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AI chatbots as Open Educational Resources: Enhancing student agency and Self-Directed Learning

I chatbot AI come Risorse Educative Aperte: potenziare l'efficacia della partecipazione nel processo educativo e l'apprendimento autoregolato dello studente

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ABSTRACT In modern education, self-directed learning (SDL) is paramount. SDL empowers learners, OERs democratize access, and AI chatbots, as virtual companions, offer enriched learning experiences. Balancing AI's advantages and challenges in education is vital. This paper explores AI chatbots' role in promoting SDL and student autonomy, highlighting their potential to guide and empower learners in navigating the knowledge landscape. By uncovering this potential, the study encourages educators and learners to embrace AI chatbots as partners in achieving self-directed, limitless education.

KEYWORDS Self-Directed Learning; Student Agency; AI Chatbots; Self-Regulated Learning; Open Educational Resources.

SOMMARIO Nell'istruzione moderna, il Self-Directed Learnig (SDL) è fondamentale. Il SDL conferisce potere agli studenti, le OER (risorse educative aperte) democratizzano l'accesso e i chatbot AI, come compagni virtuali, offrono esperienze di apprendimento arricchite. Bilanciare i vantaggi e le sfide dell'IA nell'istruzione è essenziale. Questo articolo esplora il ruolo dei chatbot AI nel promuovere l'SDL e l'autonomia degli studenti, evidenziando il loro potenziale nel guidare e rafforzare gli studenti nella navigazione del panorama della conoscenza. Scoprendo questo potenziale, lo studio incoraggia gli educatori e gli studenti ad accettare i chatbot AI come partner per raggiungere un'istruzione auto-diretta e senza limiti.

PAROLE CHIAVE Self-Directed Learning; Agency dello Studente; Chatbot AI; Apprendimento Autoregolato; Risorse Educative Aperte.

1. Introduction

The integration of technology in education has fundamentally transformed the way students access and engage with learning materials. One groundbreaking development on this frontier is the emergence of Artificial Intelligence (AI), particularly AI chatbots. While there exists a somewhat negative

perception of AI in education due to the challenges it may pose, it is imperative to strike a delicate balance between the advantages offered by AI chatbots and the potential obstacles they present. This conceptual paper explores literature about self-directed learning (SDL), student agency and the use of AI chatbots as open educational resources (OERs) to delf into their potential to not only facilitate learning but also to foster an environment where students take the reins of their education, making informed choices and pursuing knowledge in a more self-regulated manner. OERs are educational materials that are freely accessible and openly licensed, enabling users to legally engage in activities such as use, adaptation, and redistribution. These resources encompass a wide range of digital assets, including textbooks, multimedia content, learning assessments, and increasingly, chatbots and open internet resources. In this exploration, we uncover the multifaceted ways in which AI chatbots, when integrated into educational settings, can elevate the concept of SDL, and enhance student agency.

2. Rationale and Problem statement

In the fast-evolving landscape of education, the concept of learning has transcended traditional boundaries (Yang & Kongjit, 2022). Today, the pursuit of knowledge is not confined to the classroom or tethered to a set curriculum. Instead, it is increasingly becoming a self-directed pursuit, driven by individual curiosity and the quest for lifelong learning (Vázquez, 2017). This paradigm shift is at the heart of SDL, a pedagogical approach that places learners at the helm of their educational journey, fostering autonomy, motivation, self-regulation, and a profound sense of ownership over the learning process (Chen et al., 2023).

It is important to first distinguish between SDL, self-regulated learning (SRL) and student agency. These three related constructs have been used ambiguously in the literature (Taub et al. 2020). These concepts can also be confused with similar terms like autonomous learning, self-planned learning, self-teaching and independent study (Saks & Leijen 2013). Self-directed learning is an adult-education concept, also called andragogy, developed by the American adult educator Malcolm Shepherd Knowles. Knowles (1975:18) defines SDL as "[A] process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes". Situated in cognitive psychology, as a micro-level construct, SRL is "the process through which individuals control their own learning from a cognitive, meta-cognitive, behavioural, emotional and motivational point of view" (Bartolomé et al., 2010). Then, student agency is characterized by one's intentionality, forethought, self-reactiveness, and self-reflectiveness, which enable a student to ensure an activity occurs (Bandura, 2001). In essence, in this study SDL is viewed as the overarching paradigm, with SRL and student agency operating as integral components within its educational framework (Figure 1). The figure highlights SDL as a broader, macro-level construct enveloping SRL and student agency within smaller circles to indicate relatedness as narrower micro-level constructs, all situated within the overarching framework of life-long learning.

