# A SYSTEMATIC LITERATURE REVIEW: ASPECTS OF ARTIFICIAL INTELLIGENCE USE IN THE SELF-DIRECTED LEARNING PROCESS OF GENERATION Z

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Abstract: The aim of this paper is to identify and synthesize the positive and negative aspects of using artificial intelligence (AI) in the self-directed learning process of Generation Z. The paper is structured as a systematic literature review following the PRISMA framework, with the analysis based on the thematic synthesis method of Thomas and Harden (2008). The findings suggest that artificial intelligence can function as a safe and personalized tutor within the process of self-directed learning, supporting the development of metacognition and having a positive impact on both cognitive and affective components of learning, provided that it is used as a so-called "scaffold", i.e. as a support for thinking, and not as a replacement for one's own cognitive work. At the same time, the findings show that excessive reliance on AI tools can lead to cognitive passivity, weakened critical thinking, and plagiarism. Further risks include inaccurate or outdated AI outputs, students' insufficient AI literacy, and ethical dilemmas related to authorship and algorithmic bias. The effectiveness of AI-supported self-directed learning therefore depends primarily on students' critical and reflective approach to its use.

Keywords: Generation Z. Self-directed learning. Artificial intelligence. AI. Education.

## 1 Introduction

Young people born between 1997 and 2012, also referred to as Generation Z, are currently considered the first generational cohort to grow up with unlimited access to digital technologies, which later became an inseparable part of their lives (Evidence In Motion, 2024). As early as 2010, the prominent Australian sociologist Mark McCrindle stated that the age at which we first use technology determines how deeply it becomes embedded in our lifestyle. He regards Generation Z as so-called *"digital integrators,"* since these young people have used technology from an early age and have managed to integrate it seamlessly into nearly every area of their lives (McCrindle & Wolfinger, 2009). This everyday entanglement with technology has fundamentally shaped their thinking, preferences, and the way they learn (Evidence In Motion, 2024). Digital technologies substantially transform the cognitive functions and learning habits of Generation Z by reshaping their neurological engagement and the way they process information, which can also have various negative effects. These may include, for example, difficulty building deeper causal connections, a reduced capacity for systems thinking — which requires 23 minutes of uninterrupted concentration — a marked reduction in attention span and the ability to concentrate, and a decline in the ability to perform more complex analytical work (Sureshkumar, 2025). This is further confirmed by an extensive meta-analysis showing that research from recent years in the field of neurophysiology demonstrates changes in the activity of brain structures responsible for systems, critical, and analytical thinking. *"Media convergence"* [1] has caused society to shift rapidly from a *"reading"* generation to a *"watching"* one. A large proportion of online information now exists in purely visual or audiovisual form. At the same time, the human brain fundamentally gravitates toward simpler solutions — that is, toward visual or simple textual content (Vasilyeva, 2021). These facts are also largely reflected in the preferences of the digital generation. Members of Generation Z indeed prefer social media platforms that offer content in the form of short videos, most notably TikTok, Instagram, and YouTube (Pew Research Center, 2024). These young people favor content that is fast, visual, and flexible. Vertical videos with captions, background music, and a narrative style work best for them, since Generation Z primarily consumes content on mobile devices, often without sound. A content creator who explains *"how to save money during college"* in a 45-second video using on-screen text and real-life examples can capture far more attention than a long written post. Such videos are easy to watch, simple to share, and ideally suited to algorithm-driven platforms (Egnoto, 2026). Similar findings are demonstrated by the comparative study of Pandey et al. (2025). The results suggest that short-form video content represents a significant part of the everyday lives of Generation Z members, not only in terms of consumption but also of content creation (Pandey et al., 2025). However, the consumption of short video content on platforms such as TikTok, Instagram, and YouTube has been shown to have a negative impact on the cognitive abilities of Generation Z, specifically on their attention, memory, and problem-solving skills. Watching short videos in particular can weaken their critical thinking and problem-solving skills (Sureshkumar, 2025).

