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Low-Cognitive-Load Games as Attentional Support: A Scoping Review for Gen Z Learners

Abstract

In an era of constant digital multitasking, Generation Z learners struggle to maintain attention and memory during study and lecture-based learning. Although heavy social media use and technology-driven distractions are linked to poorer academic outcomes, emerging evidence suggests that low-cognitive-load digital activities – such as casual games, electronic fidgets, and brief micro-breaks – may help sustain engagement. This scoping review maps research published between 2010 and 2025 on digital micro-breaks, fidgeting tools, and other low-demand activities in learning and work contexts. Following PRISMA-ScR guidelines, 33 studies across 31 articles were identified through database searching and citation chaining. Evidence shows that short, low-effort, volitional activities can restore attentional resources, reduce fatigue, and improve affect without harming concurrent task performance, especially when compared with more demanding or externally imposed digital interruptions. Micro-break and recovery studies highlight

the benefits of brief restorative activities, while research on digital fidgets points to the self-regulatory value of rhythmic, repetitive interactions. Broader work on parallel digital activity emphasises that timing, context, and volition critically shape outcomes. Overall, findings suggest that purposefully designed low-cognitive-load games or tools may act as attentional supports, helping learners resist more disruptive cyberloafing. However, the literature remains fragmented, with inconsistent results for memory and limited research directly focused on educational settings. Future work should trial experimental prototypes of "mindless" mobile games for Gen Z learners, examining task type, timing, and individual differences to determine whether such interventions can enhance learning while mitigating distraction.

K e y w o r d s: attention and fatigue, digital micro-breaks, fidget tools, generation Z, low-cognitive-load activities

In an age of fragmented attention and information overload, maintaining focus and enhancing memory retention among younger learners has become a growing concern for educators, researchers, and designers of digital learning environments. This challenge is particularly salient for Generation Z – individuals born between the mid-1990s and early 2010s – who have grown up in a hyperconnected world of constant notifications, digital multitasking, and diverse media stimuli "from dusk to dawn" (Brosnan et al., 2025). The majority of students use electronic media either in class, while studying or while doing homework (Uncapher et al., 2017).

Research consistently shows that heavy social media use and digital multitasking are associated with poorer academic outcomes. Heavy social media use has been linked to lower academic performance among adolescents (Sampasa-Kanyinga et al., 2019), and multitasking behaviours such as texting in class (Ellis et al., 2010) or using multiple technologies while studying (Rosen et al., 2013) predict reduced task persistence and lower grades. Experimental work confirms that off-task technology use during lectures detracts from learning and cannot be offset by familiarity with such behaviours (Wood et al., 2012). Similarly, heavy media multitaskers tend to show reduced performance across a range of cognitive domains relative to light multitaskers (Uncapher et al., 2017).

Synthesising these findings, Van der Schuur et al. (2015) concluded that media multitasking is typically negatively related to academic outcomes, study behaviours, and perceived learning, though effects are often small to moderate and not always significant. They propose that multitasking may impair learning by displacing study time or taxing attentional resources. Extending this, Vedechkina and Borgonovi (2021) highlight that while cross-sectional studies often reveal negative associations, longitudinal evidence suggests weaker or absent effects, indicating that the relationship may be bidirectional and shaped by individual motivation and engagement rather than stable attentional deficits.

On the other hand, there is a tendency to integrate digital media use into formal education, a process globally fast-tracked by the Covid-19 pandemic in 2020-2022. Contemporary students seem to prefer learning through digital technologies, such as mobile applications, over more traditional methods (Szymkowiak et al., 2021). Besides technology integration, it is also important to include digital storytelling (Shorey et al., 2021). Game-based learning methods have gained increasing prominence. Generation Z prefers practical, career-focused, and personalized learning experiences that are structured, tech-integrated, and clearly connected to real-world outcomes. They value independence, mental health support, and social responsibility, but often need help with focus, digital literacy, and managing academic stress (Seemiller and Grace, 2016).

Research Problem

How to unite student preferences for digital media use with the need to minimize distractions for better academic performance as stipulated by cognitive load theory (Sweller et al., 1998)? Rigid application of the theory has been challenged by findings that affordances of digital learning such as detailed visuals or interactive responses induce some amount of "irrelevant cognitive load while still fostering learning outcomes" (Skulmowski & Xu, 2022). In this research we entertain the idea that certain types of low-cognitive-load digital activities – especially what we call "mindless" games – may paradoxically support sustained attention and improve the assimilation of auditory or passive learning content. Anecdotal evidence from educators and learners indicates that light interactivity during listening-based tasks – such as lectures or podcasts – can help prevent zoning out, reduce anxiety, and create subtle mnemonic anchors. However, formal research on this phenomenon is sparse and fragmented across multiple disciplines, including cognitive psychology, educational technology, human-computer interaction, and game studies.

In the present scoping literature review, we examine the potential cognitive and emotional functions of low-cognitive-load digital games and other digital activities when used in parallel with other tasks, such as passive learning, particularly in the context of Generation Z learners. By synthesizing cross-disciplinary evidence and identifying conceptual, methodological, and empirical gaps, this review serves as a foundation for the design of experimental pre-research and future intervention developments in the form of a low-cognitive-load ("mindless") mobile game that would replace other student cyberloafing activities and distractions during lectures, potentially anchoring their attention. To reiterate, this represents a distinct area of inquiry from the well-established research on the cognitive effects of video gaming, where strong evidence for broad skill enhancement beyond the specifically

trained tasks remains limited, suggesting a bidirectional link between gaming and cognition (Vedechkina & Borgonovi, 2021).