The acquisition of 21st-century skills has become not merely advantageous but essential for individuals seeking academic and professional success (Murshidi, 2017). These skills encompass critical thinking, problem-solving, effective communication, collaborative teamwork which are sought-after workplace skills, whereas digital literacy, adaptability, and a steadfast commitment to self-directed and lifelong learning has become paramount for success in the fourth industrial revolution (Jagals, 2020). As traditional educational paradigms undergo significant transformation in the wake of Education 4.0

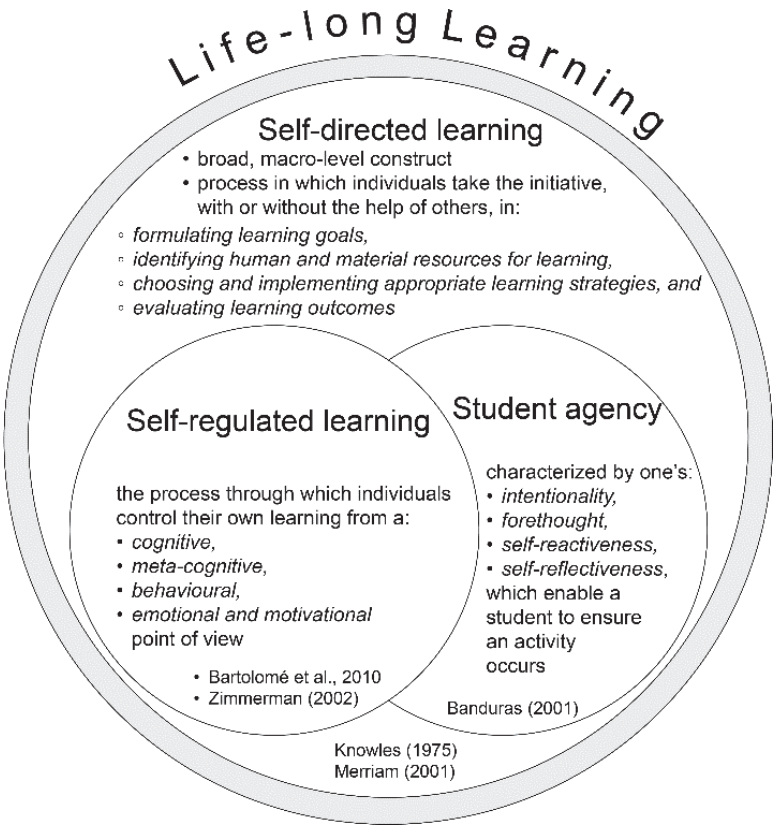

Figure 1. Schematic illustration depicting the hierarchical relationship among key constructs in learning theories, namely self-directed learning (SDL), self-regulated learning (SRL), and student agency to visualise how these constructs are viewed in this paper.

(Moraes et al., 2023), the concept of SDL has risen to prominence as an educational approach that not only fosters these critical skills but also harmonizes seamlessly with the demands of the 21st century (Shamsuddin et al., 2017).

The significance of this study lies in the intersection of three compelling forces shaping modern education: SDL, OERs and AI. SDL, often regarded as the pinnacle of student agency, empowers individuals to take charge of their learning paths, fostering a deep sense of motivation and relevance (Chen et al., 2023). OERs embody the spirit of open knowledge-sharing, democratizing education by providing free and accessible resources to learners worldwide (Zulaiha & Triana, 2023). While AI chatbots are intelligent virtual companions designed to effectively assist and enrich the process of learning (Han et al., 2022). There might exist a somewhat negative perception of AI in education due to the challenges it may pose. It is imperative to strike a delicate balance between the advantages offered by AI chatbots and the potential obstacles they present. (Mair et al., 2023; Moldt et al., 2023).

This study seeks to answer a fundamental question: What is the potential of AI chatbots as Open Educational Resources to enhance student agency and self-directed learning? To address this question, we will delve into the multifaceted dimensions of SDL and student autonomy, examining the potential of AI chatbots as OERs to assist students in taking ownership of their educational destiny. By embarking on this exploration, we aim to shed light on the symbiotic relationship between technology and education, paving the way for a new era of self-directed, AI-augmented learning experiences.

