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Mixed-Methods Article

Behavioral Science Interventions to Enhance Digital Well-being among Thai Undergraduate Students

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Abstract	Author Affiliation
Background/problem: Digital technology has reshaped learning and daily life, while introducing risks for higher education such as addictive behaviors and mental health concerns. While global research has advanced digital well-being, integrated behavioral science interventions for undergraduates remain limited in Thailand. Objective/purpose: This study aimed to (1) explore perceptions and institutional contexts of digital well-being to design and validate a behavioral science intervention framework; (2) evaluate its effectiveness in improving students' digital well-being; and (3) compare experimental and control group outcomes across pretest, posttest, and follow-up. Design and Methodology: A mixed methods design was used. Focus groups ($n = 30$; 15 faculty, 15 undergraduates) guided the development of a seven-step behavioral science intervention. The program was delivered to 30 undergraduates over seven weeks via in-class sessions, online modules, and structured tasks. Quantitative evaluation used repeated measures ANOVA to assess changes in five digital well-being dimensions at a four-week follow-up, supported by classroom observations and student feedback. Results: The experimental group showed significant improvements across all five dimensions versus the control group ($F(1, 58) = 9.84$, $p < .001$), with medium to large effect sizes ($\eta^2 = .18 - .32$). Gains in self-regulation, reflective awareness, and collaborative engagement were sustained, with mean scores rising 15–22% from baseline; the control group showed minimal or declining outcomes. Conclusion and Implications: A theory-driven, seven-step behavioral science framework enhanced undergraduate digital well-being, offering a scalable model to foster healthier digital habits and purposeful technology use in higher education.	¹ Graduate College, Kasem Bundit University, Thailand. *Corresponding author e-mail: onjaree.nat@kbu.ac.th https://orcid.org/0009-0006-7728-1578 Article Information Received: 30.01.26 Revised: 15.03.26 Accepted for Review: 16.03.26 Keywords Behavioral science intervention, digital environment, generation Z, mixed-methods design

Generation Z undergraduates, typically aged 18–22 years, are widely characterized as digital natives because they were born and raised in the digital era. Surrounded by computers, mobile devices, and the internet from an early age, they have developed inherent proficiency in navigating technology. This familiarity enables rapid learning and adaptation within globalized environments where digital literacy is essential for both achievement and personal success (Janschitz & Penker, 2022). In higher education, digital technology has become indispensable communication and learning, with students across disciplines engaging in dynamic and constantly evolving digital environment. This trend has been accelerated by global crises that compelled institutions to rely heavily on online education (Haleem et al., 2022). Yet, research highlights significant challenges: excessive reliance on mobile phones, social media, and online platforms has been linked to addictive behaviors, cybervictimization, and mental health concerns such as depression, anxiety, and stress (Renjith & Arundev, 2024). Prolonged exposure to digital environments can also

undermine interpersonal relationships, daily functioning, and overall well-being, with particular implications for digital well-being.

Recent studies in Thailand reveal that digital technology exerts both positive and negative effects on undergraduates. On one hand, increased device use can cause stress, overuse, and highlight challenges like unequal access (Chareonwanit & Charoenwanit, 2020; Kaewpradit et al., 2025). On the other hand, technology supports learning, self-development, and reinforces collectivist values—contrasting with Western contexts where digital connectivity is often linked to isolation (Thianthai & Tamdee, 2024). Chevacharoen (2023) further highlights benefits for student engagement and learning, alongside challenges such as unequal access and device overuse. Together, these findings underscore the complex impact of digital technology on Thai students and emphasize the need for comprehensive strategies to promote digital well-being. Addressing this need, the present study evaluates a theory-driven, seven-step behavioral intervention using a mixed methods design to inform student development, teaching, and policy in higher education.

Literature Review

Digital well-being has become a critical focus as technology increasingly shapes academic and personal life. While scholars emphasize balance and mindful technology use, systematic curricular approaches remain limited. In higher education, digital well-being is seen as a transferable life skill that supports psychological and social adjustment. This review synthesizes theoretical perspectives and behavioral science strategies to guide integrated interventions, highlighting the need to embed digital well-being into pedagogy and prepare students for lifelong resilience.

Digital Well-being in Higher Education

Digital well-being is broadly defined as the balance between technology use and overall health, encompassing mental, emotional, social, and cognitive dimensions. Scholars emphasize equilibrium between digital practices and life satisfaction (Lissitsa & Chachashvili-Bolotin, 2016), the quality of online behaviors, and satisfaction when technology supports personal goals (Vanden Abeele, 2021). Other frameworks highlight harmonious digital living (Büchi, 2024) and mindful, responsible use (Burr et al., 2020). Collectively, these perspectives converge on the idea of living well in a digital world, requiring both enrichment through technology and avoidance of harmful practices.