The scoping framework allows for a broad, exploratory investigation while enabling critical interpretation across multiple disciplines and media types. Following the structure proposed by Arksey and O'Malley (2005), updated by Peters et al., 2015) and adhering to PRISMA reporting standards (Tricco et al., 2018), the scoping review focuses on identifying, categorizing, and mapping existing literature and perspectives related to low-cognitive-load digital games or activities and their potential cognitive or emotional benefits in learning contexts. The research question guiding this review is: What types of digital games or activities with minimal cognitive demands have been associated with improved focus, memory retention, or sustained engagement during passive learning experiences – particularly among Generation Z?

Methodology of Research

Sources were included if they were published during 2010-2025, written in English, and with no limits on publication status. Given the limited volume of directly relevant empirical work, no exclusion was made based on study design or outcome reporting. The pilot search indicated that "low-cognitive-load" digital games or activities as an umbrella term needs to be specified. Therefore, sources that mentioned minimalist game designs, such as (hyper)casual, idle, incremental, background or ambient games (Alharthi et al., 2018) were included, together with electronic/digital fidgeting tools and micro-breaks with the use of technology.

Relevant documents were retrieved from Scopus, Web of Science, and Google Scholar, complemented by citation chaining (i.e., screening reference lists and forward citations) to capture studies not identified in the database search. The search strategy was drafted by one of the authors and refined through team discussion. The final search string combined terms for game types, related activities, and cognitive or behavioural outcomes using Boolean operators and truncation, as follows:

("idle game*" OR "incremental game*" OR "ambient game*" OR "ambient activit*" OR "hypercasual game*" OR "low-interactivity game*" OR "background play" OR "background game" OR "nonchallenging activit*" OR "low-cognitive-load" OR "low cognitive load" OR gameplay OR gaming OR "playing game*" OR fidget* OR "fidget device" OR micro-break* OR dual-tasking)

AND

(cognit* OR attention* OR behavior* OR focus OR memory OR engagement OR learning OR listening OR lecture OR "auditory learning" OR "lecture-based learning")

One reviewer screened the publications by sequentially evaluating the titles, abstracts and then the full texts of all publications identified by our searches for potentially relevant publications. All retrieved search results were exported and organised in a Google Sheet to facilitate screening and analysis. Challenging items were discussed with other reviewers. After discussion on the theme of fidgeting and fidget devices, results for fidgeting as (involuntary) body movement while not integrating with objects (Da Câmara et al., 2018) or non-electronic fidget devices were excluded from consideration due to the agreement that they bear only tangential relation to the research topic of digital low-cognitive activities. Instead, results of systematic reviews and metaanalyses of non-digital fidgeting are included in the introduction to the discussion of digital fidget results. In a similar manner, non-digital micro-break activities were excluded and digital interventions subjected to literature reviews were not considered eligible on their own. To further refine results, studies of micro-breaks with the use of technology outside of gaming or not explicitly regarded as low-cognitive load activity, such as attending to social media (Liu et al., 2021), were also excluded.

A data charting form was developed by one reviewer and subsequently evaluated by the team. The form was iteratively revised, primarily to include a category specifying the digital game or application used in the intervention – providing greater detail given the wide scope of digital media – and to remove the "setting" parameter, which was frequently unreported or ambiguously reported. One researcher performed the data charting, and the remaining team members verified the extracted data for accuracy. We extracted data on article characteristics (authors, year, location), research design, population, and sample size. We then charted the type of (digital) intervention, study purpose, outcome measures (where applicable), and key findings relevant to the review question. In cases where study aims were neither clearly nor concisely stated, we interpreted or simplified the information. Similarly, qualitative results were summarised to maintain clarity and brevity.

In Table 1, we categorised the studies into three groups according to their primary focus: (A) micro-breaks and recovery, (B) digital or electronic fidgets, and (C) other, e.g., the impact of interactive technology and video games on attention and learning outcomes. The qualitative text analysis was performed manually and with the assistance of ChatGPT-5 Pro. A descriptive format (Peters et al., 2015; Tricco et al., 2018) of narrative synthesis was used to summarise the types of settings, populations, and study designs for each group, along with the measures employed and the broad findings. This descriptive format was deemed most appropriate for the objectives of our review, particularly given the heterogeneity of study designs and the prevalence of non-quantitative or otherwise incompatible outcome measures. Finally, the results were integrated across all groups.

Results

A total of 2,776 records were identified through database searching, with an additional 26 records retrieved from citation chaining. After removing duplicates, 2,056 records were screened by title and abstract, resulting in the exclusion of 1,917 records. The full texts of 139 articles were assessed for eligibility, of which 108 were excluded for the following reasons: 11 articles were not retrievable, 93 did not address the research question, and four were part of literature reviews already included in the final dataset. This process resulted in 33 studies reported across 31 articles, as one article (Wu et al., 2025) included three relevant research studies (see Figure 1 for the PRISMA flow diagram).

