ecosystem

The present integrative review suggests that mobile apps, wearables, and eHealth literacy should be understood as interdependent rather than isolated determinants of student health. Across the reviewed literature, digital tools appear to offer students accessible opportunities for self-monitoring, prompts, feedback, and behavioral support, while eHealth literacy shapes whether such opportunities are interpreted critically and translated into meaningful action. The value of digital technologies does not lie in their availability alone. Rather, their effectiveness depends on the interaction between technological functionality, user competence, and the everyday realities of student life. This interpretation is strongly supported by the systematic review of eHealth literacy among postsecondary students and by longitudinal evidence showing that eHealth literacy

may precede later health-promoting lifestyles (Li et al., 2022; Li et al., 2025). Primary evidence on young adults' app and wearable use further supports the idea that digital tools are widely accepted, but often used more for tracking than for sustained behavior change (Leuzzi et al., 2025).

From access to action: a proposed interpretive pathway

On the basis of the reviewed evidence, the present paper proposes a five-step pathway for understanding digital student health promotion: access, appraisal, engagement, enactment, and integration. Access refers to exposure to health information, platforms, and devices. Appraisal refers to credibility judgments and the interpretive work captured by eHealth literacy. Engagement refers to whether students actually adopt and continue using a tool, which depends heavily on usability, burden, and perceived relevance. Enactment refers to the point at which information or monitoring begins to shape concrete routines such as walking more, regularizing sleep, seeking help, or using coping strategies. Integration refers to whether these changes become durable parts of student life rather than short-lived episodes around novelty or crisis.

This pathway helps explain a central tension in the literature: many digital tools succeed at access and monitoring, but fewer achieve integration. A wearable can generate daily data without changing self-regulation; a mental health app can be downloaded without becoming part of a help-seeking routine; an informational website can be trusted in principle but not remembered in moments of stress. By distinguishing stages rather than collapsing them into a single notion of effectiveness, the review offers a more realistic account of how digital health operates in university settings.

Why physical activity dominates the evidence

A second major finding is that the evidence is currently strongest in the domain of physical activity. Interventions using social media and text messaging among university students frequently improve physical activity outcomes, and broader digital lifestyle reviews identify self-monitoring, goal setting, personalized feedback, participant engagement, and digital literacy as recurring ingredients of effective intervention design. At the same time, the more rigorous meta-analytic evidence indicates that digital interventions improve step counts more consistently than broader indicators such as light physical activity, moderate-to-vigorous physical activity, or sedentary time. This pattern suggests that digital interventions may currently be most successful in modifying behaviors that are simple, visible, and easily quantified. It also explains why wearable devices have become especially prominent in activity promotion: they reduce the burden of manual tracking and fit naturally into everyday routines (Bi et al., 2024; Buja et al., 2024; Chatterjee et al., 2021; Leuzzi et al., 2025).

Mental well-being, sleep, and intervention logic

The evidence for mental well-being and sleep is also encouraging, although more heterogeneous. Digital mental health interventions for college students have often been reported as effective or partially effective in reducing depression and anxiety symptoms and in improving psychological well-being. Meta-analytic evidence further indicates a small but statistically significant overall effect on psychological well-being. In parallel, digital sleep interventions for college students and young adults have shown benefits across several sleep-related indicators, including perceived sleep quality, insomnia symptoms, sleep hygiene practices, and knowledge about sleep. However, the literature also shows that evidence quality remains uneven and that implementation-related variables such as usability, acceptability, and sustained adoption are not always reported in sufficient detail. As a result, the field has stronger evidence for the potential of digital support than for its long-term integration into student health systems (Ferrari et al., 2022; Lattie et al., 2019; Lu et al., 2025; Matos Fialho et al., 2025).

The mental well-being and sleep literature further underscores that digital delivery is not sufficient in itself. What appears to matter is whether a digital format carries a coherent therapeutic or behavioral logic that students can use under real-life conditions. The more promising interventions are not simply digitized versions of generic advice; they are structured, theory-informed, and tied to a health concern that students recognize as relevant. This may explain why sleep interventions are especially interesting for university settings: they connect directly to concentration, academic functioning, and everyday coping, which may strengthen motivation to engage.

Usability, authenticity, and implementation in university settings

A particularly important implication of the reviewed evidence is that usability, engagement, and implementation context are not secondary concerns but central determinants of intervention value. Young adults value user-friendliness, clear visual design, fast loading speed, and unrestricted access to content, which indicates that even well-designed interventions may fail if they are inconvenient or burdensome. Earlier student reviews likewise emphasized that better user experience and stronger engagement are crucial if digital mental health tools are to be sustained in real college settings. Broader youth-focused mHealth evidence also points to recurring structural challenges, including limited standardization, high heterogeneity in outcomes, and insufficient youth-centered implementation planning. Taken together, these findings suggest that universities should not approach digital health promotion simply as a matter of purchasing or recommending apps. Rather, digital tools should be embedded within broader educational, behavioral, and institutional strategies that support trust, continuity, and inclusion (Ding et al., 2023; Lattie et al., 2019; Leuzzi et al., 2025; Matos Fialho et al., 2025).