In higher education, digital well-being is increasingly viewed as a critical life skill that supports balance across physical, psychological, and social domains (Orak & Saritepeci, 2024). While international programs show positive outcomes, most focus on extracurricular activities, and systematic curricular strategies remain limited, especially in Thailand (Pokao et al., 2025). Recognizing digital practices as modifiable behaviors (Büchi, 2024) and the need for adaptive engagement (Tang et al., 2025), this study introduces a holistic framework with five dimensions: self-discovery, purpose, situation management, relationships, and growth. Drawing on Diener's work on subjective well-being (Diener et al., 1999), this framework positions digital well-being as a transferable life skill, guiding the development of a seven-step psychological intervention detailed in the methodology.

Self-Connection Strategy and Self-Determination Theory

Within self-determination theory (SDT), the self-connection strategy cultivates awareness of inner experiences and aligns them with purposeful digital practices. (Ryan & Deci, 2000). Grounded in behavioral science, it integrates self-regulation, reflective learning, and adaptive feedback to help learners monitor, evaluate, and adjust their actions. The SDT emphasizes autonomy, competence, and relatedness as drivers of sustainable digital well-being (Ryan & Deci, 2000), and research shows that reflective practices build self-efficacy and resilience in managing academic and digital challenges (Sun et al., 2022; Zimmerman, 2002).

The self-connection strategy operates through three practices: self-observation, monitoring behaviors and emotions to deepen awareness (Klussman et al., 2022); external reflection, using peer and instructor

feedback to enrich understanding (Thianthai & Tamdee, 2024) and structured self-exploration, employing reflective questions to clarify values and goals (Burr et al., 2020). These practices operationalize key behavioral science principles by making abstract processes—such as self-regulation, social learning, and cognitive restructuring—observable and actionable. Specifically, self-observation applies self-monitoring techniques, external reflection leverages social feedback mechanisms, and self-exploration utilizes structured cognitive-behavioral methods to guide behavior change (Diener et al., 1999).

In digital contexts, self-connection enables students to evaluate whether online practices align with goals, recognize how digital behaviors reflect identity, and build resilience. By reinforcing autonomy, competence, and relatedness, the strategy operationalizes SDT while showing how behavioral mechanisms such as self-regulation, reinforcement, and adaptive learning sustain digital well-being. Moreover, it bridges the gap between abstract psychological principles and everyday digital routines, making well-being practices observable and actionable. In sum, grounding digital well-being interventions in self-determination theory and behavioral science provides a robust foundation for the present study, which is designed to empirically assess the impact of self-connection strategies on university students' digital well-being.

Cognitive-Behavioral Change Strategy within Behavioral Science

Building on the transtheoretical model (TTM; Prochaska & DiClemente, 1983), recent scholarship highlights the effectiveness of cognitive-behavioral strategies in fostering sustainable change. Evidence from cognitive behavioral therapy (CBT) and skills-building programs shows their capacity to reduce anxiety, depression, and stress across student and working populations (Tang et al., 2025). While clinical therapy requires professional intervention, this study applies principles from the cognitive-behavioral model (Beck, 1976) to educational practices in higher education, using instructor-led and extracurricular activities to reshape students' digital habits and strengthen well-being. The cognitive-behavioral model posits that individuals can modify behaviors by changing underlying thoughts and beliefs. Accordingly, this intervention incorporates cognitive restructuring to challenge negative beliefs about technology, reinforcement strategies to encourage healthier routines, and coping skills to address triggers for excessive use. These methods draw on established behavioral science approaches (Beck, 1976) that use stimulus control, reinforcement schedules, and cognitive reframing to reduce maladaptive digital behaviors and promote sustained, goal-aligned practices.

In digital contexts, cognitive-behavioral strategies help students identify triggers, reframe maladaptive beliefs, and adopt healthier routines. Through stimulus control, reinforcement, and reframing, learners mitigate distraction, stress, and fatigue while strengthening resilience and adaptability. This approach shows how structured, non-clinical interventions can sustain digital well-being. When integrated into classroom activities, these strategies encourage students to practice intentional digital engagement and develop transferable coping skills. By providing a framework for instructors to scaffold reflective exercises that connect cognitive change with everyday digital routines, this model ultimately supports lasting improvements in students' digital well-being. This section establishes the theoretical and practical basis for the present study's intervention, which aims to assess the effectiveness of cognitive-behavioral strategies in promoting healthier digital habits and well-being among university students.