As already indicated, one consequence of this constant digital engagement for the young generation is that their thought processes differ from those of previous, older generations. It should also be emphasized that these changes are not genetic in origin but result from growing up with continuous access to digital technologies. These shifts in thinking naturally also lead to specific learning preferences (Shirazian et al., 2025). One notable aspect of how Generation Z members process information is their inclination toward visual content — that is, information conveyed through videos, images, or infographics — which they prefer over text. This preference is also evident on platforms such as YouTube, Instagram, Snapchat, and TikTok, which likewise dominate their media consumption (Shaikh, 2024). According to Shirazian et al. (2025), this dominance of visual information processing is attributable to the region of the brain responsible for visual abilities and the processing of complex images, which is considerably more developed in Generation Z. As a result, visual forms of learning are more effective for them than traditional lecture-based instruction relying on listening, which they find less appealing (Shirazian et al., 2025). The digital engagement of Generation Z members exposes them to constant access to large volumes of information. While this can lead to information overload, in the context of education and learning it can also be understood as a certain independence or self-sufficiency of young people in seeking answers to their questions or solving various problems on their own (Shaikh, 2024). Since these young people are accustomed to obtaining information instantly through search engines, they often prefer to study at their own pace and may also employ so-called *"self-education"* or *"self-directed learning"* methods (Shirazian et al., 2025). Self-directed learning can be defined as a process in which an individual independently assesses their own learning needs, sets goals, and takes the initiative in finding ways to acquire new knowledge (KnowledgeAnywhere, n.d.). For self-directed learning to be effective, students must, according to scholars, possess a mature, outcome-oriented approach to learning — one that serves not merely to fulfill course requirements but also to develop their own knowledge and skills. At the same time, they must be able to manage their time effectively and reflect on their decisions. Effective self-directed learning also requires technological readiness. Students' perception of web-based learning technologies significantly influences their learning behavior, since students who can effectively access and utilize online materials and online learning tend to perform better, and still value personal interactions during which they can receive feedback (Geng et al., 2019). Nair et al. (2023) reach similar conclusions, finding that students learn more effectively in the presence of an instructor than through self-directed learning alone. However, they do not claim that self-directed learning is useless. Scholars emphasize that technology and self-directed learning show a positive association with student motivation, but that students still prefer guided, in-person, interactive learning involving an engaged teacher (Nair et al., 2023).

[1] The term *"media convergence"* refers to the gradual interlinking of different media and technologies. Thanks to modern technology, the same media content is now available through multiple channels. At the same time, the functions of devices that were once separate are also merging. Media convergence thus represents the merging of media, technologies, and their functions into a single system or device (Brestovanský, 2010).

## 2 Methodology

We decided to structure this paper as a systematic review. This approach represents a synthesis of knowledge that is identified and critically evaluated. The aim of systematically gathering and synthesizing scientific findings is to achieve a deeper understanding of a specific issue. At the same time, the systematic procedure adopted ensures that all relevant studies are included in the synthesis, while also reducing the risk of bias by establishing predetermined study-selection criteria prior to the search itself (Randles & Finnegan, 2023). Conducting a systematic literature review involves several steps, namely defining the research questions, establishing inclusion and exclusion criteria for scientific studies, carrying out a comprehensive review of the relevant scientific literature, analyzing and extracting the findings, and, finally, synthesizing and interpreting the results (Fain, 2025). The first phase of the systematic review primarily involves establishing the aim and research questions and collecting the scientific studies to be analyzed in the second, empirical phase of the work. In this first phase, we therefore followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, which condition study selection on the establishment of exclusion and inclusion criteria used to select the relevant scientific papers. This is followed by a transparent description of the selection process, including the choice of search keywords and the scientific databases from which studies were drawn. The final step is the critical appraisal of the studies (Page et al., 2021). The second phase of the research consists of analyzing and synthesizing the findings from the selected studies. In this context, it should also be noted that for the analysis itself we adopted a qualitative research approach and, for this purpose, decided to apply so-called thematic synthesis. Thematic synthesis is used in qualitative research and serves to effectively combine the results of multiple studies, including within systematic reviews. The process of qualitative synthesis consists of three steps: coding the text, generating descriptive themes, and subsequently developing analytical themes. This research technique allows researchers to go beyond the original data and generate new hypotheses or concepts, while maintaining a transparent link to the primary sources (Thomas & Harden, 2008).

### 2.1 Defining the research problem, aim, and research questions

Based on the information presented above in the introduction, we can state that the close connection between Generation Z and digital technologies substantially shapes the way these young people learn and process information. This, in turn, gives rise to various specific characteristics and preferences in their educational process. One such preference is so-called self-directed learning. Today, however, artificial intelligence (AI) may also enter into this process, as it can be integrated into self-directed learning through personalized tools and real-time support (Vijnatham School, 2025). Artificial intelligence has the potential to substantially support this process, but on the other hand may also limit its effectiveness. The aim of this paper is to identify and synthesize the positive and negative aspects of AI use in the self-directed learning process of Generation Z members, with an emphasis on the mechanisms and conditions under which individual factors of AI use act as either enablers of, or barriers to, effective self-directed learning.

**Research questions:**

**PRQ:** What aspects of artificial intelligence (AI) use in the self-directed learning process of Generation Z members, in terms of their impact on the effectiveness of this type of learning, appear in the findings of the selected scientific publications?
**SRQ1:** What positive aspects, or supportive mechanisms, of AI tool use can be identified in scientific studies in the context of the self-directed learning of Generation Z members?
**SRQ2:** What negative aspects, or risks and barriers, do the selected scientific studies associate with the use of AI in the self-directed learning process of Generation Z members?