This paper is strategically tailored for a diverse audience encompassing educators, academic researchers, policymakers, practitioners in technology-enhanced learning, and students engaged in higher education. For educators and curriculum designers, the study offers insights into integrating AI chatbots to enhance learner autonomy and 21st-century skills. Students benefit by understanding how AI chatbots can be virtual companions, assisting them in navigating the knowledge landscape and taking control of their educational journey. The research adds to the academic discourse on the evolving educational landscape, emphasising the balance needed for AI chatbots. Ultimately, it serves as a catalyst for informed decision-making, advocating for accessible and democratised education on a global scale by promoting the sharing of knowledge resources through AI chatbots, thereby breaking down geographical and financial barriers.

3. Literature review

3.1. Self-directed learning

In the contemporary age, the demand for SDL has grown significantly. SDL represents an educational paradigm where individuals assume primary responsibility for planning, initiating, and managing their own learning process. SDL fosters autonomy, motivation, and a lifelong commitment to learning (Lew et al., 2020). Its relevance spans diverse educational settings, including formal education, workplace training, and personal development, empowering individuals to cultivate self-reliance, intrinsic motivation, and a continuous learning ethos (Shamsuddin et al., 2017; Xiao-hong et al., 2018).

In contrast, traditional classroom environments often employ didactic methods, resulting in passive student roles (Yuan, 2018). Wang and Walkington (2023) argue that students in such settings may lack motivation. Conversely, active learning thrives when learners engage in self-directed educational journeys, driven by their eagerness to pursue authentic challenges (Suroto et al., 2022). Guglielmino (1977) outlines the characteristics of highly self-directed learners, emphasizing qualities like initiative, independence, and persistence. Such learners also display self-discipline, curiosity, and self-confidence (Okafor, 2022).

Integrating SDL techniques aims to mimic how individuals naturally acquire knowledge (Dewi & Primayana., 2019). Therefore, learners must realize the importance of their knowledge, attitudes, and SDL skills in active learning (Adnan & Sayadi, 2021) and understand that educators now serve as facilitators rather than exclusive sources of information (Saks & Persky, 2020). Educators play a pivotal role in guiding learners toward greater self-direction (Leahy & Smith, 2021). They should help learners plan, execute, and evaluate their own learning. Educators should grant learners more autonomy, particularly in resource identification and alternative learning methods (Yuliansyah & Ayu, 2021) and offer options for resource utilization, learning approaches, and objectives (Loeng, 2020). They should also challenge learners, provide constructive feedback, and promote critical thinking (Song et al., 2022; van Woezik et al., 2021). An open and trusting environment encourages student engagement and questioning (van Woezik et al., 2021).

3.2. Student Agency

In the 21st century, the concept of student agency holds profound relevance and significance in education (Stenalt, 2021). It represents a shift from traditional, teacher-centred approaches to a more learner-centred paradigm (Borokhovski et al., 2018). Student agency encompasses the capacity and inclina-

tion of learners to actively participate in their educational journey, making choices, setting goals, and taking ownership of their learning experiences (Tong & An, 2022). While a multifaceted concept, fundamentally involves students' ability to make choices and decisions regarding their learning (Tong & An, 2022). This sense of agency is rooted in several psychological and educational theories.

One prominent theory underpinning student agency is Bandura's social cognitive theory (Bandura. 1982), which emphasizes the role of self-efficacy in shaping human behaviour (Klemenčič, 2015). Self-efficacy refers to an individual's belief in their ability to accomplish tasks and achieve goals. In the context of student agency, high self-efficacy is associated with learners' confidence in their capacity to take charge of their learning process (Ahrens, 2022; Ngarisan et al., 2022). Another relevant theoretical framework is Deci and Ryan's self-determination theory (SDT) (Deci & Ryan, 1985). SDT posits that individuals have innate psychological needs for autonomy, competence, and relatedness (Chiu & Chai, 2020; Klemenčič, 2015). Autonomy, in particular, aligns closely with the concept of student agency. It suggests that individuals are inherently motivated when they have a sense of control and volition over their actions (Lozano-Jiménez et al., 2021). In the educational context, fostering autonomy corresponds to empowering learners to make choices, set goals, and determine their learning path (Zhou, 2021), all of which are central to SDL. Vygotsky's sociocultural theory (Vygostsky, 1987) highlights the importance of social interaction and collaboration in learning. student agency, while often seen as an individual attribute, can also be cultivated through social interactions and collaborative learning experiences (Torres & LePeau, 2022). When learners have opportunities to engage with peers, share their perspectives, and collectively shape their learning environment, they are more likely to develop a sense of agency (Moissac et al., 2020).

