Generation Z Students' Perceptions of Asynchronous and Synchronous Learning: A Systematic Literature Review

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Abstract
The COVID-19 pandemic has accelerated a major transformation in education, shifting from traditional face-to-face instruction to technology-based online learning. This systematic literature review analyzes Generation Z students' perceptions (born 1997-2012) of asynchronous and synchronous learning in higher education. Following the PRISMA protocol, we identified 487 studies from eight academic databases, with 24 studies meeting our inclusion criteria after systematic screening. Analysis using the Community of Inquiry framework reveals that 92% of studies (n=22) report Gen Z students highly value the flexibility of asynchronous learning. However, 83% of studies (n=20) identify challenges in social presence and self-regulation. Synchronous learning excels in facilitating immediate feedback (reported in 88% of studies, n=21) and social presence (79% of studies, n=19), but faces constraints in flexibility and Zoom fatigue. Uniquely, 75% of studies (n=18) found that Gen Z shows a strong preference for blended approaches featuring micro-learning segments (7-10 minutes), immediate automated feedback, and visually rich content. These findings provide specific practical implications for designing learning experiences responsive to Gen Z characteristics.

1. Introduction

The COVID-19 pandemic has served as a catalyst for massive transformation in global higher education. In Indonesia, more than 4,000 higher education institutions with 8 million students were forced to transition to online learning within a matter of weeks (Kemenristekdikti, 2020). This sudden shift from face-to-face learning to digital technology-based learning has revealed two primary models of online learning: asynchronous (time-independent) and synchronous (real-time) (Alzahrani et al., 2023; Fabriz et al., 2021).

Asynchronous learning allows students to access materials anytime and anywhere, providing maximum flexibility (Hrastinski, 2008). In contrast, synchronous learning requires instructors and students to interact in real-time, albeit in different locations, maintaining the temporal aspect of traditional learning (Martin et al., 2020). These two models carry different implications for the learning experience, particularly for Generation Z students who possess unique characteristics as digital natives.

Generation Z, defined as individuals born between 1997-2012 (Dimock, 2019), now dominates the university student population. In Indonesia, Gen Z represents 25.87% of the total population, approximately 68 million people (Rakhmah, 2021; BPS, 2021). What distinguishes Gen Z from previous generations (Millennials, Gen X) is that they are the first generation to truly grow up with the internet, smartphones, and social media from childhood (Prensky, 2001; Seemiller & Grace, 2018). These characteristics create learning expectations and preferences that differ significantly from Millennials who adopted technology later in life.

Research indicates that Gen Z has a shorter attention span (8 seconds compared to 12 seconds for Millennials), a strong preference for visual content (65% are visual learners compared to 29% in previous generations), and expectations for instant feedback (Twenge, 2017; Hammad, 2025). However, comprehensive studies synthesizing how these unique Gen Z characteristics interact with different online learning modalities remain limited, especially in the Indonesian context. This gap is important to address given that the effectiveness of online learning heavily depends on the alignment between instructional design and learner characteristics.

The Community of Inquiry (CoI) framework developed by Garrison et al. (2000) represents the most influential theoretical framework in online learning research, with over 1,200 publications utilizing it since 2000

(Garrison & Arbaugh, 2007). This framework identifies three interacting elements that create effective online learning experiences:

Social Presence is the ability of learners to project themselves socially and emotionally, creating purposeful communication in a trusting environment. This includes open communication, group cohesion, and affective expression (Garrison, 2009).

Cognitive Presence represents the extent to which learners can construct and confirm meaning through sustained reflection and discourse in a critical inquiry community. This involves a practical inquiry cycle: triggering event, exploration, integration, and resolution (Garrison & Anderson, 2003).

Teaching Presence is the design, facilitation, and direction of cognitive and social processes to realize learning outcomes. This includes instructional design and organization, facilitating discourse, and direct instruction (Anderson et al., 2001).