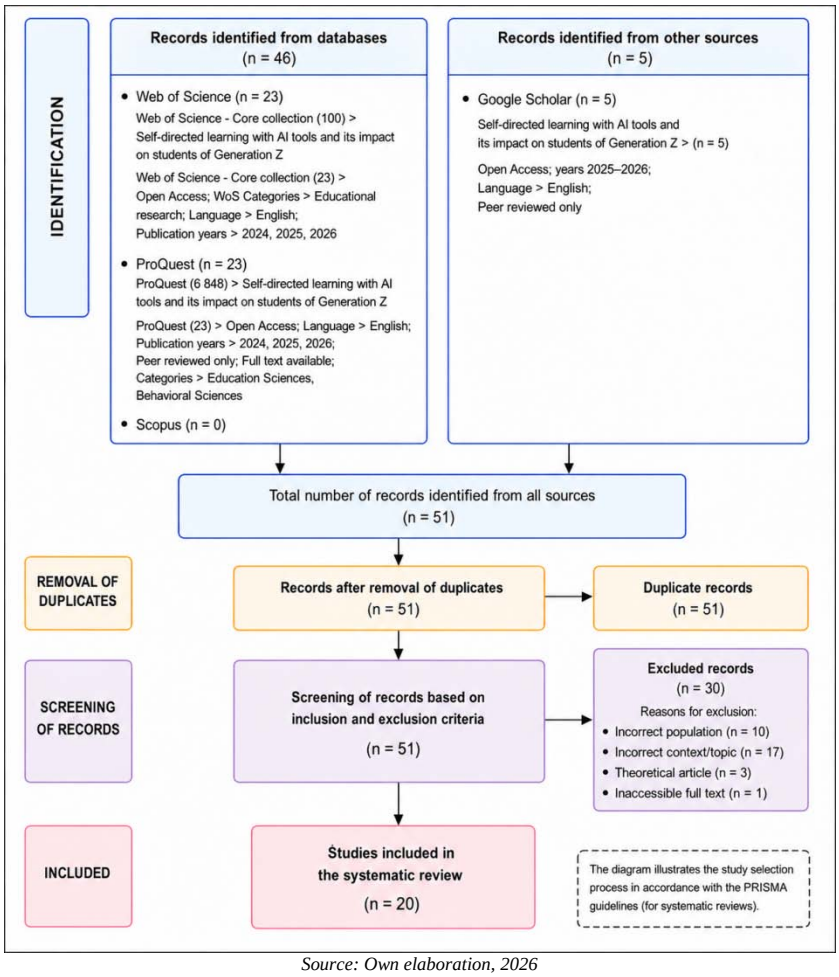
### 2.2 Study selection strategy for the systematic review

Three scientific databases were used to conduct the systematic review: Web of Science — Core Collection, Scopus, and ProQuest. The Google search engine was also used to search for studies. The search was carried out using a combination of keywords covering three conceptual areas: (1) Generation Z, (2) self-directed learning, and (3) artificial intelligence. All three areas were incorporated into a single English-language search phrase: *"Self-directed learning with AI tools and its impact on students of Generation Z."* The search was limited to studies published between 2024 and 2026, and covered study titles, abstracts, and keywords. The search results were then subjected to a screening process in accordance with predetermined inclusion and exclusion criteria, formulated in line with the systematic literature review methodology and the PRISMA 2020 statement (Page et al., 2021), and consistent with the established research questions and the chosen thematic synthesis method (Thomas & Harden, 2008).

**Inclusion criteria:** 1. Topic and content of the study: The systematic review included studies examining the use of artificial intelligence tools in self-directed learning, where the research population consisted of Generation Z members or university students. University students were included as an equivalent group, since the current university-age population overlaps substantially with Generation Z in terms of age, and not all authors explicitly identify this generational affiliation. 2. Type of publication: Included were empirical studies employing quantitative, qualitative, or mixed methods, review studies relevant to the topic, and conference papers indexed in WoS or Scopus. 3. Time frame: Studies published between 2024 and 2026 (given the pace of development of AI tools in education). 4. Language of publication: Primarily studies published in English or Slovak/Czech were included. 5. Availability: Studies included in the review had to be available in full text.

**Exclusion criteria:** 1. Topic and content of the study: In terms of topic and content, we excluded studies focused on other generational cohorts (Millennials, Generation X, Baby Boomers, Generation Alpha) without specific consideration of Generation Z, as well as studies addressing AI in education without a contextual link to students (e.g., the administrative use of AI in educational institutions, and similar topics). 2. Type of publication: Studies published without peer review were excluded from the systematic review. 3. Time frame: Studies published before 2024. 4. Language of publication: Studies published in languages other than English, Slovak, or Czech were excluded. 5. Availability and quality: Studies were also assessed and excluded on the basis of whether they were available in full text and had a clearly described methodology and research design. Duplicates were also removed from the systematic review using the Zotero application.

Figure 1: The diagram illustrates the process of identifying, screening, and including studies in the systematic review in accordance with the PRISMA 2020 statement.