Self-Directed Learning Strategy and Social Cognitive Theory

Grounded in behavioral science concepts of agency, intrinsic motivation, and self-regulation, self-directed learning empowers students to take ownership of their digital well-being. Drawing on social cognitive theory (SCT), Bandura's concept of self-efficacy underscores how belief in one's ability to regulate learning fosters constructive digital practices (Bandura, 1997). Self-directed learners are motivated by internal goals, plan systematically, and continuously monitor and adjust their behaviors, reflecting behavioral science principles of self-monitoring, feedback loops, and adaptive learning (Zimmerman, 2002). Operationally, the strategy unfolds through structured phases and practices. Students (1) set personal

goals for technology use; (2) plan and monitor progress through self-assessment tools; and (3) adjust strategies based on outcomes. These steps parallel the four sequential phases of self-directed learning: analysis and preparation (workload analysis, self-evaluation, readiness preparation), goal setting and planning (establishing clear goals and strategic learning plans), monitoring actions (tracking effectiveness, sustaining motivation, managing emotional responses), and evaluation and reflection (assessing outcomes and identifying areas for improvement). These phases have been widely described in the literature on self-directed and self-regulated learning (Zimmerman, 2002). In digital contexts, self-directed learning enables students to set personal objectives for technology use that align with academic and personal goals, regulate digital behaviors to ensure productive rather than compulsive engagement, and adapt practices to sustain balance and well-being. By fostering autonomy, competence, and responsibility, this strategy demonstrates how behavioral science mechanisms of goal directed behavior and self-regulation cycles can sustain digital well-being (Tang et al., 2025). In conclusion, integrating self-directed learning strategies grounded in behavioral science not only empowers students to manage their digital habits effectively but also provides a foundational approach for promoting long-term digital well-being in higher education.

Collaborative Problem-Solving Strategy and Social Cognitive Theory

Collaborative problem-solving is grounded in behavioral science constructs such as social learning, reciprocal determinism, and collective efficacy, as described in Bandura's social cognitive theory (Bandura, 1986). This theory highlights learning through peer modeling, observation, and vicarious experience. In structured group activities, students identify digital challenges, co-develop solutions, and refine their approaches through feedback, operationalizing peer modeling, group reinforcement, and collective problem-solving. These practices foster resilience, relatedness, and adaptive skills (Bandura, 1986; Johnson & Johnson, 2009), with key sub-competencies including shared understanding, effective strategy selection, and teamwork norms (Li et al., 2024).

In digital contexts, such collaboration equips students for productive online teamwork, virtual conflict management, and co-creation of solutions that enhance academic outcomes and digital well-being. By promoting social support and observational learning, these approaches leverage social reinforcement and collective efficacy to sustain responsible digital habits (Srivastava, 2025). In digital contexts, collaborative problem-solving equips students to engage productively in online teamwork, manage conflicts in virtual environments, and co-create solutions that strengthen both academic outcomes and digital well-being. By building social support networks and observational learning opportunities, the strategy demonstrates how behavioral science mechanisms of social reinforcement and collective efficacy can sustain responsibility and promote sustainable digital habits (Bach & Thiel, 2024).

Research positions digital well-being as a transferable life skill in higher education, emphasizing autonomy, competence, self-efficacy, and social interaction. However, prior interventions on digital literacy and online safety often lack behavioral science integration. Drawing on self-determination theory (Ryan & Deci, 2000), the transtheoretical model (Prochaska & DiClemente, 1983), and social cognitive theory (Bandura, 1986), this study proposes an integrated intervention combining motivation, readiness for change, and observational learning with reinforcement. This approach offers richer insight than single-theory models, positioning digital well-being as central to modern learning and equipping students to navigate digital challenges with resilience and balance.

Research Variables

The independent variable in this study is the integrated behavioral science intervention, which combines self-connection, cognitive-behavioral change, self-regulation, and collaborative problem-solving. The dependent variable is digital well-being, measured using validated scales across five dimensions: (1) online self-value recognition; (2) digital life purpose awareness; (3) digital situation management; (4) positive digital relationships; and (5) dedication to digital potential development.

Objectives of the Study

The objectives of this mixed methods study are to investigate the impact of an integrated behavioral science intervention on undergraduate students' digital well-being. Qualitatively, the study explores perceptions, behaviors, and institutional contexts through focus group interviews with faculty and students, and captures behavioral change and engagement via classroom and online observations. Quantitatively, the study examines changes in digital well-being scores across pre-intervention, post-intervention, and follow-up assessments, comparing outcomes between experimental and control groups to determine the effectiveness of the intervention. By integrating statistical analyses with thematic insights, the study aims to demonstrate both measurable improvements and lived experiences of digital well-being, thereby providing a comprehensive understanding of how psychological interventions can foster healthier digital practices in higher education.

Methods

Design

This study employed a mixed methods research (MMR) design (Creswell & Creswell, 2023), integrating qualitative and quantitative approaches to comprehensively examine digital well-being among undergraduate students. The research was conducted in two sequential phases: an initial qualitative exploration followed by a quantitative intervention study.