Authenticity is an underappreciated dimension of implementation. Students are unlikely to engage deeply with tools that feel generic, overly clinical, commercially manipulative, or disconnected from their actual routines. The reviewed literature suggests that authenticity is built through low-burden design, visible credibility, relevant content, and an intervention logic that students can understand. Expert moderation in networked interventions, transparent purpose, and clear links to institutional support may help digital tools feel less like surveillance and more like legitimate support.

For universities and student health services, several practical implications follow. First, digital tools should be selected as parts of pathways rather than as standalone solutions. A physical activity app may be linked to campus challenges or peer communities; a sleep program may be promoted during examination periods; eHealth literacy support may be embedded in first-year orientation or health education. Second, institutional endorsement matters. Students navigate crowded digital markets of uneven quality, so universities can play a curatorial role by identifying trustworthy platforms, clarifying privacy expectations, and signaling when a tool is evidence-informed. Third, implementation should include feedback loops with students themselves. Co-design, pilot testing, and ongoing usability checks are essential if interventions are to remain relevant across fields of study, years of study, and differing levels of digital confidence.

One implication is that eHealth literacy should be treated as educational infrastructure, not as a private skill students are expected to possess already. Orientation programs, campus health campaigns, and academic advising can all become sites where students learn how to judge source quality, interpret tracker data, and recognize when digital self-help is insufficient. A second implication is that universities need governance criteria for selecting digital tools, including evidence base, privacy safeguards, accessibility, cost, language options, and compatibility with referral pathways. Without such criteria, institutional endorsement risks reproducing the logic of the commercial app marketplace rather than the logic of student well-being.

A third implication concerns authenticity in everyday use. Students are more likely to engage with digital supports when these are visibly linked to recognizable moments in university life, such as first-year transition, examination periods, residence life, commuting, or return after illness. Digital health promotion becomes more credible when it feels situated in actual student routines rather than imported as a generic wellness package. This may be especially important for populations whose schedules, financial constraints, or cultural expectations do not match the assumptions built into many commercially designed tools.

Equity, limitations, and future directions

Equity should remain central to interpretation. University students are often treated as a uniformly connected population of digital natives, but the literature suggests a more cautious view. Differences in device ownership, cost sensitivity, digital confidence, disability accommodation, privacy concerns, and eHealth literacy may all shape who benefits from digital health support. Evidence from youth-focused reviews also shows that the field remains heavily weighted toward developed-country studies and often underreports diverse user needs. A digital strategy that works well for already motivated students may fail to reach those with the greatest health vulnerability.

Seen through an equity lens, the category of university students should not be treated as socially flat. International students, students with disabilities, first-generation students, students who work alongside study, and those living away from campus may experience digital tools differently in terms of cost, language, data privacy, time burden, and access to follow-up support if a tool indicates worsening health. Future campus

strategies should therefore evaluate not only average uptake, but also which groups remain excluded, fatigued, or underserved.

This review also has several methodological limitations. First, the evidence base itself is heterogeneous in relation to design, target outcomes, follow-up duration, and intervention logic, which constrains direct comparison. Second, much of the literature remains cross-sectional or short-term, particularly in the domains of eHealth literacy and general app or wearable use. Third, the present paper was constructed as a focused integrative review rather than a de novo systematic review with an original end-to-end PRISMA search across all databases. The review therefore emphasizes conceptual coherence and interpretive integration over exhaustive retrieval. Fourth, some included publications addressed adjacent youth or young-adult populations rather than strictly enrolled university students, which broadens relevance but also introduces population variation. Finally, the reliance on open-access English-language sources may have excluded relevant work from other linguistic and publishing contexts.

Future research should move toward integrated multi-behavior interventions that address physical activity, sleep, mental well-being, and broader lifestyle regulation within a single student-centered framework. It should also place greater emphasis on standardized outcome measures, longer follow-up periods, and designs that combine objective behavioral data with qualitative accounts of how students actually use tools in everyday life. Just as importantly, upcoming studies should report adoption, disengagement, privacy concerns, and institutional feasibility as core outcomes rather than side notes. Research that includes co-design, implementation science, and cross-cultural comparison will be especially valuable for moving the field beyond proof-of-concept and toward sustainable campus health promotion.

Conclusions

In conclusion, the literature reviewed here indicates that mobile apps, wearable devices, and eHealth literacy are promising but interdependent components of health-promoting lifestyles among university students. The strongest evidence currently supports digital approaches to physical activity self-monitoring, selected mental well-being outcomes, and sleep improvement, while broader integrated lifestyle change remains less comprehensively studied. eHealth literacy appears to strengthen the pathway from digital exposure to healthier behavior, whereas usability, trust, and implementation context shape whether digital tools are adopted and sustained in practice. The interpretive model advanced in this review suggests that student digital health promotion is best understood as movement from access to appraisal, engagement, enactment, and lifestyle integration. For universities, this means that digital student health promotion should be treated not merely as a technological solution, but as a behavioral, educational, and social strategy. Future work should therefore focus on integrated interventions, standardized assessment, and equitable implementation across diverse student populations.

Ethics Statement: No ethics approval was required because this review used only previously published literature and did not involve human participants or original data collection.

Conflicts of Interest: No conflicts of interest to declare.

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