*Source: Own elaboration, 2026*

Table 1: Overview of scientific studies included in the knowledge synthesis

| Author | Aim of the study | Research sample | Study methodology |
|---|---|---|---|
| Jhoname Besas, Louida Patac & Adriano Patac Jr. (2026) | To examine the relationship between AI-supported self-directed learning (SDL) and performance in mathematics among Generation Z students. | Junior high school students, grades 7–10 (Generation Z) > purposive sample. n = 345 | Mixed method (convergent design). 272 students in the quantitative part (questionnaire) and 73 in the qualitative part (focus groups). |
| Anastasiya Shikina (2025) | To determine how AI tools help Uzbek students develop self-directed learning skills and increase their autonomy and motivation. | Undergraduate and postgraduate students (Generation Z) > purposive/convenience sample n = 27 | Quantitative method (questionnaire) supplemented by thematic analysis of semi-structured interviews. |
| Wanxin Yan, Taira Nakajima & Ryo Sawada (2024) | To examine students' perspectives, benefits and challenges of using generative AI as a learning partner in the process of learning programming. | Third-year undergraduate students (Generation Z) > purposive sample. n = 9 | Qualitative method (case study). |
| Davy Tsz Kit Ng, Chee Wei Tan & Jac Ka Lok Leung (2023) | To evaluate the impact of GPT-driven chatbots on self-regulated learning (SRL) and science knowledge among students, compared with traditional chatbots. | Fourth-year high school students (Generation Z) > purposive/convenience sample. n = 74 | Mixed method: quasi-experiment and follow-up interviews. (37 students in the experimental group and 37 in the control group) |
| Mohammed Ahmed Kofahi & Anas Jebreen Atyeh Husain (2025) | To present a ChatGPT-supported learning model and examine its effects on higher-order thinking (HOT) skills among IT students. | Undergraduate students in IT (Generation Z) > purposive sample. n = 53 | Quantitative method (quasi-experimental design). Students were randomly divided into two groups (30 in the experimental and 23 in the control group). |
| Ke Wang & Zong Guo (2025) | To quantitatively synthesize existing evidence on the impact of generative AI on students' cognitive, behavioral and affective engagement. | The sample consisted of scientific studies covering various levels of education, including basic, higher and lifelong education. > systematic selection. n = 31 scientific studies | Quantitative method (meta-analysis). |
| Evangelia Manousou (2025) | To examine the development of perceptions and practices of fostering critical thinking in postgraduate distance education over the course of a | Students and graduates of postgraduate programs (higher education) focused on educational sciences and technology (Generation Z) > purposive sample. n = | Qualitative method (semi-structured interviews and thematic analysis). |

| | | | |
|---|---|---|---|
| | decade, with a focus on the role of AI. | 30 | |
| Jerry Chih-Yuan Sun, Hsueh-Er Tsai & Wai Ki Rebecca Cheng (2022) | To understand the effects of a personalized data-visualization platform on students' strategies and behavioral patterns in self-regulated learning. | Master's and doctoral students from four national universities (Generation Z) > purposive/convenience sample. n = 182 | Quantitative method (four-group experiment and sequential analysis). |
| Ziwei Li, Chunlai Wang & Curtis J. Bonk (2024) | To examine students' motivations and strategies when using ChatGPT for self-directed online language learning. | Undergraduate students (Generation Z) > random and purposive sample. n = 287 | Mixed method (questionnaire and interviews). 276 students completed the questionnaire and 11 took part in in-depth interviews. |
| Jasper Roe & Mike Perkins (2025) | To map the landscape of generative AI applications in the context of SDL and critically evaluate their benefits and risks based on existing evidence. | Studies drawn predominantly from the higher-education environment. Scientific studies were analyzed. > systematic selection. n = 18 scientific studies | Qualitative method (thematic scoping review). |
| Ali Darvishi, Hassan Khosravi, Shazia Sadiq, Dragan Gašević & George Siemens (2023) | To examine the effect of AI assistance on students' independence and initiative and to determine whether they can maintain the quality of their work after this support is removed. | Undergraduate students from ten different disciplines (Generation Z) > random sample. n = 1,625 | Quantitative method (randomized controlled experiment). |
| Fernando Viadero-Monasterio et al. (2026) | To analyze the impact of integrating generative AI into an engineering course on students' autonomy and academic outcomes. | Engineering course students, university students (Generation Z). > purposive/convenience sample. n = 132 | Quantitative method (grade analysis and questionnaire survey). |
| Kristina Posavec (2026) | To examine how students construct prompts and how this practice relates to their self-directed learning skills and AI literacy. | First-year female bachelor's students (Generation Z) > purposive sample. n = 57 | Quantitative phase: provided descriptive findings on prior experience. Qualitative phase: captured the reflections of the female students. |
| Joel Weijia Lai et al. (2025) | To analyze students' interactions with a Socratic chatbot in a statistics course in order to gain insight into self-regulated learning processes. | Undergraduate students (Generation Z) > purposive sample. n = 34 | Quantitative method (epistemic network analysis — ENA). |
| Sung-Hee Jin, Kowoon Im, Mina Yoo, Ido Roll & Kyoungwon Seo (2023) | To examine students' perceptions of AI applications supporting self-regulation and to identify important pedagogical and psychological aspects of their integration. | University students across ten different disciplines. > purposive sample. n = 16 | Qualitative method (exploratory design using the "speed dating" method with storyboards). |
| Guixia Wang, Zehui Zhan & Shouyuan Qin (2025) | The aim of the study was to design and test an intelligent tutoring model (KG-CQ) that integrates knowledge graphs with LLMs to support self-directed learning. | University students in Educational Technology in China (Generation Z) > purposive sample. n = 30 | Quantitative method (comparative model experiment). |
| Mehmet Yavuz, Şener Balat & Bünyami Kayalı (2025) | To determine the impact of an AI-supported flipped classroom on the literacy, perceptions and experiences of higher-education students. | First-year vocational higher-education students in Web Design and Coding (Generation Z) > purposive/convenience sample. n = 33 | Mixed method (quasi-experimental pre-test/post-test design and qualitative case study). |
| Ahmed Kharrufa & Ian Johnson (2024) | To explore the possibilities and pedagogical implications of integrating generative AI into education in the field of human-computer interaction (HCI). | Third-year undergraduate computer science students (Generation Z) > purposive/convenience sample. n = 12 | Qualitative method (pedagogical reflection and module delivery report). |
| Huiwen Zou et al. (2026) | To explore how pedagogical novelty and ethical awareness influence students' acceptance of AI, and whether ethics prevents the emergence of mindless dependence. | University computer science students (Generation Z) > purposive/convenience sample. n = 134 | Quantitative method (quasi-experiment and SEM model analysis). |
| Madina Yermaganbetova et al. (2026) | To evaluate the effectiveness of an integrated AI platform in improving performance, motivation and self-directed learning in a 3D-modeling course. | Second-year undergraduate students. > purposive/convenience sample. n = 120 | Mixed method (quasi-experiment with pre-test and post-test, and thematic analysis). 62 students participated in the experimental group and 58 in the control group. |