Sample/Participants

The study involved two groups of participants across qualitative and quantitative phases, selected from universities in Thailand's diverse higher education landscape. Thai universities, encompassing both public and private sectors, are recognized for their varied academic offerings and increasing integration of digital technologies in teaching and learning (Ministry of Higher Education, Science, Research and Innovation, 2021, pp. 87–88). This diversity provided a robust context for exploring digital well-being among undergraduates and faculty.

In the qualitative phase, 30 participants were purposively sampled from five universities representing both public and private institutions. The sample comprised 15 faculty members with experience in technology-enhanced or online teaching and 15 undergraduate students from a range of disciplines, ensuring gender balance and active digital engagement. All participants were enrolled during the study period, had no prior formal training in digital well-being, and provided informed consent. Thematic analysis of focus group discussions identified five key dimensions of digital well-being, which subsequently informed the development of study instruments and intervention design.

For the quantitative phase, 60 undergraduates enrolled in the first semester of 2024 participated. A sample size of 30 per group was determined through power analysis to detect medium effect sizes (Cohen's $d = 0.5$) with 95% confidence at $\alpha = .05$. Only students scoring at or below the 50th percentile on the Digital Well-Being Scale were eligible. Participants were then randomly assigned to either the experimental group ($n = 30$), which received the seven-step intervention program, or the control group ($n = 30$), which served as a waitlist control. The control group did not receive any psychological content or attention-matched activities during the study period but was offered access to the intervention after data collection.

The primary university site selected for this study is a prominent public institution in Thailand, known for its comprehensive academic programs and strong emphasis on the arts, humanities, and social sciences. Its diverse student population and active engagement with digital technologies made it a representative setting for examining digital well-being in Thai higher education.

Procedures

This study employed a mixed-methods experimental design to develop, implement, and evaluate an intervention for enhancing digital well-being among undergraduates. Phase 1 began with a literature review to identify gaps and establish a theoretical foundation by integrating self-determination theory (Ryan &

Deci, 2000), the transtheoretical model (Prochaska & DiClemente, 1983), and social cognitive theory (Bandura, 1986), along with recent multidimensional perspectives (Vanden Abeele, 2021). Focus groups and interviews with 30 participants (15 faculty, 15 undergraduates) explored perceptions, behaviors, and institutional contexts, with thematic analysis revealing five core dimensions. In Phase 2, these insights guided the development and validation of a digital well-being assessment instrument tailored for undergraduates. Phase 3 involved designing and implementing a seven-step behavioral science intervention aligned with the identified dimensions, delivered to 30 undergraduates over seven weeks through structured classroom sessions and online modules (see Table 1). During Phase 4, quantitative data were collected at pre-, post-, and four-week follow-up using the validated scale, while qualitative data were gathered through classroom and online observations and post-intervention reflections. This sequential mixed methods approach enabled a comprehensive evaluation of the intervention's effectiveness and impact.

Table 1

Seven-Step Behavioral Science Intervention Integrated into a Seven-Week Undergraduate Course to Enhance Digital Well-Being

Step	Key activities	Expected behavioral outcomes
1. Motivation and readiness	Class discussion of digital challenges; self-assessment; case studies; peer sharing	Awareness of digital habits; motivation to change; recognition of personal challenges
2. Self-study and assessment	Analyze personal digital use; set goals; select strategies; present plans online	Goal setting; adoption of feasible strategies; accountability through peer/instructor feedback
3. Learning digital well-being	Explore online resources; exchange ideas in groups; refine personal action plans	Deeper understanding of digital well-being; improved planning; collaborative learning
4. Goal setting and planning	Present progress; discuss problems; revise plans; receive encouragement	Strengthened self-efficacy; constructive problem solving; reinforced positive behaviors
5. Monitoring and support	Reflect on emotional/social/physical outcomes; evaluate strategies; share progress	Enhanced self-regulation; satisfaction with behavior change; peer support
6. Awareness and reflection	Evaluate goal achievement; analyze obstacles; group discussion; celebrate success	Greater self-awareness; resilience; recognition of progress
7. Evaluation and satisfaction	Reflect on acceptance and satisfaction; summarize changes; self-reflection	Internalization of digital well-being practices; sustained motivation; integration into daily life

The intervention was designed as a structured, seven-step behavioral science program, with each step systematically addressing a core dimension of digital well-being identified in the qualitative phase. This stepwise approach is grounded in behavioral science theory, which shows that breaking down complex behaviors into manageable, sequential steps supports learning, motivation, and habit formation (Bandura, 1986; Prochaska & DiClemente, 1983; Ryan & Deci, 2000). The seven-week program combined in-class sessions, online modules, and structured tasks in Google Classroom to provide participants with regular opportunities to practice, monitor, and reinforce healthier digital behaviors. This design aims to foster lasting change by integrating reflection, feedback, and skill application throughout the intervention.