The integration of student agency into the educational process can significantly enhance the practice of SDL. When learners are equipped with the skills, mindset, and motivation to take ownership of their learning, they are better prepared to engage in self-directed learning activities (Djatmika et al., 2022). Educators have at their disposal a range of strategies to facilitate the cultivation of student agency, thereby enhancing SDL. Educators can offer learners the opportunity to exercise agency by providing them with choices regarding their learning journey. This may involve allowing learners to select what they learn, how they learn it, and how they demonstrate their understanding (Wehmeyer, 2022). The provision of flexible learning pathways and diverse assessment methods allows learners to personalize their educational experiences according to their preferences and interests (Liu et al., 2018). Learners should be encouraged to establish both short-term and long-term learning goals that can infuse a sense of purpose and direction into their educational endeavors. Educators can guide learners in formulating SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goals that align with their individual aspirations. The act of setting and pursuing these goals reinforces agency by putting learners in control of their educational trajectory (Chitra et al., 2022). The development of metacognitive skills, such as self-reflection and self-assessment, plays a pivotal role in fostering agency and is closely intertwined with SDL. By honing these skills, learners can effectively monitor their progress and make informed decisions about their learning strategies (Wong & Kan, 2022).

Although SDL often emphasises independent learning, collaborative experiences can serve as a catalyst for agency development. In collaborative settings, learners can assume leadership roles, engage in negotiations, and establish learning goals (Nazarianpirdosti et al., 2021). These interactions empower learners to actively shape their learning experiences, fostering a sense of agency within a cooperative framework. Encouraging regular feedback and self-reflection equips learners with the tools needed to assess their learning strategies and make adjustments as necessary (Rapi et al., 2021). When learners

engage in reflective practices and seek feedback from peers and educators, they become more adept at self-directed learning. Educators can create an inclusive classroom environment characterized by trust, open communication, and a growth mindset (Liu et al., 2018). Such an environment is conducive to nurturing student agency. When learners feel secure in taking risks and making choices, they are more likely to engage in SDL with confidence (Van Wyk, 2017). Establishing a supportive learning community fosters a sense of agency among learners, empowering them to take an active role in their education (Hostetter et al., 2007) The integration of technology, including AI chatbots and other digital tools, presents opportunities to bolster student agency. These technological resources can provide learners with immediate access to educational materials, personalized learning experiences, and the autonomy to explore their interests independently (Wong & Kan, 2022).

3.3. Open Educational Resources

OERs have emerged as a catalytic force within the realm of education, fundamentally reshaping the landscape of knowledge generation, dissemination, and accessibility (Bahrawy, 2019). Distinguished by their open licenses, OERs empower users with a spectrum of rights, including the liberty to access, adapt, and share content without constraints (Huang et al., 2019). Typically available in digital formats, these resources offer unparalleled ease of distribution and customization. What sets OERs apart from conventional copyrighted materials are these open licenses, which not only liberate creators but also endow users with specific rights and freedoms, encompassing the modification, sharing, and distribution of educational materials (Downes, 2019). Among the most widely embraced open licenses for OERs are the creative commons licenses, providing creators with standardized options to select the degree of openness and flexibility they wish to imbue into their works (Huang et al., 2019).

At the core of OERs lie the foundational principles of accessibility and equity, intimately entwined, and together they underpin the transformative potential of OERs within the educational domain (Kinskey & Miller, 2019; Menzel, 2023). Traditional educational materials, often exemplified by expensive textbooks and learning resources, routinely pose substantial financial barriers for many learners. In stark contrast, OERs champion unimpeded accessibility, effectively dismantling the financial hurdles associated with procuring textbooks and educational content (Serrano et al., 2019). This affordability transcends economic boundaries, rendering education an achievable pursuit for individuals from diverse financial backgrounds (Huang et al., 2019). Through a steadfast commitment to creating accessible content, OER creators ensure that learners with varying needs can actively and inclusively engage with educational materials, thus nurturing a learning environment that accommodates a wide spectrum of learners (Ferri et al., 2020). Furthermore, OERs serve as a potent equalizer, bridging educational disparities by offering learners, regardless of their socioeconomic backgrounds, access to the same high-quality educational resources. This harmonization of educational opportunities mitigates discrepancies in educational access and outcomes, propelling the cause of educational equity. Additionally, OERs empower educators to customize materials to meet the unique requirements of their learners (Ujakpa et al., 2020).

