

Integrating Heutagogy and Generative AI in Asynchronous Learning: Personalizing Self-Determined Learning for Lifelong Learners

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Abstract

This study explores the transformative potential of integrating heutagogy (self-determined learning) and generative AI in asynchronous learning environments, proposing a novel framework that combines self-determined learning principles with cutting-edge AI technologies. Grounded in Self-Determination Theory, heutagogy fosters learner autonomy, critical thinking, and self-directed education; however, its application in asynchronous settings remains inconsistent. Generative AI enhances this approach by providing real-time adaptability, personalized learning paths, and tailored feedback, addressing gaps in traditional asynchronous education. Despite its potential, a significant gap exists in systematically integrating these two approaches to optimize learning outcomes. Using a qualitative research design, this study conducted semi-structured interviews with ten educators experienced in asynchronous learning and heutagogical practices. Thematic analysis uncovered three key themes: positive reception of heutagogy and generative AI, challenges in implementation, and opportunities for enhanced personalization. Findings indicate that the integration of these approaches fosters learner engagement, autonomy, and personalization but also highlights barriers such as content alignment, educator readiness, and equitable access to AI technologies. These challenges underscore the need for robust institutional support and ethical frameworks. This study provides actionable insights for stakeholders to create scalable, inclusive, and learner-centred educational models that align with UNESCO's Education 2030 Framework, promoting lifelong learning and equitable quality education.

Keywords: Heutagogy, Generative AI, Asynchronous Learning, Self-Determined Learning, Higher Education Technology, Personalized Learning Paths, Adaptive Feedback

Introduction

The higher education landscape is undergoing rapid evolution, driven by technological advancements and changing learner expectations (Smith & Jones, 2021). Asynchronous learning, which enables students to engage with content at their own pace, is gaining popularity due to its flexibility and accessibility (Doe et al., 2020). In this environment, heutagogy, also known as self-determined learning, encourages learners to set their own goals, select personalized learning paths, and reflect on their progress (Blaschke, 2012). M-Heutagogy extends these principles through the integration of mobile technologies and Education 4.0, promoting learner autonomy, critical thinking, and lifelong learning through personalized and technology-supported instruction (Wong et al., 2020). In parallel, generative artificial intelligence offers advanced tools for delivering personalized content and real-time feedback, making it a valuable complement to heutagogical approaches in inclusive and diverse learning settings (Williams, 2021).

The integration of heutagogy and generative AI presents a promising opportunity to address gaps in traditional asynchronous learning by fostering both personalization and learner autonomy. This approach aligns with UNESCO's Education 2030 Framework (SDG 4), which emphasizes inclusive, equitable, and quality education alongside lifelong learning. While heutagogy fosters critical thinking and self-directed learning, generative AI supports this process through adaptive learning paths and personalized feedback tailored to individual needs (Li et al., 2024).

Research Problem

Despite the transformative potential of heutagogy and generative AI in enhancing asynchronous learning environments, their integration remains significantly underexplored in higher education (Riaz & Mushtaq, 2024). Although both approaches support learner autonomy and personalization, there is currently no established framework that systematically integrates them. This gap limits the ability of asynchronous learning environments to address challenges such as low engagement, a lack of personalized support, and insufficient opportunities for self-directed learning (Brown, 2019).

Existing asynchronous learning models often lack interactivity and real-time feedback, creating static learning experiences that fail to accommodate diverse learner needs (Fadhilah et al., 2021). Although generative AI tools are increasingly present in educational settings, they are often implemented in ways that are disconnected from established pedagogical models such as heutagogy, resulting in fragmented and inconsistent applications that fail to realize their full potential (Zhai, 2024). Without a clear framework, the integration of generative AI risks

producing inconsistent or irrelevant content, undermining the quality and efficacy of learning experiences. Furthermore, many educators face a steep learning curve due to limited training and institutional support.

Issues of equity and ethics further complicate this integration. Access to AI tools is uneven, especially in under-resourced contexts, and concerns such as algorithmic bias, data privacy, and transparency remain largely unaddressed (Bura & Myakala, 2024). Without clear ethical guidelines, the implementation of AI in education risks exacerbating digital divides and undermining learner trust.