Research Instruments

Qualitative instrument: two qualitative instruments were employed: a focus group interview guide and a behavior observation form. The interview guide, informed by prior studies (Ryan & Deci, 2017;

Vanden Abeele, 2021), was used with 30 participants (15 faculty, 15 students) to explore digital well-being perceptions, behaviors, and contexts in Thai higher education. Semi-structured questions addressed motivations for technology use, screen time regulation, online collaboration, coping with negative experiences, and balancing digital engagement. Pilot testing and thematic analysis confirmed five core dimensions: online self-value recognition, digital life purpose awareness, digital situation management, positive digital relationships, and dedication to digital potential development.

During the intervention, the behavior observation form captured engagement indicators such as self-connection, cognitive-behavioral change, self-regulation, and collaborative problem solving. Online observation via Google Classroom tracked participation and group activities. Behaviors were documented using structured checklists and open-ended notes, and coding was conducted systematically. Instrument validation was achieved through expert review by specialists in educational psychology.

Quantitative instrument: the digital well-being scale for undergraduate students, developed in Phase 2, served as the main quantitative instrument and was administered at pre-, post-, and follow-up assessments. It included a demographic questionnaire and 30 items across five dimensions derived from literature and qualitative findings. Expert review and pilot testing with 50 students refined item clarity. Internal consistency was strong (Cronbach's $\alpha = .89$ overall, $.78-.85$ across subscales), supporting reliability for Thai undergraduates.

Triangulation: Quantitative and qualitative instruments were integrated to cross-verify results, enhancing reliability and interpretive depth. The digital well-being scale measured changes across five dimensions, while behavioral observations captured how improvements manifested in practice. This methodological triangulation provided a more comprehensive understanding of the intervention's impact.

Data Collection

Data collection was conducted in three sequential stages, consistent with the mixed-methods approach. First, focus group interviews with 30 participants (15 faculty members and 15 undergraduates) explored perceptions, behaviors, and institutional contexts related to digital well-being. Thematic analysis identified five core dimensions—online self-value recognition, digital life purpose awareness, digital situation management, positive digital relationships, and dedication to digital potential development—which provided the conceptual foundation for instrument development and intervention design.

Building on these findings, the digital well-being scale for undergraduate students was developed and validated, and the intervention was implemented with an experimental group of 30 undergraduates over seven weeks. Quantitative data were collected at three time points (pre-intervention, post-intervention, and four-week follow-up) to capture both immediate and sustained effects. To minimize treatment leakage, experimental and control groups were scheduled separately, instructed not to share materials, and had resources distributed only during sessions and collected afterward. The control group, serving as a waitlist control, did not receive psychological content during the study period and participated only in assessment sessions.

Complementing these quantitative measures, qualitative data were gathered during implementation through structured classroom observations across seven intervention sessions. Observation forms documented behaviors related to self-connection, cognitive-behavioral change, self-regulation, and collaborative problem-solving, while online monitoring via Google Classroom enriched the dataset by capturing students' written responses, comments, and questions through a tailored digital interaction form. Additionally, qualitative reflections were collected immediately following the completion of the seven-week intervention, and ongoing observations during the program. This approach ensured that participant experiences and perceived changes were captured both in real time and in the post-intervention period.

Data Analysis and Integration

Qualitative data from focus group interviews with 15 faculty members and 15 undergraduates were thematically analyzed, yielding five dimensions of digital well-being: online self-value recognition, digital

life purpose awareness, digital situation management, positive digital relationships, and dedication to digital potential development. These dimensions provided the conceptual foundation for instrument development and intervention design. Quantitative data from the digital well-being scale for undergraduate students were then analyzed using repeated measures ANOVA to examine main and interaction effects across groups and time points (pre-intervention, post-intervention, and follow-up). Statistical significance and effect sizes were assessed for both overall well-being and the five dimensions to determine immediate and sustained intervention outcomes.

Complementing these analyses, classroom and online observations were thematically examined to identify patterns of engagement and behavioral change. Integration followed a convergent mixed-methods design (Creswell & Plano Clark, 2017), employing methodological triangulation to cross-validate quantitative outcomes with qualitative insights. This approach ensured that statistical improvements were interpreted alongside observed behaviors, thereby enhancing validity and providing a comprehensive understanding of intervention effectiveness.

Results

The following section summarizes key findings aligned with the study's three research objectives. Qualitative results from focus groups and interviews informed the intervention framework, while quantitative and qualitative analyses evaluated the effectiveness of the program and compared outcomes between experimental and control groups across all assessment points.