*Source: Own elaboration, 2026*

## 3 Results

### 3.1 Coding and the development of descriptive themes

In this chapter, we present the individual thematic codes as well as the descriptive themes. The analysis and coding of the findings from the individual scientific studies included in the systematic review provided the basis for developing the descriptive themes. Through this process, using an inductive approach, we identified several codes that recurred across the results of the studies. These are, specifically: (1) personalized support and motivation, (2) availability and immediate feedback, (3) emotional well-being and stress relief, (4) support for metacognition, (5) risk of excessive reliance on or dependence on AI, (6) risk of passive learning, (7) cognitive offloading, (8) goal-setting and self-paced learning, (9) cognitive development / reduced cognitive load, (10) more effective time management, (11) inaccurate information and AI hallucinations, (12) technological/AI literacy, (13) AI as an aid rather than a replacement for the tutor/teacher, and (14) ethical dilemmas in the use of AI. In addition, we identified further codes that did not recur across the results of the studies and were therefore not included in the knowledge synthesis.

As already stated in the Methodology, the process of thematic synthesis consists of three steps: (1) coding the text, (2) developing descriptive themes, and (3) developing analytical themes, i.e., the synthesis of the findings itself. By sorting and grouping the individual codes into similar thematic clusters, we developed six descriptive themes: Theme 1: Personalized support — comprises the codes personalized support and motivation, availability and immediate feedback, and emotional well-being and stress relief. Theme 2: Support for cognitive development — draws on the codes support for metacognition and cognitive development/reduced cognitive load. Theme 3: Self-regulation of learning — is formed by the codes goal-setting and self-paced learning and more effective time management. Theme 4: Risk of passivity in AI use —comprises the codes risk of excessive reliance on or dependence on AI, risk of passive learning, and cognitive offloading. Theme 5: Limitations of AI tools in self-directed learning — links the codes inaccurate information and AI hallucinations and technological/AI literacy.

Theme 6: The relationship between AI and the human factor — consists of the codes AI as an aid rather than a replacement for the tutor/teacher and ethical dilemmas in the use of AI.

### 3.2 Thematic synthesis of findings and development of analytical themes

Based on the results of the systematic literature review, we proceeded to synthesize the findings, that is, to develop the analytical themes. This paper focuses on the aspects of artificial intelligence (AI) use in the process of self-directed learning among Generation Z members. The central aim, through a systematic review of relevant scientific publications and qualitative thematic synthesis, is to identify and synthesize the aspects of AI use that support young people in the self-directed learning process. A further aim is to identify the risk-related aspects that could act as barriers to self-directed learning within this generational cohort. Based on the thematic synthesis, analytical themes were established, through which the findings are interpreted in the following section in relation to the stated research questions:

***SQ1:*** *What positive aspects, or supportive mechanisms, of AI tool use can be identified in scientific studies in the context of the self-directed learning of Generation Z members?*