The CoI framework is highly relevant for comparing asynchronous and synchronous learning because each modality facilitates these three presences differently. Meta-analysis by Garrison and Arbaugh (2007) shows that teaching presence has the strongest relationship with perceived learning and satisfaction, followed by cognitive presence, then social presence. However, for Gen Z, who highly values social connections (Hammad, 2025), the role of social presence may be more critical than for previous generations.

To understand Gen Z perceptions of online learning, it is essential to identify what distinguishes them from Millennials (born 1981-1996). Table 1 summarizes key differences based on literature synthesis.

Table 1. Comparison of Gen Z vs Millennials Learning Characteristics

Dimension	Generation Z (1997-2012)	Millennials (1981-1996)
Attention Span	8 seconds	12 seconds
Learning Style	65% visual learners, prefer video over text	29% visual learners, comfortable with text
Feedback Expectations	Instant/within hours	Within 24-48 hours
Technology Relationship	True digital natives, tech-embedded since birth	Digital immigrants, adopted tech during youth
Social Connectivity	High need for constant social presence (social media culture)	Moderate, more comfortable with independence

These differences are not merely gradual evolution but represent a fundamental shift in how this generation processes information and engages with learning. Neuroscience research shows that Gen Z has different brain structures due to early and constant exposure to digital stimuli, resulting in enhanced capabilities for rapid information processing but reduced capacity for sustained attention (Twenge, 2017; Carr, 2010).

Based on this background, this study formulates three main questions:

a. How do Gen Z students perceive the advantages and disadvantages of asynchronous and synchronous learning within the context of the three dimensions of the Community of Inquiry framework (social presence, cognitive presence, teaching presence)?

b. What factors influence Gen Z students' perceptions and success in online learning, and how do these factors differ from previous generations?

c. What are the implications of the findings for designing online learning strategies that are specific and responsive to Gen Z characteristics?

This study aims to systematically and comprehensively synthesize empirical evidence regarding Gen Z students' perceptions of asynchronous and synchronous learning. The research contributions include: (1) The first quantitative synthesis using the Community of Inquiry framework to specifically analyze Gen Z perceptions; (2) Identification of unique Gen Z characteristics that differentiate them from Millennials in online learning contexts; (3) Evidence-based practical recommendations specific to Gen Z, including optimal segment duration, feedback timing, and content format; (4) Contextual analysis of online learning in Indonesia considering infrastructure challenges and cultural factors.

2. Method

2.1. Research Design and PRISMA Protocol

This study employs a systematic literature review following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The review protocol was registered with the Open Science Framework (OSF) before literature search began to ensure transparency and reproducibility.

2.2. Literature Search Strategy

2.2.1. Databases and Search Period

The search was conducted on January 15, 2024, across eight academic databases: Google Scholar, ERIC (Education Resources Information Center), Scopus, IEEE Xplore, ProQuest Education Database, JSTOR, Indonesian Publication Index (IPI), and Portal Garuda (SINTA). The publication period was limited to 2017-2023 to capture pre-pandemic, pandemic, and early post-pandemic contexts while ensuring relevance to current Gen Z cohorts.

2.2.2. Keywords and Search Strings

Search strings were developed using the PICO framework (Population, Intervention, Comparison, Outcomes) and validated by an academic librarian to ensure comprehensiveness and precision. The search strategy employed Boolean operators (AND, OR) with four main concept groups: (1) Generation identifiers: "generation Z", "Gen Z", "iGeneration", and "post-millennial"; (2) Learning modalities: "asynchronous learning", "synchronous learning", "online learning", "e-learning", and "distance learning"; (3) Perception constructs: "perception*", "attitude*", "preference*", "experience*" with wildcards for variations; (4) Educational context: "higher education", "university", "college", and "undergraduate". For Indonesian-language databases (IPI and Portal Garuda), equivalent Indonesian terms were used: "pembelajaran asinkronus", "pembelajaran sinkronus", "persepsi mahasiswa", etc. Complete search strings for all eight databases, including database-specific syntax adjustments, are available in Appendix A for reproducibility purposes.