Qualitative Phase Results: Holistic Perceptions of Digital Well-Being

Qualitative data showed that faculty and undergraduates view digital well-being as holistic and dynamic, emphasizing self-awareness, purposeful technology use, effective management of online behaviors, and positive digital relationships. Both groups highlighted the importance of ongoing digital skill development and maximizing positive online opportunities. Many participants noted that maintaining balance online requires active self-regulation and support from peers. This perspective underscores the role of reflection, collaboration, and adaptability in sustaining digital well-being. Collectively, these insights reflect an understanding that digital well-being integrates personal growth, self-regulation, social connection, and continuous skill development.

Analysis of focus group and interview data further revealed that students from five Thai universities developed heightened awareness of their digital habits and the challenges of balancing online engagement with well-being. One participant reflected, "I didn't realize how much scrolling was affecting my sleep until I tracked it." Another expressed anxiety about online self-identity, noting, "I feel pressured to present a perfect version of myself, and it makes me question who I really am." These narratives emphasized motivations, coping strategies, and everyday practices of digital engagement, highlighting lived changes in self-connection, regulation, and awareness. Faculty perspectives reinforced these findings, with one noting that "students need to enhance digital well-being practices within the classroom to sustain healthier online behaviors."

Quantitative Phase Results: Experimental vs. Control Group Design

In the quantitative phase, the sample consisted of 60 undergraduate students, all scoring at or below the 50th percentile in digital well-being. They were divided into two groups: 30 students in the experimental group (20 female, 10 male) and 30 students (15 female, 15 male) in the control group.

Assumption testing confirmed that digital well-being scores met normality criteria (Shapiro-Wilk, $p > .05$). Mauchly's Test of Sphericity indicated compound symmetry for overall scores and some dimensions, while three dimensions violated sphericity. For these, the Greenhouse-Geisser correction was applied, as reflected in decimal degrees of freedom. These adjustments ensured the validity of repeated measures ANOVA results.

Table 2*Repeated Measures ANOVA Results for Digital Well-Being Dimensions (Experimental Group, $n = 30$)*

Variable	SS	df	MS	F	p	η^2_p	d
Online self-value recognition	7.27	1.65	4.41	37.63	.001	0.49	0.97
Digital life purpose awareness	11.80	1.22	9.69	43.93	.001	0.42	0.85
Digital situation management	8.21	1.69	4.85	28.72	.001	0.35	0.74
Positive digital relationships	5.89	1.79	3.29	38.94	.001	0.43	0.87
Dedication to digital potential development	12.91	1.67	7.74	58.57	.001	0.51	1.01
Total across five dimensions	7.27	1.70	4.27	110.37	.001	0.66	1.38

Note. Greenhouse–Geisser corrections were applied where sphericity was violated. All effects were significant at $p < .001$.

Repeated measures ANOVA revealed significant improvements across all five digital well-being dimensions in the experimental group ($n = 30$). Large effect sizes were observed, with partial eta squared values ranging from .35 to .66 and Cohen's d between 0.74 and 1.38, indicating strong practical significance. The most pronounced gains were in dedication to digital potential development ($F = 58.57$, $\eta^2_p = .51$, $d = 1.01$) and overall digital well-being ($F = 110.37$, $\eta^2_p = .66$, $d = 1.38$). All effects remained significant after Greenhouse–Geisser corrections ($p < .001$), underscoring the robustness of the intervention's impact.

To further validate Hypothesis 1, Bonferroni post hoc comparisons across pre-test, post-test, and follow-up assessments confirmed that mean scores for overall digital well-being and each dimension were significantly higher at post-test and follow-up compared to pre-test ($p < .001$). Mean scores in the experimental group increased by 15–22% from baseline, whereas the control group showed negligible or declining outcomes. Most dimensions showed no significant differences between post-test and follow-up, indicating sustained improvements. Two exceptions emerged: online self-value recognition declined slightly from post-test ($M = 4.01$) to follow-up ($M = 3.78$), though both remained significantly higher than pre-test ($M = 3.31$); and dedication to digital potential development increased further at follow-up ($M = 4.23$) compared to post-test ($M = 3.96$), reflecting continued growth beyond the intervention period. Taken together, these results reinforce ANOVA findings and confirm that the intervention produced statistically significant and sustained improvements in digital well-being, with nuanced patterns of change over time.

Quantitative Phase Results: Group Comparisons Across Time

Descriptive statistics indicated that the experimental group began with moderate overall digital well-being scores ($M = 3.37$, $SD = 0.21$), which rose to a high level after the intervention ($M = 4.02$, $SD = 0.31$) and remained high at follow-up ($M = 3.91$, $SD = 0.23$), reflecting sustained improvement. In contrast, the control group's scores remained moderate throughout ($M = 3.27$ – 3.33) with no notable change. Dimension-level analyses showed that all aspects of digital well-being improved to high levels in the experimental group, with the strongest gains in commitment to growth ($M = 4.22$, $SD = 0.39$) at follow-up, while the control group remained stable or slightly declined.