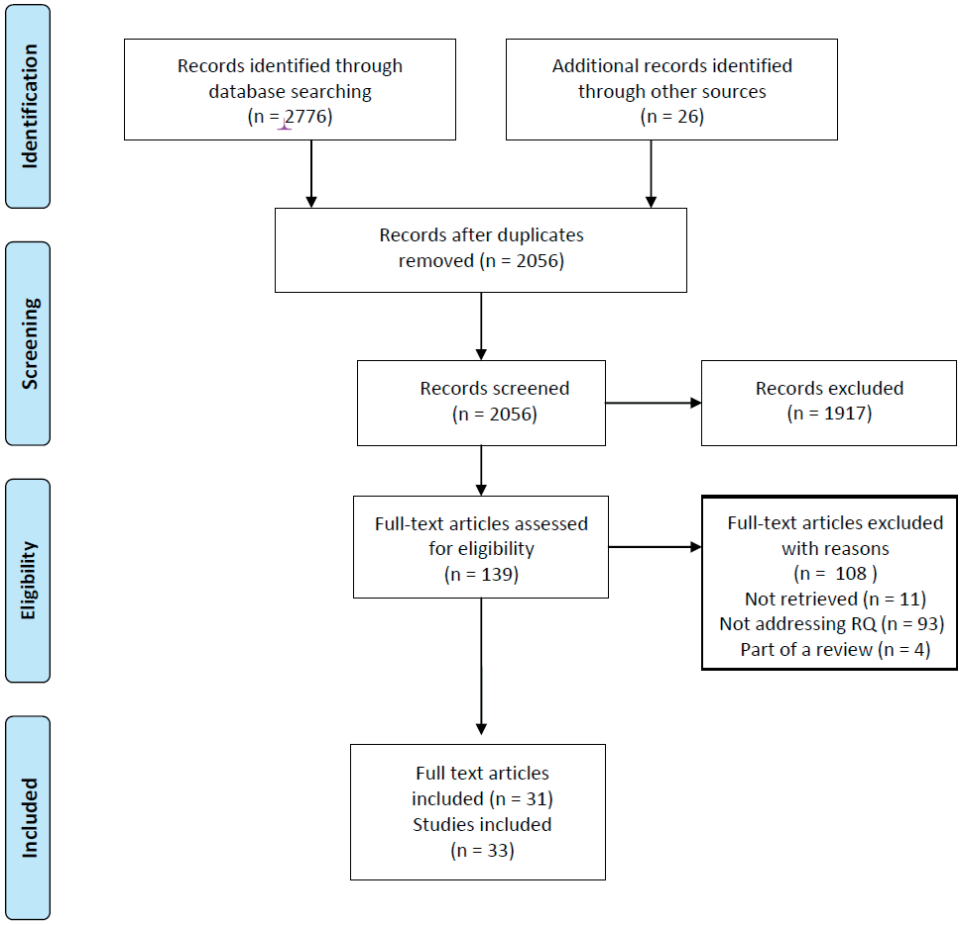

Figure 1. Flow diagram

S o u r c e: Own work.

The 33 studies included in this review were reported across 31 articles. Studies were conducted in multiple countries: eight in Europe (five in Germany), six in Asia (Japan and China), four in the USA, and one in New Zealand (Figure 2). A few intervention development studies and one experimental study did not specify a location. For literature reviews, this characteristic was considered not applicable. Most of the articles (24) have been published since 2020, demonstrating the growing interest in this topic. The included studies employed diverse designs (Figure 3), comprising 12 experimental studies (Burney & Sharp, 2025; Dianita et al., 2024; Dianita et al., 2025; Graben et al., 2022a, 2022b; Grobelny et al., 2024; Kitayama et al., 2023; Kuschpel et al., 2015; Liu et al., 2015; Liu et al., 2019; Wu et al., 2025), 10 intervention development studies (Da Câmara, 2022; Eichenlaub, 2022; Eichenlaub et al., 2023; Ji & Isbister, 2022; Karlesky & Isbister, 2014; Ross et al., 2023; Tancredi & Abrahamson, 2024; Torin, 2021; Williams et al., 2019; Zhang & Qin, 2021), seven literature reviews or meta-analyses (Albulescu et al., 2022; Barton et al., 2020; Gellmers & Yan, 2023; Jiang et al., 2023; Lyubykh et al., 2022; Perrigino et al., 2024; Sonnentag et al., 2022), two cross-sectional studies (Nalliah & Allareddy, 2014; Wu et al., 2025), one mixed-methods study (Rykard, 2020), and one qualitative study (Karlesky & Isbister, 2016). Sample sizes varied widely: experimental studies typically involved 30–100 participants, whereas intervention development studies often included fewer than 10 participants. Participants included university students (13 studies), office workers or working adults (four studies), high school students (one study), children (one study), and general adults with unspecified characteristics (six studies). One qualitative study did not report any demographic information.