#### 3.2.1 Artificial intelligence as a safe and personalized tutor

In order to answer the first research question, the thematic synthesis of findings focused on the aspects of AI use that could have the potential to support the self-directed learning process among Generation Z members. The extracted findings show that the use of artificial intelligence (AI) in the self-directed learning process is of great significance to students, primarily as a form of support across various domains. Based on research conducted with students, scholars point out that AI becomes a kind of *"personal tutor"* for them. For example, the findings of Besas et al. (2026) indicate that the support provided by artificial intelligence lies primarily in the fact that, unlike teachers, it is available to students at all times, which allows them to maintain their learning momentum (Besas et al., 2026). Immediate and personalized feedback from AI in the self-directed learning process gives students the opportunity to solve various problems or have more complex topics explained to them right away, even outside of class (Besas et al., 2026; Shikina, 2025; Roe & Perkins, 2025). An interesting finding in this context is that students in the research group of the study by Kharrufa and Johnson (2024) reported using AI for its ability to sustain a dialogue and turn abstract definitions into real-world examples. This allowed them to better understand the problems they were working on (Kharrufa & Johnson, 2024). The high degree of personalization and availability of AI use within self-directed study also contributes to the formation of habits related to working on assignments and learning, which contributes to better time management (Li et al., 2024). These findings therefore also point to the use of artificial intelligence for the possibility of individualized, real-time support. In addition, students show a greater tendency toward interactive querying — that is, they reformulate their query or question multiple times until they sufficiently understand the topic. This is also a consequence of the sense of safety in the learning process, which is very important for Generation Z. This, in turn, leads to emotional well-being and reduced anxiety, since AI provides them with a judgment-free environment in which students are not ashamed to make mistakes (Besas et al., 2026). Students also benefit from the fact that AI tools transform the traditional learning environment, giving individuals greater control over their study process. They can set their own pace and approach to studying, or even generate their own study aids, which has a positive impact on their engagement (Shikina, 2025). Scholars nevertheless point out that the best outcomes were achieved by students who, within self-directed learning, used AI tools as a so-called *"scaffold."* In this context, this refers to students using AI alongside their own thinking — for example, to check the correctness of their reasoning or to understand a complex topic — rather than merely as a shortcut to ready-made generated results (Besas et al., 2026; Wang & Guo, 2025).

#### 3.2.2 AI tools as support for the development of metacognition

Personalized AI support for students, however, need not serve only as a tutor; as already mentioned, it can also act as a *"mirror"* for understanding and identifying one's own knowledge gaps. This process is part of so-called *"metacognition."* [2] By being able to use a chatbot as an interactive partner, students can also improve their metacognitive ability within self-directed learning, which contributes to better outcomes. According to the findings of Kharrufa and Johnson (2024), students must actively work to formulate their prompts and queries with sufficient complexity. If a student enters a superficial or unclear prompt, the AI generates an equally superficial result. This direct feedback leads students to recognize the gaps in their own argumentation and understanding of context, which motivates them toward deeper reflection and the refinement of their own reasoning (Kharrufa & Johnson, 2024). Properly harnessed interaction with AI leads students to critically evaluate answers, explain problems, and effectively formulate their questions. As a result, they must adapt their communication strategies, which leads to greater awareness of their own cognitive processes (Yan et al., 2024; Besas et al., 2026). AI can also stimulate students' thinking by prompting them to reflect on their own strategies and progress. According to the findings of the study by Ng et al. (2024), specialized AI chatbots (SRLbots) encourage students toward metacognitive reflection by asking them questions about their learning goals, prior knowledge, and the success of the strategies they have chosen. This process helps students better track their progress and, when necessary, adapt their approaches in real time. A further example is the experimental study by Yermaganbetova et al. (2026), which used an AI-integrated platform. This platform served as the aforementioned *scaffold*, reinforcing strategic learning behavior and leading students toward active planning and self-correction in their learning and work process. The visualization of progress is also useful for students in this process. The AI-supported learning model tested in the study by Sun et al. (2023) gave students the ability to visualize data. Thanks to the ability to visualize personalized feedback, students were better able to identify their weaknesses and target their improvement efforts, which strengthens their metacognitive control over learning (Sun et al., 2023).

#### 3.2.3 Artificial intelligence as a tool for stimulating cognitive and affective processes

The use of AI tools in self-directed learning can also contribute to the development of students' cognitive and affective components. The findings of the scientific studies suggest that, in terms of strengthening cognitive components, this primarily concerns deep information processing, problem-solving, and the analysis and evaluation of knowledge (Wang & Guo, 2025; Kofahi & Husain, 2025). Scholars, however, discuss this benefit in the context of using AI tools as targeted, personalized support in the learning process — that is, as the aforementioned *"scaffold"* — rather than as a tool that generates ready-made outputs. A confirming example is the experimental study by Yavuz et al. (2025), in which the researchers used a *"flipped classroom"* [3]model incorporating artificial intelligence. According to the findings, the use of AI tools within this model strengthened students' critical thinking and problem-solving skills while also increasing their AI literacy (Yavuz et al., 2025). The use of AI tools in the self-directed learning process can also have a positive effect on students' affective, i.e., emotional, experience during learning. The previously mentioned personalized and immediate AI feedback has the potential to

[2] The term *"metacognition"* refers to complex thinking that enables one to understand, analyze, and control one's own cognitive processes, especially when learning (Cambridge Dictionary, n.d.).

[3] The *"flipped classroom"* model refers to a teaching method where students are exposed to information before instruction, freeing up time within the lesson for activities that involve "higher-order thinking," that is, thinking at a higher cognitive level (Harvard Bok Center, n.d.).

alleviate the anxiety, boredom, and frustration that students may experience during conventional instruction as passive recipients of information (Wang & Guo, 2025; Kofahi & Husain, 2025). At the same time, the interactive mode of querying can stimulate curiosity and interest in students (Wang & Guo, 2025).