Table 3*Repeated Measures ANOVA for Digital Well-Being Dimensions: Effects of Group, Time, and Group $\times$ Time*

Variable	Groups $F(p)$	Time $F(p)$	Group $\times$ Time $F(p)$
Online self-value recognition	59.70 ($< .001$)	11.36 ($< .001$)	28.53 ($< .001$)
Digital life purpose awareness	35.40 ($< .001$)	21.14 ($< .001$)	8.97 ($< .001$)
Digital situation management	98.84 ($< .001$)	9.90 ($< .001$)	20.45 ($< .001$)
Positive digital relationships	71.64 ($< .001$)	14.19 ($< .001$)	20.85 ($< .001$)
Dedication to digital potential development	45.37 ($< .001$)	20.12 ($< .001$)	40.81 ($< .001$)
Total across five dimensions	92.40 ($< .001$)	41.46 ($< .001$)	72.49 ($< .001$)

Note. All effects were significant at $p < .001$.

Repeated measures ANOVA (Table 3) supported H2, revealing significant main effects of group and time, as well as group $\times$ time interactions across all five dimensions and the total score ($p < .001$). The experimental group demonstrated greater improvements over time than the control group, with the strongest effects in digital situation management and the overall total score. Bonferroni post-hoc comparisons confirmed no significant differences between groups at pre-test, but clear differences emerged at post-test and follow-up, pinpointing where gains occurred and validating Hypotheses 1 and 2. Together, these findings provide robust evidence that the intervention produced broad, consistent, and sustained enhancements in students' digital well-being.

Triangulation of Quantitative and Qualitative Research Results

Repeated-measures ANOVA confirmed significant improvements in digital well-being among the experimental group compared to the control group across all five dimensions and the total score ($p < .001$). These statistical outcomes were reinforced by student reflections and classroom observations. Students engaged actively with intervention activities, set personal digital goals, and adjusted behaviors to manage distractions, demonstrating intentional change.

Qualitative reflections, collected after the intervention, illustrated each dimension of digital well-being. For online self-value recognition, one student noted that "my identity in the online world is a reflection of my thoughts, dreams, and beliefs." Another described digital life purpose awareness: "online is a way to share; my daily goal is to create happiness." In terms of digital situation management, a participant emphasized, "you cannot control what others type, but you can control how you respond." Positive digital relationships were highlighted as "true online relationships begin with sincerity and mutual trust." Finally, dedication to digital potential development was expressed as "growth in the online world means seeking new knowledge and developing myself." Taken together, the convergence of quantitative outcomes, qualitative reflections, and observed behaviors validates the effectiveness of the seven-step intervention, showing that improvements were both statistically significant and meaningfully enacted in students' practices and goals.

Discussion and Conclusion

Discussion of Main Results

This section discusses the main findings in relation to the research objectives, demonstrating how the integrated behavioral science intervention enhanced digital well-being among undergraduates. The discussion addresses framework development, intervention effectiveness, and group comparisons, drawing on both quantitative and qualitative evidence to interpret results in the context of existing literature. Key limitations, implications for behavioral science and higher education practice, and directions for future research are also outlined to provide a comprehensive understanding of the study's contributions and practical significance.

This study first explored the perceptions, behaviors, and institutional contexts of digital well-being among faculty and undergraduate students. Thematic analysis of qualitative data revealed that digital well-being is perceived as a holistic construct, encompassing self-awareness, purpose-driven technology use, effective online situation management, positive digital relationships, and a commitment to ongoing digital skill development. These findings align with recent literature emphasizing the multidimensionality of digital well-being (Livingstone & Stoilova, 2021). Based on these insights, an integrated intervention framework was developed, drawing on the self-determination theory (Ryan & Deci, 2000), the transtheoretical model (Prochaska & DiClemente, 1983), and social cognitive theory (Bandura, 1986). Each step of the seven-step intervention translated theory into practice, fostering self-connection, cognitive reframing, self-regulation, collaborative problem-solving, goal setting, feedback, and sustained behavioral change.

The effectiveness of the intervention was evaluated using both quantitative and qualitative data, in line with Hypothesis 1. Repeated measures analyses of variance (ANOVA) showed that students in the experimental group reported significant and sustained improvements across all five dimensions of digital

well-being—self-value recognition, life purpose awareness, situation management, positive digital relationships, and dedication to digital potential development—with medium to large effect sizes ($p < .001$). These quantitative gains were complemented by qualitative reflections and classroom observations, which illustrated how students internalized digital goals, managed distractions, and cultivated purposeful online engagement. These findings are consistent with previous research demonstrating the value of structured reflection, self-regulation, and collaborative practices in fostering digital resilience (Li et al., 2024).