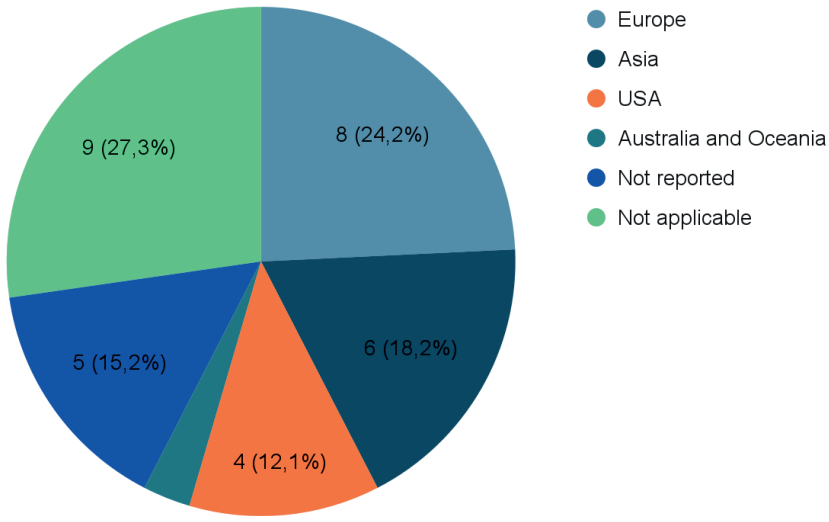

Figure 2. Study location distribution

S o u r c e: Own work.

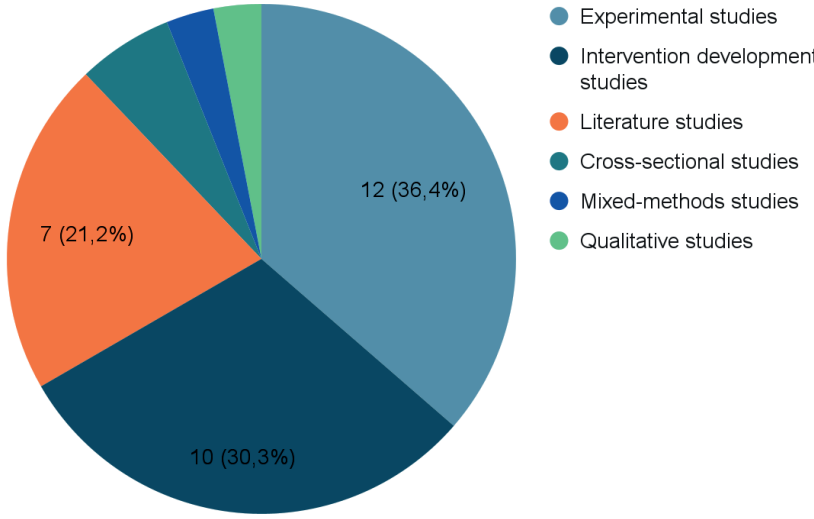

Figure 3. Study designs

S o u r c e: Own work.

The interventions and activities examined were diverse, encompassing casual video games (e.g., *Angry Birds*), screen-based micro-breaks, custom micro-games, fidgeting devices (e.g., *Fidget Widgets*, smart fidget prototypes), cyberloafing, and sensor-based interactive tools such as balance boards. Some studies focused on passive digital media consumption, while others involved active engagement with interactive applications or gamified tasks. The primary aim of most studies was to investigate the effects of brief digital or physical activities on attention, cognitive performance, engagement, well-being, or recovery. Literature reviews and meta-analyses sought to synthesise existing evidence on work breaks, recovery, and technology-mediated micro-interventions. Experimental studies predominantly combined behavioural tasks with self-report measures, with one including biological or physiological assessments, whereas intervention development studies primarily relied on self-reports. Overall, the included studies represented a wide methodological and intervention spectrum, offering insights into both experimental and applied contexts of micro-breaks, digital games, and fidgeting interventions across cognitive and behavioural outcomes. Key findings from each study are summarised separately in Table 1. The studies have been divided into three categories: micro-break and recovery studies, digital fidgeting studies and other technology use.

Table 1A
Micro-break and recovery studies

Authors (Year)	Important Results
S. Sonnentag, B. H. Cheng, S. L. Parker (2022)	Recovery activities like exercise, socialising, and low-effort tasks generally enhance well-being; high-duty tasks show opposite effects. Passive activities may be restorative depending on individual/work factors. Technology can support or hinder recovery; future work should explore application-based interventions.
Lyubykh et al. (2022)	Social media breaks have mixed effects; low-effort respite activities improve motivation, reduce exhaustion, and support well-being and task/contextual performance.
P. Albulescu et al. (2022)	Micro-breaks sustain vigour, reduce fatigue, and improve performance for clerical/creative tasks but not cognitively demanding ones; no negative effects reported; short breaks restore energy and focus, supporting learning.
J. Gellmers, N. Yan (2023)	Hedonic videos enhance positive affect and relaxation; eudaimonic videos foster gratitude and mastery; smartphone breaks increase vigour and reduce exhaustion; computer games promote detachment, relaxation, mastery, and control.
M. S. Kuschpel et al. (2015)	Active gaming during breaks negatively impacts working memory, increases mind wandering, and reduces concentration, taxing executive resources.
S. Liu et al. (2015)	Post-learning break activities affect memory retention differently; *Angry Birds* reduced auditory memory but improved visual memory compared to passive breaks.
S. Liu et al. (2019)	Video gaming decreased relaxation, increased heart rate, impaired working memory, and reduced SMA activation; different games affect cognitive functions differently.
K. Kitayama et al. (2023)	Micro-refresh (MR) is unlikely to reduce concentration; unclear if effects are due to MR or spontaneous breaks.
O. Dianita et al. (2024)	MB intervention stabilised performance across blocks; minor differences in subjective workload; three 20-second breaks had little effect on perceived symptoms.
O. Dianita et al. (2025)	Visual stimuli improved late-task performance, reduced fatigue, and enhanced detachment and relaxation; accuracy largely unaffected; productivity benefits observed.
Z. Zhang, L. Qin (2021)	Micro-games integrated into workflows reduce disruptions, act as rewards, gameplay should be low cognitive/physical effort, and support workflow without distraction.
Xuyao Wu, Qinghong Chen, Ye Li (2025)	Cyberloafing can reduce ego depletion variably; low-cognitive-load activities (music) are more restorative than high-load (shopping); benefits depend on prior ego depletion and timing.
J. Grobelny et al. (2024)	Social media breaks partially restore fatigue and vigour; nature-based breaks more effective; brief SM engagement aids detachment but limited relaxation/mastery benefits.
V. Burney, R. A. Sharp (2025)	Micro-breaks improve engagement, focus, enjoyment, and reduce stress/fatigue; preference for short, frequent breaks.