OERs strongly advocates for open pedagogical practices that prioritize collaboration and learner-centred learning (Huang et al., 2019). These innovative approaches foster active engagement among learners from diverse backgrounds, thereby nurturing a sense of equity within the educational experience (Vlachopoulos & Makri, 2019). By embracing open pedagogies, educators cultivate inclusive learning environments that embrace and celebrate the diversity of their learners. Open pedagogies

have evolved in response to the evolving educational landscape, driven by technological advancements and a growing demand for more participatory and learner-centric approaches (Bali et al., 2020). Early forms of open pedagogy were rooted in the emergence of OERs, and these principles have since expanded to encompass a broader spectrum of openness in education (Nascimbeni & Burgos, 2019). Open access to educational materials laid the foundational groundwork for open pedagogical practices, extending beyond content to encompass collaborative, transparent, and inclusive teaching and learning approaches. In addition, open pedagogies prioritize transparency within teaching and learning processes (Seraphin et al., 2019). Educators openly share course materials, objectives, and assessment criteria, cultivating an environment of trust and collaboration among learners. Central to open pedagogies is the promotion of student agency, empowering learners to co-create content, define learning objectives, and shape their educational journeys, fostering a sense of ownership over their learning expedition (Nascimbeni & Burgos, 2019). Learners actively engage in collaborative projects, engage in peer evaluations, and contribute to the co-creation of open educational resources, thereby enriching their learning experiences.

3.4. AI chatbots in Education

The integration of Chatbot systems in education has witnessed a remarkable evolution, reflecting the continuous advancement of technology and the expanding applications of these intelligent conversational agents. Initially designed to automate administrative tasks and provide basic information, the development of natural language processing (NLP) and machine learning algorithms has propelled AI chatbots into multifaceted roles across various educational domains (Adıgüzel et al., 2023; Kamalov et al., 2023). In the realm of teaching and learning, chatbots have emerged as conversational agents, delivering course content and accurate information through online platforms (Adamopoulou & Moussiades, 2020; Okonkwo & Ade-Ibiijola, 2021). Notable free AI chatbots such as ChatGPT, Google Bard, Microsoft Bing AI, Lyro, Drift, ChatSpot, and MobileMonkey have played pivotal roles in transforming educational experiences. Educators now recognize their value in creating engaging learning experiences, allowing students to ask questions and receive personalised assistance (Medeiros et al., 2018; Chen et al., 2020; Wu et al., 2020). Administratively, chatbots have contributed to areas such as orientation, recruitment, and retention, optimising services and enhancing cost efficiency (Ranoliya et al., 2017; Hien et al., 2018; Lee et al., 2019;). Moreover, they've become integral to student assessments, powering automated and intelligent teaching systems that analyse and assess students' learning abilities (Ndukwe et al., 2019; Sreelakshmi et al., 2019; Durall & Kapros, 2020). In the context of research and development, these AI tools have supported students in STEM-related research concepts and information retrieval (Mckie & Narayan, 2019). While the advantages of chatbots in education are abundant, spanning content integration, quick access to information, motivation, engagement, multi-user accessibility, and immediate assistance, it's imperative to acknowledge potential challenges. Factors like content relevance, ethical considerations, and evolving AI landscapes in education require careful consideration for the optimal utilisation of chatbots (Durall & Kapros, 2020; Hien et al., 2018; Wu et al., 2020).

3.5. AI chatbots as Open Educational Resources

Within the transformative landscape of OERs marked by their open licenses and steadfast commitment to accessibility and equity, there lies an opportunity to amplify their impact through the strategic

integration of AI chatbots. OERs have already revolutionized the educational landscape, reshaping how knowledge is generated, shared, and accessed (Bahrawy, 2019; Huang et al., 2019). Their open licenses, granting users the freedom to access, adapt, and share content freely, are pivotal in making education more inclusive and affordable. AI chatbots, harnessed for their advanced capabilities in AI and natural language processing, have emerged as transformative educational tools (Wang and Walkington., 2023). These intelligent companions possess the capacity to hyper-personalize learning experiences, offer instant access to a wealth of educational resources, provide timely guidance, and feedback, and nurture a sense of autonomy among learners.

When we seamlessly merge AI chatbots with the principles of OERs, a powerful synergy emerges. One of the cornerstones of OERs is accessibility, and AI chatbots can further enhance this aspect by providing learners with immediate access to resources and personalized support (Serrano et al., 2019). Regardless of a learner's location or time constraints, AI chatbots are available around the clock, breaking down traditional barriers to learning access. Moreover, these chatbots can adapt content to meet diverse learner needs, including those with disabilities, thereby promoting inclusive education (Ferri et al., 2020).