***SQ2:*** *What negative aspects, or risks and barriers, do the selected scientific studies associate with the use of AI in the self-directed learning process of Generation Z members?*

**3.2.4 Risk of cognitive passivity and excessive reliance on AI**

In the preceding subsections, we outlined the various mechanisms that have a positive effect on the self-directed learning process of Generation Z members. These aspects of AI tool use were frequently explained by scholars in relation to the concept of the *"scaffold,"* which is key to the transition to the analytical themes addressing the second research question, focused on the risks and barriers of AI use in the self-directed learning process of young people. The results of the studies indicate that one of the risk factors of AI use within self-directed learning may be excessive reliance on, or even dependence on, artificial intelligence. This can lead to the superficial acceptance of information and ready-made answers without critical reflection. This means that students would not engage themselves, for example, in analyzing data or text, but would instead leave this to AI. The consequence of such dependence is a reduced capacity for independent problem-solving and critical thinking, and it may also lead to *"rigid cognitive patterns"* [4](Besas et al., 2026; Wang & Guo, 2025; Manousou, 2025). If a student accepts only ready-made solutions, they stop "exercising their brain," which leads to growing ignorance and an inability to independently assess the truthfulness of information, or even to stagnation and decline in creative thinking and imagination (Manousou, 2025). If students rely too heavily on AI outputs without deeper understanding, there is also a risk of superficial learning without genuine comprehension, or even plagiarism in school or academic assignments (Yan et al., 2024). Interesting findings in this context were produced by the experimental study of Darvishi et al. (2024). The scholars found that when AI support was removed, the quality of students' work dropped sharply, suggesting that they had not actually acquired the knowledge but had merely *"outsourced"* it — literally meaning the delegation of certain tasks, in this case to an AI tool. This risk factor is directly related to the concept of *"cognitive offloading"* (Darvishi et al., 2024). Students' tendency toward this cognitive offloading is problematic primarily because they may shift key problem-solving steps or logical reasoning onto AI that they would otherwise have to carry out themselves. This process leads to a reduction in deep cognitive processing of information, which in turn weakens the long-term retention of knowledge in memory. At the same time, cognitive offloading can turn the process of learning, acquiring knowledge, and building genuine understanding into mere mechanical task completion (Besas et al., 2026). Drawing a comparison of the findings discussed so far, we can conclude that the risk of cognitive passivity is not caused by the technology itself but by its uncritical and passive use. It is therefore essential, when using AI tools in the self-directed learning process, to use them as a *"scaffold,"* that is, as a form of support that allows students to ask questions while still thinking about the context, critically evaluating their reasoning, and understanding problems — rather than merely passively generating answers.

**3.2.5 Limitations of AI tools in the self-directed learning process**

Within the process of AI-assisted self-directed learning, there are various limitations inherent to the tools themselves. According to the findings of the scientific studies, these errors are not merely a technical imperfection; they can affect the quality of education and students' critical thinking. Based on the results of the thematic synthesis, the most significant limitation of artificial intelligence is its tendency to provide incorrect, incomplete, or outdated information. This results from the fact that large language models (such as ChatGPT) may misinterpret the context of a question or prompt and therefore generate factually incorrect responses, or even *"hallucinate."* [5](Wang et al., 2025). Researchers Viadero-Monasterio et al. (2026) also point out that students sometimes fail to realize that the hallucinations generated by artificial intelligence are often not immediately obvious and can easily be overlooked. The results of the study also show that while 50% of students were able to recognize incorrect information, only 18% of them regularly checked external sources to verify the accuracy of the answers. At the same time, the quality of responses depends heavily on how the prompt is formulated, with imprecisely worded questions leading to vague or irrelevant answers (Viadero-Monasterio et al., 2026). Students often lack sufficient skills to use AI tools correctly, which leads to frustration (Shikina, 2025). A teaching model based on the flipped classroom could have the potential to reduce these risks. This is demonstrated by the experimental study of Yavuz et al. (2025), in which students engaged with the learning materials at home and used AI tools in the classroom. This approach helped improve the overall level of AI literacy among the students who took part in the experiment (Yavuz et al., 2025). We can therefore say that the use of AI tools proved effective in improving AI literacy when practically applied within the teaching process in the presence of educators. These findings are further supported by those of a study focused on the use of AI tools for self-directed language learning within informal education. Based on the results, the scholars concluded that although AI is a useful technological tool, it is not, on its own, the only factor in self-directed learning. It can effectively serve as a facilitator and supplement, but AI cannot be regarded as a full substitute for the process of self-directed learning, or for the internal cognitive work an individual must invest in order to acquire knowledge or skills. The researchers also recommend incorporating AI into a broader ecosystem of educational tools, since it offers a high degree of personalization and flexibility, but in the context of self-directed learning it works best as a supplementary resource strategically linked with other established methods and tools (Li et al., 2024).