S o u r c e: Own work.

Table 1B
Digital fidgeting

Authors (Year)	Important Results
M. Karlesky, K. Isbister (2014)	*Fidget Widgets* support mindless and playful engagement; provide tactile, programmable, and bodily interaction; support daydreaming and overcoming mental blocks.
M. Karlesky, K. Isbister (2016)	Fidgeting supports self-regulation of creativity, focus, and calm; repetition and tactile movement central; short, mindless activities recommended around computing devices.
C. Ji, K. Isbister (2022)	Prototyped dynamic visualizations with audio to guide fidget gestures; aim to regulate undesired affective states via tapping interactions.
S. B. da Câmara (2022)	*Fidgetato* did not impair memory test performance; had no effect on metacognitive estimates; positive correlation between reports of attentional lapses and fidgeting frequency; design and selection matter.
J. A. Eichenlaub (2022)	Reflexive Focus Bounding (RFB) theory: fidgeting limits mind wandering and distraction; fidgeting reportedly regulates affect, anxiety, supports focus, attention, well-being; mindless fidgeting as an immediate, task-compatible intervention.
J. A. Eichenlaub, G. Huisman, H. Xue (2023)	*Fidget Knob* can replace distracting fidgeting; supports constructive mind wandering; interactive fidgets have both benefits and drawbacks; potential applications beyond HCI.
T. Torin (2021)	Fidgeting used during passive tasks supports emotion regulation without disrupting tasks; excessive focus can undermine regulation.
A. Williams et al. (2019)	Fidget conditions did not impair visual search; participants preferred fidgets, particularly the mobile haptic version; perceived and actual performance aligned.
S. Ross, N. Sullivan, J. Yoon (2023)	Virtual fidgets prevented 62.5% from switching to other sites; effectiveness varied; context-aware, interactive, visually appealing, but not distracting and easy to adopt designs recommended for lecture settings.
S. Tancredi, D. Abrahamson (2024)	Stimming is regulatory, cognitive, social, and pedagogically valuable; intentional stimming supports problem-solving and interaction; design heuristics proposed for learning environments.

S o u r c e: Own work.

Table 1C
Other technology use

Authors (Year)	Important Results
A. C. Barton et al. (2020)	Certain video games and exergames can boost attention temporarily; casual games show limited restorative effects; short, practical sessions recommended; longitudinal studies needed.
H. Jiang, M. Siponen, A. Tsohou (2023)	PUTW effects on executive attention depend on cognitive load, arousal, timing, and frequency; low-load, low-arousal, between-task, appropriately-timed activities are optimal.

M. B. Perrigino et al. (2024)	Non-work technology use occurs for varied reasons; short, positive, distributed episodes enhance engagement; excessive use may be harmful; policy design recommended.
R. P. Nalliah, V. Allareddy (2014)	Distraction by devices did not affect learning outcomes; performance similar between “distracted” and “non-distracted” groups.
K. Graben, B. K. Doering, A. Barke (2022a)	Gaming app use did not reduce reading speed, test performance, or time; push notifications had no effect; cognitive similarity may explain lack of impact.
K. Graben, B. K. Doering, A. Barke (2022b)	Push notifications reduced learning performance; parallel game play without notifications did not impair performance; source of interruption matters.
K. S. Rykard (2020)	44% reported no negative impact from cyberslacking; some noted reduced concentration; others reported stress relief, reduced worry, or improved peer relations.

S o u r c e: Own work.

Discussion

This review explored what types of digital games or low-cognitive-demand activities are associated with improved focus, memory retention, or sustained engagement when performed in parallel with passive learning or work tasks, particularly among Generation Z. Across the three result groups – digital micro-breaks, digital fidgets, and other parallel technology use – findings point to nuanced effects that depend on activity design, cognitive load, and contextual factors such as timing, duration, and task similarity.