AI chatbots also extend the adaptability of OERs, allowing learners to interact with educational materials in a dynamic and responsive manner. Through natural language interfaces, chatbots engage with learners to understand their specific goals, preferences, and challenges, tailoring content recommendations and learning pathways accordingly (Ujakpa et al., 2020). Learners are empowered to navigate their educational journey with flexibility and personalization, aligning seamlessly with the principles of learner-centred learning. By promoting collaboration, transparency, and student agency, AI chatbots can also enhance open pedagogical practices (Nascimbeni & Burgos, 2019). Learners can collaborate with chatbots in problem-solving, engage in peer-reviewed assessments, and even participate in the co-creation of open educational resources (Bali et al., 2020). The transparency of AI chatbots in providing learning support and guidance cultivates trust within the learning community, fostering a culture of collaboration among learners (Seraphin et al., 2019).

Central to the integration of AI chatbots within OERs is the promotion of student agency (Nascimbeni & Burgos, 2019). Learners, guided by these intelligent companions, have the autonomy to co-create content, set learning goals, and shape their educational experiences. This active involvement empowers learners to take ownership of their learning journey, aligning seamlessly with the principles of SDL and open pedagogies. Learners can engage in self-directed projects, explore topics of interest, and receive personalized guidance from chatbots, thus enriching their learning experiences. Therefore, the strategic integration of AI chatbots within OERs represents a harmonious partnership that amplifies the transformative potential of both technologies. AI chatbots enhance the accessibility, adaptability, and effectiveness of OERs, aligning seamlessly with the principles of openness and equity. By fostering student agency and promoting self-directed learning, this integration empowers learners to take charge of their educational journeys, navigate the complex landscape of knowledge, and thrive in the 21st century.

The role of AI chatbots as Open educational resources in promoting Self-directed learning The integration of AI in education has garnered both excitement and scepticism (Rainey et al., 2021). While some still have a negative sentiment towards AI's role in education due to concerns about the depersonalisation of education, quality control, and overreliance on technology, it is crucial to emphasise that AI, when harnessed effectively, can serve as a powerful tool to enhance student agency and SDL (Rainie et al., 2021; Schiff, 2021;). It is essential to clarify that the integration of AI chatbots as OERs is

not about substituting human educators but augmenting their capabilities (Kasneci et al., 2023). These AI chatbots are designed to complement the learning experience, providing learners with additional support, resources, and opportunities for personalised learning. AI chatbots, when integrated strategically, can play a pivotal role in fostering learner agency (Rainie et al., 2021). AI chatbots, as OERs, offer several advantages in this regard. Firstly, they provide learners with immediate access to a vast array of educational resources. This access empowers learners to explore topics of interest independently, facilitating the development of autonomy and self-directedness (Wang & Walkington, 2023). Moreover, AI chatbots can personalise learning experiences, tailoring content and activities to individual needs and preferences (Hannan & Lui, 2023). This level of customization not only engages learners but also nurtures their sense of ownership over their learning journey. However, it is crucial for facilitators to recognize and respect the individual variations in students' levels of self-directedness, tailoring their support and guidance accordingly to foster a personalized and effective learning experience for each student. Educators can effectively utilize Grow's 1991 Self-Directed Learning (SDL) model (Grow, 1991) as a framework to assist them in tailoring their teaching approaches across the four stages—coaching, guiding, facilitating, and empowering. One of the key components of SDL is the ability to set goals and make choices about what and how to learn. AI chatbots can assist learners in this process by helping them define learning objectives, suggesting relevant resources, and tracking progress (Hannah & Lui, 2023; Rainie et al., 2021). For instance, an AI chatbot can guide a learner through the creation of a learning plan, breaking down long-term goals into manageable steps. This guidance aligns with the concept of SDL, where individuals take the initiative to design their learning experiences based on their specific needs and interests.