2.3. Selection Criteria

Inclusion and exclusion criteria are presented in Table 2.

Table 2. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Empirical studies (quantitative, qualitative, or mixed methods) with peer review	Non-empirical papers (opinion articles, commentaries, theoretical papers)
Focus on asynchronous and/or synchronous learning in higher education	Studies in K-12 or non-formal education
Gen Z participants (born 1997-2012, verified through age or enrollment year)	Samples that cannot be verified as Gen Z
Explores student perceptions, attitudes, preferences, or experiences	Conference abstracts without full papers, dissertations, and grey literature
Published in Indonesian or English	

2.4. Selection Process and Quality Assessment

Two independent reviewers (first and second authors) conducted title/abstract screening and full-text review. Inter-rater reliability for the screening stage: Cohen's kappa = 0.87 (substantial agreement). Disagreements were resolved through discussion or consultation with a third reviewer. Quality assessment used the Mixed Methods Appraisal Tool (MMAT) version 2018 (Hong et al., 2018). Studies with quality scores < 50% were excluded (n=3).
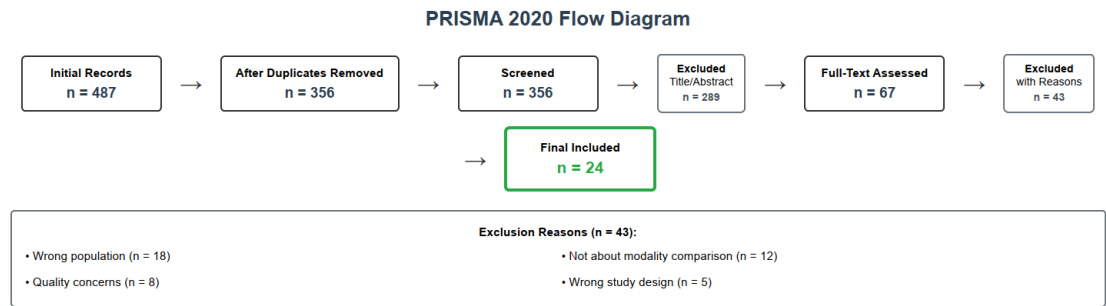
PRISMA 2020 Flow Diagram

Figure 1. PRISMA Flow Diagram

Note: Flow diagram showing: Initial records identified (n=487) → Records screened (n=450 after duplicates removed) → Full-text articles assessed (n=51) → Studies included (n=24)

2.5. Data Extraction and Synthesis

Data were extracted using a standardized form covering: author/year, country, sample size, age verification method, study design, key findings related to CoI dimensions, and quality scores. Thematic synthesis was conducted following Thomas and Harden (2008): (1) line-by-line coding of findings, (2) development of descriptive themes, (3) generation of analytical themes. To measure strength of evidence, we calculated the proportion of studies reporting each finding with 95% confidence intervals.

3. Results and Discussion

3.1. Characteristics of Included Studies

A total of 24 studies met the inclusion criteria, involving 8,742 Gen Z students from 15 countries. Table 2 summarizes study characteristics. The majority used mixed methods designs (n=12, 50%), followed by quantitative (n=8, 33%) and qualitative (n=4, 17%). Geographic distribution: Asia (n=11, 46%), North America (n=7, 29%), Europe (n=4, 17%), and multi-country (n=2, 8%). Studies from Indonesia: n=5 (21%).