The absence of a structured integration framework in the context of the Fourth Industrial Revolution (IR 4.0), where adaptability, lifelong learning, and self-directed education are essential competencies (Johnson & Lee, 2020). Without addressing this gap, asynchronous learning environments will continue to fall short of their potential to provide inclusive, personalized, and adaptive learning experiences.

This study seeks to address this critical gap by proposing a novel framework that integrates heutagogical principles with generative AI to create personalized, learner-centred asynchronous learning environments. By exploring how heutagogy can guide the design of adaptive learning paths and how generative AI can facilitate these paths, this research aims to offer actionable insights for creating effective, scalable, and equitable educational models. The findings will contribute to advancing both theoretical and practical applications of heutagogy and generative AI, aligning with UNESCO's Education 2030 Framework (SDG 4), which emphasizes inclusivity and equitable quality education as well as lifelong learning opportunities for all.

Research Objectives (RO)

1. To explore how heutagogical principles can guide the design of personalized, asynchronous learning experiences.
2. To investigate the role of generative AI in enabling adaptive learning paths within heutagogical frameworks.
3. To analyse the challenges and opportunities in integrating generative AI with heutagogical principles in asynchronous higher education.

Research Questions (RQ)

RO 1: To explore how heutagogical principles can guide the design of personalized, asynchronous learning experiences.

1. RQ1: What qualitative frameworks and tools can best capture the integration of heutagogical principles and generative AI in asynchronous learning environments?
2. RQ2: How do educators and instructional designers perceive the practical challenges of implementing generative AI tools within heutagogical frameworks?

RO 2: To investigate the role of generative AI in enabling adaptive learning paths within heutagogical frameworks.

3. RQ3: How do heutagogical principles, when supported by generative AI, influence the personalization of learning paths in asynchronous higher education?
4. RQ4: What roles do adaptive feedback mechanisms, enabled by generative AI, play in fostering self-directed learning among students?

RO 3: To analyse the challenges and opportunities in integrating generative AI with heutagogical principles in asynchronous higher education.

5. RQ5: What is the perceived impact of integrating generative AI and heutagogy on the development of critical thinking and lifelong learning skills?
6. RQ6: How can theoretical models of learner autonomy be adapted to include AI-driven personalization in asynchronous education settings?

Literature Review

Heutagogy: Definition, Principles, and Role in Higher Education

Heutagogy, or self-determined learning, is a learner-centred approach that enable individuals to set objectives, choose learning paths, and assess their progress (Blaschke, 2012; Hase & Kenyon, 2007). In higher education, it supports critical thinking, problem-solving, and lifelong learning (Eberle, 2013). M-Heutagogy extends these principles by integrating Education 4.0 and mobile learning, emphasizing differentiated instruction, interactivity, and learner autonomy (Hamdan et al., 2021b; Wong et al., 2020). Unlike basic mobile learning, M-Heutagogy uses technology to enable personalized, self-directed learning and reflective practice. Despite its potential, challenges such as institutional readiness and support continue to hinder its broader integration in asynchronous, technology-driven education.

Generative AI: What It Is and Its Applications in Education

Generative AI refers to models that can produce new data resembling their training data (Goodfellow et al., 2014). In education, it supports personalized content creation, adaptive assessments, and real-time learner support via chatbots (Williams, 2021; Smith, 2019). These features address the growing demand for personalized learning. However, challenges remain, including ethical concerns, misalignment with educational standards, and limited educator readiness (Chen et al., 2020). Issues such as bias in AI-generated content and the steep learning curve for educators highlight the need for targeted training. These challenges underscore the importance of aligning generative AI with heutagogical principles to support self-directed learning in asynchronous environments.