Additionally, AI chatbots can provide timely feedback and support. They can offer explanations, answer questions, and even engage in interactive learning activities (Limna et al., 2023). This immediate feedback not only enhances the learning experience but also bolsters learners' self-efficacy—the belief in their ability to accomplish tasks and achieve goals. When learners feel supported and capable, they are more likely to take ownership of their learning process. While highlighting the potential of AI chatbots in enhancing student agency and SDL, it is essential to acknowledge and address ethical considerations. (Adnan & Sayadi, 2021). These include issues related to data privacy, algorithmic bias, and equitable access to technology. Educators and policymakers must work collaboratively to establish ethical guidelines for the use of AI in education, ensuring that it serves all learners, regardless of their background or circumstances. The negative perceptions associated with AI in education should not overshadow its potential to enhance student agency and SDL. When used judiciously, AI chatbots as OERs can empower learners to take charge of their educational journey, aligning with the principles of SDL. Educators and institutions should embrace AI as a valuable ally in education, recognizing that it can augment human teaching and learning, equipping learners with the skills and autonomy needed to thrive in the 21st century. From the literature discussed above a list of guidelines is compiled for the use of AI chatbots as OERs to enhance SDL and student agency (Table 1).

The teaching-learning strategy of inquiry-based learning (IBL) can seamlessly incorporate AI chatbots as OERs by following this set of proposed guidelines (Table 1). First, these chatbots can aid learners in goal setting and progress tracking by assisting in the formulation of clear and measurable objectives while continuously monitoring and providing constructive feedback on their advancement. Furthermore, AI chatbots can offer immediate feedback and support for inquiries, fostering a sense of accountability and facilitating an SDL approach. They can also recommend relevant learning resources, progressively guiding learners through scaffolded activities that increase autonomy over time. The

Table 1. Guidelines for the use of AI chatbots to enhance SDL and student agency.

Nr	Guideline	Sources
1	Strategic Integration of AI Chatbots: Carefully plan and integrate AI chatbots into the educational environment to complement, not replace, human educators. Ensure that their role aligns with fostering SDL and student agency.	Kasneci et al. (2023). Schiff (2021); Rainie et al. (2021).
2	Hyper-personalized Learning Paths: Utilize AI chatbots to offer personalized learning experiences. Tailor content, resources, and activities to learners' individual needs and preferences, allowing them to choose their learning paths.	Hannan & Lui (2023); Tong & An (2022); Ahrens (2022).
3	Goal Setting and Progress Tracking: Implement AI chatbots to assist learners in setting clear, measurable learning goals. Chatbots can also track and provide feedback on learners' progress towards these objectives, fostering a sense of accountability.	Suroto et al., (2022); Nazarianpirdosti et al. (2021); Wang & Walkington (2023).
4	Immediate Feedback and Support: Leverage AI chatbots to provide instant feedback on assignments, assessments, and questions. Ensure that chatbots offer constructive feedback that encourages reflection and improvement.	Song et al. (2022) van Woezik et al. (2021); Limna et al. (2023).
5	Resource Recommendations: AI chatbots can suggest relevant learning resources, such as articles, videos, or interactive modules, based on learners' interests and learning objectives. Encourage learners to explore these resources independently.	Loeng (2020); Yuliansyah and Ayu (2021).
6	Scaffolded Learning: Gradually introduce learners to self-directed learning with the support of AI chatbots. Begin with structured activities and gradually increase autonomy as learners become more comfortable with SDL.	Lalitha & Sreeja (2020; Chitra et al. (2022).
7	Skill Development: Incorporate AI chatbots to help learners develop essential SDL skills, such as self-regulation, time management, and critical thinking. Offer guidance on how to navigate SDL effectively.	Wong & Kan (2022); Djatmika et al. (2022).
8	Peer Collaboration: Promote collaborative SDL by using AI chatbots to facilitate peer interactions and group projects. Encourage learners to take on leadership roles within these collaborative activities.	Torres & LePeau (2022); Huang et al. (2019).
9	Develop reflective practices: Reflection is central to SDL skill development. Mindfully plan to include reflective activities, e.g. on learning progress and their own thinking.	Ojeda-Ramirez et al. (2023).
10	Ethical Use of AI: Emphasize the ethical use of AI chatbots, including considerations related to data privacy and algorithmic bias. Ensure that learners understand the limitations and potential biases of AI systems.	Schiff (2021); Rainie et al. (2021).

integration of AI chatbots is instrumental in developing crucial SDL skills, including self-regulation, time management, and critical thinking, providing tailored guidance for effective learning. Moreover, these chatbots can foster peer collaboration by facilitating interactions and group inquiries, encouraging learners to assume leadership roles within such collaborative endeavors. To ensure responsible and reflective practices, IBL should include discussions on the ethical use of AI, addressing concerns related to data privacy and algorithmic bias, and ensuring learners comprehend the limitations and potential biases of AI systems. This approach not only aligns with IBL principles but also harnesses the capabilities of AI chatbots to enhance the learning experience. Table 2 suggests student and teacher roles and how the AI chatbot might be integrated.