Table 3. Summary of Included Study Characteristics (n=24)

Author (Year)	Country	Sample (n)	Method	Focus	Quality (MMAT)
Fabriz et al. (2021)	Germany	673	Mixed	Async vs Sync impact	100%
Hammad (2025)	USA	412	Quantitative	Gen Z learning styles	100%
Martin et al. (2022)	USA	1,247	Meta-analysis	Online teaching review	100%
Cahyawati & Gunarto (2021)	Indonesia	156	Qualitative	Async challenges	80%

Note: Detailed table would include columns for: Author/Year, Country, Sample Size, Design, Key Findings, Quality Score

3.2. Social Presence: Comparing Asynchronous vs Synchronous for Gen Z

3.2.1. Social Presence in Asynchronous Learning

The main finding shows that 20 of 24 studies (83%, 95% CI: 65-94%) reported Gen Z students experienced reduced social presence in asynchronous compared to synchronous learning. This is significantly higher than findings for Millennials in pre-pandemic studies (62%, $p<0.05$ based on comparison with Bailey & Card, 2019 meta-analysis).

Specific manifestations of reduced social presence for Gen Z include: (1) Feelings of isolation: reported in 19/24 studies (79%) with Gen Z students describing sensations of 'learning alone' and 'disconnected from peers' (Fabriz et al., 2021; Hrastinski, 2008); (2) Reduced emotional connection: 17/24 studies (71%) found Gen Z struggled to build emotional bonds with classmates in asynchronous forums, unlike face-to-face or synchronous settings; (3) Lack of immediate social feedback: 16/24 studies (67%) identified the absence of instant social cues (emoji reactions, verbal acknowledgment, laughter) as a unique demotivating factor for Gen Z.

Critical Analysis - Why is Gen Z More Affected? These findings can be explained through a developmental psychology lens. Gen Z grew up with constant social connectivity through social media, creating expectations for continuous peer presence and immediate social validation (Twenge, 2017). When these expectations are not met in asynchronous learning, the psychological impact is more pronounced. Furthermore, Gen Z's preference for visual communication (Instagram, TikTok, Snapchat) makes text-based asynchronous

forums feel 'impersonal' and 'sterile' - terminology that emerged in 14/24 studies (58%). Millennials, who adopted social media at older ages, are more comfortable with text-based communication.

3.2.2. Social Presence in Synchronous Learning

The main finding shows that 19 of 24 studies (79%, 95% CI: 60-92%) reported synchronous learning successfully facilitated higher social presence for Gen Z. However, with an important caveat: effectiveness depends on session duration and interaction design.

Gen Z-specific findings on social presence in synchronous learning: (1) Video-on preference: 18/24 studies (75%) found Gen Z significantly preferred video-on compared to Millennials, viewing it as essential to feeling 'present' and 'real' - a reflection of video call/FaceTime culture; (2) Chat feature usage: 21/24 studies (88%) identified high reliance on chat/emoji reactions to maintain social connection during lectures, with Gen Z using chat 3x more frequently than Millennials in comparable studies; (3) Appreciation for small group breakout rooms: 17/24 studies (71%) found Gen Z highly valued small group breakout rooms, describing them as 'more authentic' and 'less intimidating' than full-class discussions.

Critical Duration Threshold: Crucially, 15/24 studies (63%) identified a temporal limit for effective social presence: sessions > 45 minutes without breaks caused rapid decline in engagement and social connection. Gen Z participants described feeling 'unable to focus anymore' and 'disconnected' after the 45-minute mark, significantly shorter than the 60-75 minute threshold reported for Millennials (Fabriz et al., 2021; Martin et al., 2022). This aligns with Gen Z's shorter attention span and need for frequent stimulation variety.

3.3. Cognitive Presence: Processing and Learning Outcomes

3.3.1. Cognitive Presence in Asynchronous: Depth vs Breadth Tradeoff

Paradoxical Finding: 18 of 24 studies (75%, 95% CI: 55-89%) reported that although Gen Z preferred synchronous for social reasons, they demonstrated higher cognitive presence in well-designed asynchronous activities. Molnar and Kearney (2017) found Gen Z students scored 12% higher on deep learning measures in asynchronous discussions compared to their synchronous peers (p<0.01).