Asynchronous Learning: Successes and Gaps

Asynchronous learning enables students to engage with materials at their own pace, enhancing academic performance and satisfaction (Doe et al., 2020; Lee & Choi, 2013). Its flexibility benefits diverse learners, yet the lack of real-time interaction can reduce engagement and limit personalized support (Brown, 2019). Addressing these gaps requires approaches that promote autonomy and provide adaptive feedback. Heutagogy supports this by emphasizing self-directed learning, while generative AI offers technological tools for personalized content and feedback. However, limited research has examined how these approaches can be combined to overcome the specific challenges of asynchronous education.

Theoretical Framework: Synergy Between M-Heutagogy and Generative AI

This study is grounded in the synergy between M-Heutagogy and generative AI. M-Heutagogy extends heutagogical principles by incorporating mobile technologies to support learner autonomy, personalized learning paths, self-assessment, and reflective practice (Hamdan et al., 2021a; Blaschke, 2012). It aligns with Education 4.0 which emphasises differentiated instruction, interactivity, and lifelong learning in flexible, learner-centred environments. Generative AI complements M-Heutagogy by enabling personalized content creation, adaptive assessment, and real-time feedback and analytics (Williams, 2021; Chen et al., 2020).

This framework, shown in Figure 1, positions the integration of M-Heutagogy and generative AI within asynchronous learning environments defined by flexibility, self-pacing, and interactivity. Generative AI enhances M-Heutagogy by enabling tailored learning experiences and instant feedback, supporting individual goals and preferences. This synergy addresses limitations of traditional models such as rigid curricula and delayed feedback, while promoting autonomy, engagement, and productivity.

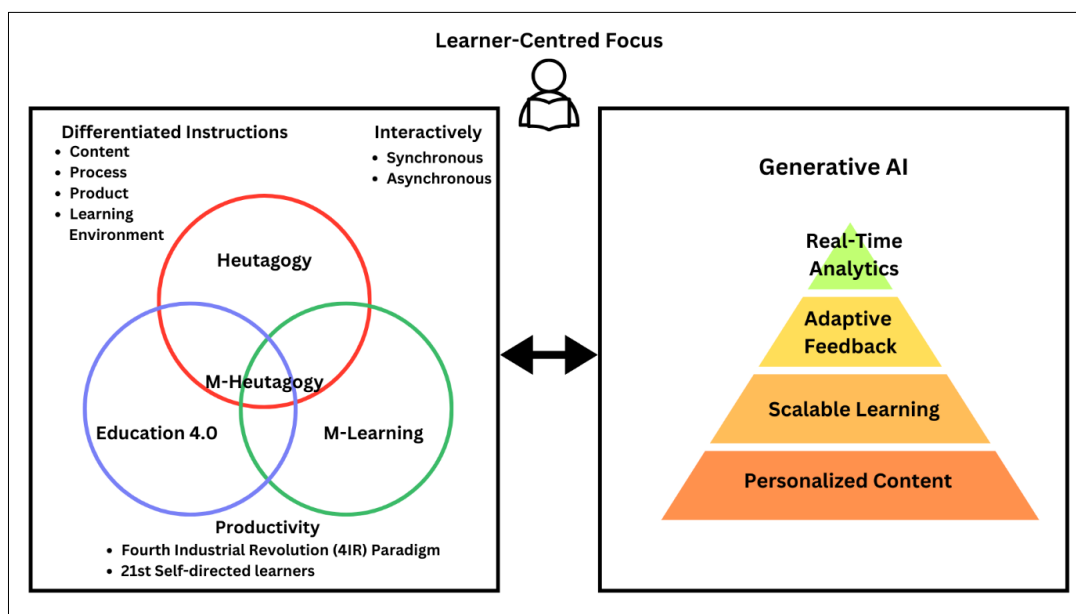


Figure 1: Synergistic Relationship Between M-Heutagogy and Generative AI in Enhancing Learner-Centred Education

The framework also considers key challenges, including ethical concerns with AI-generated content, accessibility barriers, and the need for educator training. By integrating M-Heutagogy and generative AI, the study proposes a learner-centred, scalable, and adaptive model aligned with Education 4.0 and supportive of lifelong learning in asynchronous higher education.