**3.2.6 Ethical dilemmas in the use of AI tools**

The final analytical theme extracted from the thematic synthesis of findings concerns the ethical dilemmas related to the use of artificial intelligence tools in the self-directed learning of the younger generation. In this context, scholars point in particular to the dilemma of where the boundaries of a student's authorship lie when using AI. According to Posavec (2026), students are often unsure how to balance the contribution of artificial intelligence with their own authorship. This raises questions about personal responsibility and academic integrity (Posavec, 2026). Another problematic aspect of ethics in the use of AI tools, according to Zou et al. (2026), is the student's own approach — that is, whether they use these tools "mindlessly" or as a supplement to conscious reasoning. Within the learning process, a tension arises between fast, automated behavior and the need for deep reflection. According to the study's findings, ethical awareness functions as a *"cognitive brake"* that forces students to step out of automated mode and switch into conscious, analytical reasoning. According to the author, however, the very nature and speed of the technology tempts students toward mindless dependence, which the student must consciously guard against in order to preserve their intellectual autonomy (Zou et al., 2026). The final ethical dilemma emerging from the thematic synthesis of findings and the selected studies is algorithmic bias. Wang and Guo (2025) note that the use of artificial intelligence carries an ethical risk associated with algorithmic bias and data inaccuracies. If students merely

[4] The term *"cognitive rigidity"* can be understood literally as *"cognitive inflexibility."* Cognitive rigidity refers to difficulty adapting one's thinking or behavior in response to new information, challenges, or perspectives. This mental inflexibility can limit one's ability to solve problems, connect with others, and thrive in changing environments (My LA Therapy, 2025).

[5] *"Hallucinations"* in generated content are when AI tools create incorrect, misleading, or nonexistent content. The content can include facts, source citations, code, historical events, and other real-world information (University Library – LibGuides, 2026).

passively accept outputs without critical reflection, they risk internalizing such distorted information without realizing it, which undermines the ethical dimension of self-directed learning (Wang & Guo, 2025). A sufficient level of ethical awareness helps students clearly define the boundaries of acceptable AI use, thereby reducing perceived risk and strengthening their conscious intent to use the tool responsibly (Zou et al., 2026).

### 3.3 Synthesis of findings in relation to the main research question

The main research question seeks to answer what aspects of artificial intelligence use in the self-directed learning process of Generation Z, in terms of their impact on the effectiveness of this type of learning, appear in the findings of the studies included in the systematic review. Based on the thematic synthesis, we can say that scholars have identified, through their research, various aspects of AI tool use that can function as support for students within the self-directed learning process. AI can serve as a safe and personalized tutor, since it does not provoke anxiety, fear, or frustration in students. According to the findings, AI tools also support the process of metacognition. Properly harnessed interaction with a chatbot can help students develop metacognition through improving their ability to write clear prompts, receiving feedback, or even through the ability to visualize their progress in graphs. AI tools also have the potential to develop both the cognitive and affective aspects of individuals. Across all of these aspects, it is crucial that students can make the best use of these supportive features of AI tools only under the condition that they use them as support, or as a *"scaffold,"* rather than solely to generate ready-made answers without critical reflection. Researchers also point to risk-related aspects of AI tool use. The results of the thematic synthesis show that the main risk of AI use in the self-directed learning process of Generation Z is excessive reliance on its outputs, which can lead to cognitive passivity, weakened critical thinking, reduced creativity, and a diminished ability to solve problems independently. Passively accepting answers promotes superficial learning, reduces long-term retention of knowledge, and increases the risk of plagiarism. One limitation of AI use is also the risk of generating inaccurate, incomplete, or outdated information, which students often fail to sufficiently verify, and the quality of the answers depends on the ability to formulate appropriate prompts. Other risk-related aspects include insufficient AI literacy, which can lead to frustration and the ineffective use of the tools. Within the thematic synthesis, we also identified ethical dilemmas. These relate to the boundaries of authorship, academic integrity, and algorithmic bias.

## 4 Conclusion

The aim of this paper was to identify and synthesize the positive and negative aspects of using artificial intelligence in the self-directed learning processes of Generation Z through a systematic literature review conducted in accordance with the PRISMA framework and a qualitative thematic synthesis following Thomas and Harden (2008). Based on the analysis of selected scholarly studies, it can be stated that artificial intelligence holds supportive potential for self-directed learning. AI can serve as a personalized and safe source of feedback, foster the development of metacognition, and positively influence students' cognitive and affective experiences during learning. However, this potential is realized most effectively when students approach AI as a tool that supports their own thinking rather than as a means of replacing their cognitive work. At this juncture, the positive and negative aspects of AI use converge — the same feature of AI, namely real-time availability that promotes learning, may, when used uncritically, become a source of cognitive passivity, superficial learning, or even plagiarism. The findings of the thematic synthesis also point to limits of the technology itself as well as limits of users, along with ethical concerns related to authorship boundaries and algorithmic bias. From this follows that the effectiveness of AI-supported self-directed learning among young people is not determined by the technology alone but by the degree of critical reflection with which students employ it. The present systematic review has its own limitations. The included studies differ methodologically (quantitative, qualitative, and mixed-methods designs) and in sample size, which restricts the generalizability of the synthesized findings. The review was also limited to studies published in English, Slovak, and Czech and to the period 2024–2026, which may have unintentionally excluded relevant older or linguistically different scholarly sources.

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