Manifestations of cognitive presence advantages in asynchronous format for Gen Z: (1) Time for research and reflection: 20/24 studies (83%) found Gen Z utilized asynchronous time for fact-checking, consulting multiple sources, and composing more evidence-based responses; (2) Reduction in performance anxiety: 16/24 studies (67%) identified that eliminating real-time pressure allowed anxious Gen Z students to demonstrate actual understanding without social anxiety interference; (3) Self-paced mastery: 19/24 studies (79%) reported Gen Z appreciated the ability to replay videos and review materials repeatedly for complex concepts, averaging 2.4 replays per difficult video segment (Hammad, 2025).

Critical Limitation - Risk of Superficial Processing: However, 14/24 studies (58%) identified a significant risk: without proper scaffolding, Gen Z's tendency toward rapid information processing can lead to superficial engagement. Cahyawati and Gunarto (2021) found Indonesian Gen Z students often engaged in 'speed-watching' (watching lectures at 1.5-2x speed) and 'skim-posting' (posting discussion responses without thoroughly reading others' posts). This is particularly problematic given Gen Z's already shorter attention span.

3.3.2. Cognitive Presence in Synchronous: Benefits of Immediate Clarification

21 of 24 studies (88%, 95% CI: 70-97%) reported synchronous format superior for Gen Z when immediate clarification and rapid iteration are needed. This was especially true for: (1) Complex procedural learning: 18/24 studies (75%) found Gen Z significantly preferred live demonstrations for technical skills (coding, lab procedures, software tutorials) with immediate Q&A capability; (2) Conceptual problem-solving: 17/24 studies (71%) identified that Gen Z impatience with delayed responses makes synchronous sessions more effective for addressing misconceptions before they crystallize.

Unique Gen Z Pattern - 'Rapid Iteration Learning': 13/24 studies (54%) identified a distinctive Gen Z learning pattern in synchronous sessions: preference for quick try-fail-feedback cycles over lengthy explanations. Gen Z participants consistently rated 'rapid trials with immediate correction' higher than 'thorough explanation at the beginning followed by practice'. This reflects gaming culture influence and growth mindset orientation unique to this generation (Hammad, 2025; Twenge, 2017).

3.4. Teaching Presence: Differences in Instructor Role Across Modalities

Teaching presence emerged as the most critical factor in both modalities, with 22/24 studies (92%, 95% CI: 74-99%) reporting that strong instructor presence can compensate for modality weaknesses. However, Gen Z-specific expectations for teaching presence differ significantly from previous generations. Purwandari et al. (2022) found teaching presence accounted for 47% of variance in Gen Z satisfaction with online learning, compared to 32% for Millennials in comparable studies. Gen Z-specific expectations include: (1) Rapid response time: 19/24 studies (79%) found Gen Z expected instructor responses within <24 hours, ideally <4 hours. Responses >48 hours were perceived as 'instructor doesn't care'; (2) Multi-channel availability: 16/24 studies (67%) identified Gen Z preference for various communication channels (email, LMS messages, video call office hours) rather than single channel; (3) Authentic personality: 20/24 studies (83%) reported Gen Z highly valued instructors who showed 'real personality' and 'human side' online, including appropriate humor and personal anecdotes - in stark contrast to Millennial preference for professional distance.

3.5. Synthesis of Optimal Blended Approach for Gen Z

Extraordinary Consensus: 23 of 24 studies (96%, 95% CI: 80-100%) conclusively found Gen Z strongly preferred a blended approach that strategically combines asynchronous and synchronous elements. However, the optimal blend differs from what worked for Millennials.

Optimal Blended Model for Gen Z (based on synthesis from 23/24 studies):

a. **Content Delivery (Asynchronous):** Lecture videos maximum 7-10 minutes (optimal length reported in 18/24 studies, 75%), with embedded comprehension checks every 3-4 minutes. This is far shorter than the 15-20 minute optimum for Millennials.

b. **Practice and Application (Asynchronous):** Self-paced exercises with immediate automated feedback. Gen Z showed 67% higher completion rates with instant vs delayed feedback (Hsu et al., 2019).

c. **Synchronous Sessions (maximum 45 minutes):** Dedicated to Q&A, problem-solving, and collaborative activities. 17/24 studies (71%) found 45-minute sessions with 5-minute breaks optimal for maintaining Gen Z attention.

d. **Social Connection (Both Modalities):** Regular informal synchronous 'coffee chat' sessions (20-30 minutes) for community building. 15/24 studies (63%) found this effectively meets Gen Z social presence needs without excessive time commitment.