Micro-breaks and Recovery Activities

Evidence from micro-breaks research highlights their potential to sustain vigour, reduce fatigue, and restore attentional resources during cognitively lighter tasks, with generally positive effects on well-being and task performance (Albulescu et al., 2022; Lyubykh et al., 2022; Gellmers & Yan, 2023). Importantly, micro-breaks rarely impair performance, even if they do not enhance it (Albulescu et al., 2022; Kitayama et al., 2023). Yet, the nature of the break matters: leisure or nature-based breaks appear more restorative than smartphone or social media use (Grobelny et al., 2024; Sonnentag et al., 2022; Wu et al., 2025), while short humorous or meaningful video clips can improve affective states and support recovery (Gellmers & Yan, 2023). Untaxing digital visual stimuli were shown to stabilise work performance over time, reduce fatigue, and enhance detachment

and relaxation (Dianita et al., 2024, 2025). Experimental studies suggest a double edge to gaming as a break activity. While minimalist game designs may promote detachment and relaxation (Zhang & Qin, 2021), casual games can also tax executive resources, impairing working memory or long-term recall when cognitively demanding or arousing features are present (Liu et al., 2015; Kuschpel et al., 2015; Liu et al., 2019). These findings underscore the importance of low cognitive demand and low arousal in selecting micro-break activities, aligning with cognitive load and resource allocation theories (Kuschpel et al., 2015; Wu et al., 2025). From an educational perspective, programmed short breaks during online lectures appear particularly beneficial, enhancing concentration, reducing fatigue, and sustaining engagement (Burney & Sharp, 2025).

Digital Fidgets and Stimming-Inspired Interventions

Reviews of fidgeting and use of fidget toys generally do not support their implementation in the classroom (Kriescher et al., 2023), concluding that their benefits for improving academic results and behaviour are negligible, if not negative overall (Schoenen et al., 2025). Different fidget devices may have wildly different effects (Schoenen et al., 2024). Research on digital fidgets such as *Fidgetato* indicates that repetitive, low-effort interactions – whether tactile, haptic, or visual – can support self-regulation, attention, and emotional balance without impairing concurrent task performance (Da Câmara, 2022; Eichenlaub, 2022; Karlesky & Isbister, 2014; 2016; Torin, 2021; Williams et al., 2019). Unlike social media or gaming breaks, fidgets are not designed to capture prolonged attention, but instead provide mindless, rhythmic, or sensory input that helps regulate arousal. This has been observed both in physical fidgets (e.g., *Fidget Knob*, Eichenlaub et al., 2023) and in virtual ones (Ross et al., 2023), which can act as intermediary distractions that prevent more disruptive task-switching (e.g., to social media). Da Câmara et al. (2018) found that fidgeting through pressing, clicking, or tapping was linked to engagement in cognitive tasks, including studying, homework, and focused learning in children. Building on this, Ji & Isbister (2022) prototyped swiping and tapping interactions with AR glasses to guide users from undesired affective states. If similar effects really extend to the student age cohort, a mobile game incorporating simple, repetitive tapping inputs could serve precisely this regulatory function, providing brief, low-effort engagement that mitigates more disruptive task-switching. Importantly, design plays a critical role: purpose-built fidgets that are context-aware, minimally intrusive, and integrated with the learning environment show promise in sustaining focus (Ross et al., 2023). Emerging stimming-inspired interventions (Tancredi & Abrahamson, 2024) expand this logic, positioning sensorimotor activity not merely as distraction management but as an epistemic and regulatory tool. This reframing suggests that digital fidgets may

not only preserve attentional resources but actively enrich cognitive engagement, especially when legitimised as part of learning or work practices.

Other Parallel Digital(ised) Activities

The broader literature on parallel digital activities paints a mixed picture. On one hand, low-demand, passive activities such as browsing or watching short videos can restore attentional resources, relieve stress, and prevent overload (Jiang et al., 2023; Rykard, 2020; Perrigino et al., 2024). Even certain video games as an off-task activity were shown to restore attention temporarily (Barton et al., 2020). On the other, externally triggered interruptions, such as push notifications, consistently impair learning outcomes – even when the associated activity is simple or low in cognitive load (Graben et al., 2022b). This distinction highlights the importance of volitional vs. imposed activity: self-initiated micro-engagements may replenish resources, while involuntary disruptions undermine attentional control. Notably, some studies report no measurable performance loss despite self-reported distraction (Nalliah & Allareddy, 2014; Graben et al., 2022a), suggesting that subjective perceptions of distraction do not always align with learning outcomes. Together, these findings suggest that parallel activities are most adaptive when self-chosen, brief, and low in both cognitive load and arousal.

Integrating Across Groups

Taken together, the three strands of evidence converge on several design-relevant insights. First, low cognitive demand and rhythmic or repetitive qualities appear central to maintaining or restoring attentional resources. Digital fidgets and certain micro-breaks (e.g., brief visual stimuli, simple casual games) embody these features, whereas arousing or cognitively heavy activities (e.g., competitive gaming, online shopping) may hinder recovery. Students could use short, intermittent bursts of low-cognitive-load gameplay as a form of recovery from cognitively demanding lecture content with or without their teacher's approval. Second, context and timing matter: micro-breaks scheduled between tasks or during pauses support recovery more effectively than within-task diversions (Jiang et al., 2023), suggesting that unstructured playing would have a negative effect on the comprehension and retention of the material. Similarly, fidgets are most effective when designed to integrate with, rather than intrude upon, the primary task (Ross et al., 2023). Third, volition and intentionality play a crucial role. Self-initiated fidgeting or micro-breaks often aid regulation, while externally imposed interruptions (e.g., push notifications) disrupt attention and memory (Graben et al., 2022b). Finally, there is emerging evidence that these interventions may hold particular promise

for younger cohorts such as Generation Z, who both expect and navigate high levels of digital multitasking. However, the literature remains fragmented, with experimental findings on memory effects (e.g., Liu et al., 2015; Liu et al., 2019) suggesting caution in assuming universally positive outcomes.