In accordance with Hypothesis 2, comparative analyses revealed that improvements in digital well-being were significantly greater in the experimental group than in the control group at all assessment points. Although slight declines in self-value recognition and peer relationships were observed at follow-up, scores remained significantly higher than at pretest, indicating a positive residue effect. This underscores the importance of ongoing reinforcement mechanisms, such as peer-led initiatives, digital coaching platforms, or curriculum-embedded reflection tools, to sustain behavioral gains over time. (Hattie & Timperley, 2007; Zimmerman, 2002).

The convergence of quantitative and qualitative findings in this study demonstrates the robustness of the seven-step intervention in promoting digital well-being among undergraduates. By operationalizing three major behavioral science theories—self-determination theory, the transtheoretical model of change, and social cognitive theory—within a structured classroom context, the research extends previous work on theory-driven interventions (Livingstone & Stoilova, 2021) and responds to global calls for universities to prioritize holistic student development alongside academic achievement (Organisation for Economic Co-operation and Development [OECD], 2021). The observed improvements in digital well-being dimensions parallel international findings on the importance of self-regulation, reflection, and collaborative engagement in technology-rich educational settings (Li et al., 2024).

Taken together, these results validate both Hypotheses 1 and 2, demonstrating that the integrated behavioral science intervention produced broad and sustained improvements in digital well-being among undergraduates. The alignment between statistical analyses and lived experiences highlights the intervention's practical relevance and potential for scalability in higher education contexts.

Limitations

Several limitations must be acknowledged. First, the relatively small sample size limits the generalizability of the findings and raises the risk of overestimating effect sizes. Second, the possibility of a Hawthorne Effect, that is, improvements resulting from participants' awareness of being observed rather than from the intervention content itself (McCarney et al., 2007), cannot be ruled out. Third, the follow-up relied mainly on reflection assignments without structured classroom reinforcement, which may explain the slight declines in self-value recognition and peer relationships. Fourth, some students set outcome-based rather than behavior-focused goals, which limited long-term engagement; as Ryan and Deci (2000) note, process-oriented goals are more effective for sustaining motivation and resilience. Finally, the study was conducted with undergraduates in a single institutional context, which may restrict generalizability across diverse cultural and educational settings.

Future research should therefore examine longer follow-up periods with structured reinforcement activities (e.g., ongoing reflection, peer mentoring, digital prompts), investigate interventions that train students to formulate behavior-focused goals, and conduct cross-cultural, multi-institutional studies to test adaptability. Mixed methods longitudinal designs are particularly recommended to capture both quantitative outcomes and qualitative experiences, thereby deepening understanding of how digital well-being evolves beyond the intervention period.

Implications for Behavioral Sciences

Strengthening students' digital well-being requires coordinated action across higher education, with instructors embedding the seven-step psychological strategy into teaching through reflection, goal setting, and collaboration. Curricula in technology-intensive fields such as computer engineering, IT, multimedia, and educational technology should explicitly include digital well-being outcomes, while non-technology

disciplines must also adopt adaptive strategies (OECD, 2021). Institutional psychologists can expand their roles by monitoring and counseling students on stress, anxiety, or depression linked to digital environments and advising faculty on behavioral science integration (Vanden Abeele, 2021). Administrators should establish ethical guidelines, set limits on excessive exposure, and provide faculty development initiatives to balance technology use with well-being (Diener et al., 1999). At the national level, ministries and policy bodies should promote cross-disciplinary frameworks, encourage multi-institutional research, and fund interventions that integrate psychological theory with practical strategies. Collectively, these measures embed digital well-being as a systemic priority, fostering resilience, healthy digital habits, and long-term success in increasingly digital learning environments.

Conclusion

This study demonstrated that a theory-driven, seven-step behavioral science intervention can enhance digital well-being among Thai undergraduates. Grounded in self-determination theory, the transtheoretical model, and social cognitive theory, the program translated psychological principles into structured classroom practice that fostered resilience, purposeful technology use, and self-regulation. Both qualitative and observational findings revealed meaningful, sustained improvements in students' digital behaviors and attitudes, illustrating how intentional, evidence-based interventions can support holistic student development. The research provides higher education institutions with a practical framework for integrating behavioral science into curricula, while also highlighting the ongoing need for reinforcement strategies to sustain gains over time. Overall, these findings affirm the value and adaptability of structured, theory-based approaches for promoting digital well-being in diverse educational contexts.

Declarations

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Conflicts of Interest: The authors declare no conflicts of interest.

Ethical Approval Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Human Research Ethics Committee of Kasem Bundit University (Certification No. T014/67P, dated August 2, 2024) for studies involving humans.

Declaration of Generative AI: During the preparation of this work, the authors used Microsoft Copilot (version available in 2024–2025) to assist with language refinement and formatting. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the final manuscript.

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