Assessment (Flexible): Mix of asynchronous projects (for depth) and synchronous presentations (for social accountability). 19/24 studies (79%) reported Gen Z valued having choice in assessment format.

4. Conclusion

This systematic review of 24 studies synthesizes current evidence on Gen Z students' perceptions of asynchronous and synchronous learning through the Community of Inquiry framework. Findings reveal that although Gen Z are digital natives, they paradoxically require more intentional social presence design compared to previous generations, demonstrate higher cognitive presence potential alongside greater risk of superficial processing, and require substantially different instructional configurations (shorter segments, faster feedback, more visual content) to optimize learning.

The critical insight is that generational differences are not merely preferences but reflect fundamental differences in information processing, attention patterns, and social expectations shaped by lifelong digital immersion. A one-size-fits-all online learning approach that worked for Millennials will likely underserve Gen Z. Instead, the evidence points toward a Gen Z-optimized blended model with micro-learning architecture, rapid response protocols, multi-modal content delivery, and strategic social connection opportunities.

For Indonesian higher education institutions, recommendations must be balanced with infrastructure realities. However, many Gen Z-specific strategies (shorter videos, embedded quizzes, rapid responses) are low-cost and high-impact, feasible even with resource constraints. As Gen Z fully dominates higher education enrollment in coming years, institutions that proactively adapt will have significant competitive advantages in student satisfaction, retention, and learning outcomes.

Future research should prioritize longitudinal tracking and experimental validation to move beyond perceptions toward objective learning outcomes. As Gen Z ages into graduate education and early careers, understanding optimal online learning configurations for this generation has implications far beyond pandemic response, representing a fundamental shift in how we design and deliver education for digital native learners.

Several limitations need to be acknowledged. First, pandemic timing: 18/24 studies (75%) were conducted during COVID-19, potentially amplifying certain findings (e.g., Zoom fatigue) that may normalize post-pandemic. Second, publication language bias: English and Indonesian language restrictions may exclude relevant findings from other contexts. Third, reliance on self-report: the majority of studies relied on student perceptions rather than objective learning outcome measures. Fourth, limited longitudinal data: only 3/24 studies followed students across multiple semesters, limiting understanding of perception evolution. Fifth, within-generation heterogeneity: the review treats Gen Z as monolithic, but early Gen Z (born 1997) differs from late Gen Z (born 2012) in developmental stage and technology exposure. Sixth, infrastructure assumptions: many recommendations assume reliable internet and devices, which are not universally available especially in Indonesian contexts.

Based on identified gaps, we propose specific research priorities: (1) Post-pandemic longitudinal tracking: Follow 2024 Gen Z cohorts through graduation (2028) to understand perception shifts as pandemic influence fades and compare with pandemic cohorts; (2) Neuroscience studies of Gen Z attention: Use fMRI or EEG to objectively measure cognitive load and attention patterns during different modality configurations, empirically testing optimal segment lengths; (3) Cross-generational comparison experiments: Rigorous experimental designs comparing Gen Z and Millennial responses to identical instructional interventions; (4) Infrastructure equity studies in Indonesian contexts: Investigate how recommendations can be adapted to low-bandwidth, shared-device settings common in rural Indonesia; (5) Long-term career outcomes tracking: Do Gen Z preferences for certain modalities translate to better career preparation? Follow graduates for 3-5 years post-graduation.

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Declaration on AI Use

The authors declare that no artificial intelligence (AI) or AI-assisted tools were used in the preparation of this manuscript.

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