Implications and Future Directions

For designers and educators, the findings suggest prioritising digital fidgets and micro-break activities that are low in cognitive load, minimally intrusive, and context-aware. Future work should systematically compare digital fidgets, micro-breaks, and other parallel activities across different learning settings, particularly in Generation Z populations who frequently combine media and study. Longitudinal and mixed-method approaches are needed to clarify whether benefits are immediate, sustained, or contingent on task type (Barton et al., 2020), and to explore the role of individual differences (e.g., susceptibility to distraction, preference for multimodal engagement).

Design Principles for Mindless Games

These findings can also guide the formulation of specific design principles for creating experimental "mindless" games in our subsequent study. The following design implications are particularly relevant for learning contexts:

- Use continuous, rhythmic loops that run without player choices; avoid goals, scores, timers, streaks, levels, or branching. Keep loops incomplete to avoid triggering executive control.
- Treat the interaction as background cadence rather than as a secondary task.
- Ambient visuals; tactile if possible. Favour tactile over visual interaction during listening; if visual, keep muted, slow, predictable, minimal text/motion cues.
- Provide sound-off by default to avoid auditory masking, and keep haptics subtle and adjustable.
- Target low-to-moderate arousal: no competitive pressure, avoid abrupt salience (flashes, notifications, reward pops).
- Offer very short micro-doses (in the order of tens of seconds to ~1–2 min) to restore vigour and reduce fatigue without harming performance.
- Accessibility for Gen Z contexts: make the anchor instantly available; keep controls immediate and one-handed; enable quick start, pause/resume; maintain device-agnostic access, no sign-ups.

Conclusion

This review highlights that low-cognitive-load digital activities, particularly micro-breaks and digital fidgets, can support attentional recovery, reduce fatigue, and sustain engagement when paired with learning or work tasks. Evidence suggests that restorative effects depend on activity design, timing, and user volition, with self-initiated, brief, and minimally intrusive activities proving most beneficial. Digital fidgets and simple, rhythmic interactions appear especially promising compared to cognitively demanding or externally imposed activities such as competitive gaming or push notifications. While these strategies may be particularly well suited to Generation Z learners, findings remain fragmented, and caution is warranted regarding potential memory costs. Importantly, the review results also provide design implications for developing low-cognitive-load ("mindless") games as interventions to support focus and recovery in learning contexts, which will be further examined in future research.

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Gry o niskim obciążeniu poznawczym w kontekście uwagi: przeglądowe badanie w pokoleniu Z

Streszczenie

W erze ciągłego cyfrowego wielozadaniowości studenci pokolenia Z stoją przed wyjątkowymi wyzwaniami związanymi z utrzymaniem uwagi i pamięci podczas nauki i wykładów. Chociaż intensywne korzystanie z mediów społecznościowych i rozpraszające czynniki technologiczne wiążą się z gorszymi wynikami w nauce, nowe dowody wskazują, że cyfrowe działania o niskim obciążeniu poznawczym, takie jak tzw. gry casualowe, elektroniczne gadżety i krótkie mikroprzerwy, mogą paradoksalnie pomóc w utrzymaniu uwagi. Niniejszy przegląd mapuje i syntetyzuje badania opublikowane w latach 2010–2025 dotyczące cyfrowych mikroprzerw, gadżetów i innych czynności o niskim poziomie trudności w kontekście nauki i pracy. Zgodnie z wytycznymi PRISMA-ScR, na podstawie wyszukiwania w bazach danych i łańcuchowania cytowań zidentyfikowano 33 badania w 31 artykułach. Dowody wskazują, że krótkie, mało wymagające i dobrowolne czynności mogą sprzyjać przywróceniu uwagi, zmniejszeniu zmęczenia i poprawie nastroju bez wpływu na wykonywanie zadań równoległych, zwłaszcza w porównaniu z bardziej wymagającymi poznawczo lub wymuszonymi z zewnątrz cyfrowymi przerwami. Wyniki badań dotyczących mikroprzerw i regeneracji podkreślają korzyści płynące z krótkich czynności regeneracyjnych, natomiast badania dotyczące cyfrowych fidgetów wskazują na potencjał rytmicznych, powtarzających się interakcji w zakresie samoregulacji. Szersza literatura dotycząca równoległych działań cyfrowych podkreśla znaczenie czasu, kontekstu i wysiłku woli w określaniu wyników. Podsumowując, wyniki te sugerują, że celowo zaprojektowane gry lub narzędzia o niskim obciążeniu poznawczym mogą wspierać koncentrację uwagi i pomagać studentom opierać się bardziej rozpraszającym formom cyber-lenistwa.. Literatura

pozostaje jednak fragmentaryczna, z niespójnymi wynikami dotyczącymi pamięci i ograniczonymi badaniami skupiającymi się bezpośrednio na kontekstach edukacyjnych. W przyszłych pracach należy przetestować eksperymentalne prototypy „bezmyślnych" gier mobilnych dla uczniów z pokolenia Z, kładąc nacisk na rodzaj zadania, czas i indywidualne różnice, aby ustalić, czy takie interwencje mogą poprawić naukę, a jednocześnie zmniejszyć rozproszenie uwagi.