4. Conclusion

The concepts of SDL and student agency have emerged as pivotal components for equipping learners with the skills and mindset needed to thrive in the 21st century. This paper has explored the

Table 2. Roles suggested for the teacher and the students during an IBL activity with AI Chatbot integration.

Roles	Use case of AI chatbots during IBL activity
Teacher	
Facilitator	Use chatbots to generate open-ended questions for discussions. Design inquiry tasks that utilize chatbots to guide student research.
Mentor / Coach / Guide	Continuously provide guidance on effective interaction with chatbots. Address challenges or misconceptions encountered while using chatbots.
Evaluator	Review progress reports generated by chatbots to assess individual progress. Assess students' critical thinking based on chatbot feedback.
Monitor	Monitoring student progress is crucial during the entirety of the activity where the integration of AI chatbots is used. It is also important for the teacher to monitor the level of each student's SDL skills in order to cater for the diversity in digital literacy.
Student	
Active participant	Ask probing questions to deepen understanding using chatbots. Seek clarifications on complex concepts or information from chatbots.
Researcher	Actively explore learning resources suggested by chatbots. Cross-reference information obtained from chatbots with other sources.
Goal setter	Collaborate with chatbots to set clear, measurable learning goals.
Learning monitor	Task coordination and progress tracking can be supported by Chatbots assigning specific tasks and responsibilities to group members. For instance, the chatbot could help distribute research subtopics or outline individual contributions. Through regular check-ins with the chatbot, students provide progress updates on their tasks. The chatbot compiles this information, allowing the group to track overall progress.
Collaborator	Engage in collaborative activities facilitated by chatbots via group research and information sharing. Students can use chatbots to initiate group research projects. For example, the chatbot could suggest a broad topic, and students collaboratively refine it. Share findings and insights with peers using chatbots.
Reflective learner	Reflect on progress reports generated by chatbots.
Responsible user	Reflect on the ethical use of AI while interacting with chatbots. Report ethical concerns or issues encountered with chatbots to the teacher.

interplay between SDL, student agency, and the integration of AI chatbots as OERs, highlighting the transformative potential of this synergy. We began by recognizing the significance of SDL in nurturing essential 21st-century skills, including critical thinking, adaptability, digital literacy, and a commitment to lifelong learning. However, traditional educational models often struggle to fully harness the potential of SDL, leaving learners facing barriers related to motivation, access to resources, and personalized guidance. In this context, AI chatbots, powered by advancements in artificial intelligence and natural language processing, have emerged as promising facilitators of SDL. When thoughtfully integrated as OERs, AI chatbots offer personalized learning experiences, immediate access to vast educational resources, timely guidance, and opportunities for learners to explore their interests independently. However, it is essential to strike a balance between the benefits and potential drawbacks of AI in education to ensure a holistic understanding of its impact on SDL and student agency.

In the planning and integration of tasks and activities involving AI chatbots, it is crucial to uphold the principles of Self-Directed Learning (SDL). The focus should be on empowering students to take charge of their learning experiences, fostering autonomy, and encouraging critical thinking. Incorporating AI chatbots within the framework of SDL principles ensures that technological

advancements align with educational goals, promoting a learner-centric environment. As education embraces AI, maintaining a balance between innovation and the core principles of SDL becomes paramount for cultivating a holistic and effective learning landscape. The provision of free access to such advanced technologies, as exemplified by the mentioned chatbots, is crucial for fostering inclusivity and ensuring that educational benefits are accessible to all, irrespective of financial constraints. The evolving landscape of AI applications in education emphasises the need for educators and institutions to navigate the integration of chatbots with a balanced consideration of their benefits and potential limitations.

The authors acknowledge that teachers may face limitations in adopting and integrating chatbots due to varying levels of technological proficiency, potential misalignment with pedagogical principles, a need for comprehensive professional development, perceived barriers to implementation, ethical and privacy concerns, and a limited awareness of AI capabilities. These challenges could impede the seamless incorporation of chatbots into educational practices, hindering the optimization of teaching-learning activities. The identified limitations underscore the importance of targeted professional development, ethical guidelines, and increased awareness to empower educators in effectively leveraging AI chatbots within the educational landscape. Addressing these challenges is crucial for promoting a more inclusive and technologically adept approach to teaching and learning.

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