S ł o w a k l u c z o w e: uwaga i zmęczenie, cyfrowe mikroprzerwy, narzędzia rozpraszające uwagę, pokolenie Z, czynności o niskim obciążeniu poznawczym

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Juegos con baja carga cognitiva en el contexto de la atención: estudio general en la generación Z

R e s u m e n

En la era de la multitarea digital constante, los estudiantes de la generación Z se enfrentan a retos únicos para mantener la atención y la memoria durante el estudio y la enseñanza magistral. Aunque el uso intensivo de las redes sociales y las distracciones tecnológicas se asocian con peores resultados académicos, nuevas pruebas sugieren que las actividades digitales con baja carga cognitiva, como los juegos casuales, los fidgets electrónicos y los microdescansos breves, pueden, paradójicamente, ayudar a mantener la atención. Esta revisión recopila y sintetiza las investigaciones publicadas entre 2010 y 2025 sobre microdescansos digitales, juguetes electrónicos y otras actividades de baja exigencia en el contexto del estudio y el trabajo. De acuerdo con las directrices PRISMA-ScR, se identificaron 33 estudios en 31 artículos a partir de búsquedas en bases de datos y encadenamientos de citas. Las pruebas sugieren que las actividades breves, de baja intensidad y voluntarias pueden favorecer la recuperación de la atención, reducir la fatiga y mejorar el estado de ánimo sin afectar al rendimiento de las tareas simultáneas, especialmente en comparación con las interrupciones digitales más exigentes desde el punto de vista cognitivo o impuestas externamente. Los resultados de los estudios sobre microdescansos y recuperación destacan las ventajas de las actividades regenerativas breves, mientras que la investigación sobre los fidgets digitales señala el potencial de las interacciones rítmicas y repetitivas para la autorregulación. La bibliografía más amplia sobre actividades digitales paralelas destaca la importancia del momento, el contexto y el esfuerzo voluntario a la hora de determinar los resultados. En resumen, estos resultados sugieren que los juegos o herramientas diseñados intencionalmente con una baja carga cognitiva pueden servir para fomentar la atención y ayudar a los estudiantes a resistir formas más distractoras de cyberloafing. Sin embargo, la bibliografía sigue siendo fragmentada, con hallazgos inconsistentes sobre los resultados de la memoria y una investigación limitada centrada directamente en los contextos educativos. El trabajo futuro debería poner a prueba prototipos experimentales de juegos móviles «sin pensar» para los estudiantes de la generación Z, haciendo hincapié en el tipo de tarea, la sincronización y las diferencias individuales, con el fin de determinar si este tipo de intervenciones pueden mejorar el aprendizaje y, al mismo tiempo, mitigar las distracciones.

P a l a b r a s c l a v e: atención y fatiga, microdescansos digitales, herramientas de distracción, generación Z, actividades de baja carga cognitiva

Low-Cognitive-Load Games as Attentional Support:A Scoping Review for Gen Z Learners

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Игры с низкой когнитивной нагрузкой в контексте внимания: обзорное исследование поколения Z

Аннотация

В эпоху постоянной цифровой многозадачности студенты поколения Z сталкиваются с уникальными вызовами в сохранении внимания и памяти в процессе обучения и лекционных занятий. Хотя интенсивное использование социальных медиа и технологические отвлекающие факторы связаны с более низкими академическими результатами, новые данные свидетельствуют о том, что цифровые активности с низкой когнитивной нагрузкой – такие как так называемые казуальные игры, электронные фиджеты и короткие микроперерывы – парадоксальным образом могут способствовать удержанию внимания. Данный обзор отражает и обобщает исследования, опубликованные в период с 2010 по 2025 год, посвящённые цифровым микроперерывам, фиджетам и другим видам деятельности низкой сложности в контексте обучения и работы. В соответствии с рекомендациями PRISMA-ScR на основе поиска в базах данных и анализа цепочек цитирования были идентифицированы 33 исследования в 31 публикации. Полученные данные указывают на то, что краткие, малозатратные и добровольные активности могут способствовать восстановлению внимания, снижению утомляемости и улучшению настроения, не ухудшая выполнение параллельных задач, особенно по сравнению с когнитивно более требовательными или внешне навязанными цифровыми перерывами. Результаты исследований микроперерывов и восстановления подчёркивают преимущества кратких регенеративных активностей, тогда как работы, посвящённые цифровым фиджетам, указывают на потенциал ритмичных, повторяющихся взаимодействий для саморегуляции. Более широкая литература о параллельных цифровых активностях подчёркивает важность времени, контекста и волевых усилий в определении исходов. В совокупности эти результаты свидетельствуют о том, что специально разработанные игры или инструменты с низкой когнитивной нагрузкой могут служить «якорями внимания», помогая студентам противостоять более отвлекающим формам киберлофинга. В то же время литература остаётся фрагментированной, с непоследовательными выводами относительно эффектов на память и ограниченным числом исследований, непосредственно ориентированных на образовательные контексты. Будущие исследования должны протестировать экспериментальные прототипы «бездумных» мобильных игр для студентов поколения Z с акцентом на тип задания, тайминг и индивидуальные различия, чтобы определить, способны ли такие вмешательства улучшать обучение, одновременно снижая уровень отвлечения.

Ключевые слова: внимание и утомляемость, цифровые микроперерывы, инструменты отвлечения внимания, поколение Z, активности с низкой когнитивной нагрузкой