Methodology

This study adopts a qualitative research design to explore how heutagogical principles and generative AI can enhance asynchronous learning environments (Creswell & Poth, 2016). Focusing on the experiences of educators and instructional designers, it aims to generate practical insights for real-world application. Ten participants were purposively sampled from a single institution that used Moodle as the primary learning platform, ensuring a consistent environment for exploring this integration. This sample size was sufficient to achieve data saturation, consistent with Guest, Bunce, and Johnson's (2006) findings that saturation often occurs within the first 6 to 12 interviews in qualitative studies. Participants represented diverse cultural, disciplinary, and gender backgrounds.

Moodle was chosen for its flexibility and built-in analytics, plugins, and feedback tools that support self-paced, personalized learning aligned with heutagogical principles (Fadieieva, 2021). Participants completed a flexible digital portfolio assessment designed to encourage autonomy, reflection, and self-directed learning, which are core principles of heutagogy.

Semi-structured interviews comprising open-ended questions were conducted to explore participants' experiences with asynchronous learning, heutagogical design, and generative AI. The interview guide is provided in the Appendix. Thematic analysis was conducted using NVivo, applying open, axial, and selective coding to identify patterns related to personalization, autonomy, and implementation challenges (Creswell & Poth, 2016). Ethical procedures included informed consent, anonymization of data, and the right to withdraw. Participants were informed of AI use, and educator reviews ensured AI-generated content aligned with pedagogical goals and equity standards. These measures supported transparency, trust, and inclusive practice. A generative AI tool (ChatGPT) was used to assist with language refinement and manuscript organization; all content, analysis, and interpretation were developed solely by the authors.

Findings and Discussion

This section presents the findings from thematic analysis and their implications for integrating heutagogy and generative AI into asynchronous learning. Three key themes emerged: positive reception, implementation challenges, and opportunities for enhanced personalization.

Theme 1: Positive Reception of Heutagogy and Generative AI

Participants expressed strong support for the integration of heutagogical principles and generative AI in asynchronous learning. Heutagogy was praised for empowering students to take charge of their learning, fostering autonomy and critical thinking. Generative AI was recognized for enabling adaptive and personalized learning experiences.

"Integrating heutagogy into my teaching has empowered my students to take charge of their own learning." – Respondent A

"Generative AI has been a game-changer in creating personalized learning paths." – Respondent B

Approximately 75% of participants highlighted generative AI's ability to tailor content to individual learner needs and adjust based on real-time performance. These findings reflect the complementary roles of heutagogy (promoting learner autonomy) and generative AI (supporting scalable personalization).

Discussion of Theme 1

The positive reception suggests that integrating heutagogy and generative AI can promote more inclusive, learner-centred education. Heutagogy fosters autonomy and independence, particularly benefiting learners who face barriers in traditional models, such as women and students in underserved communities. Generative AI complements this by enabling tailored, real-time feedback that supports diverse learning needs (UN Women, 2024). However, equity issues remain, especially around access to digital tools. Addressing these challenges requires investment in infrastructure, inclusive design, and ongoing educator training (UNESCO, 2015; Roshanaei et al., 2023).

In summary, educators view this integration as a powerful way to enhance learner autonomy, engagement, and personalization in asynchronous settings. Together, heutagogy and generative AI support a meaningful shift from content delivery to flexible, self-directed learning.

Theme 2: Challenges in Implementation

While participants acknowledged the value of heutagogy and generative AI, they identified major implementation challenges. A key concern was the difficulty in aligning AI-generated content with course objectives and heutagogical principles.

“The main challenge is ensuring that the AI-generated content aligns with the course objectives and standards.” – Respondent C

“There’s a steep learning curve for educators to understand how to best utilize generative AI in a heutagogical framework.” – Respondent D

Educators highlighted a steep learning curve and lack of institutional support as major barriers to adopting AI tools within heutagogical frameworks. These challenges underscore the need for targeted professional development and institutional capacity-building.

Discussion of Theme 2

These findings align with RO 2, which examines challenges and opportunities in integrating generative AI with heutagogical principles. They highlight gaps in institutional readiness, including inadequate training and the absence of clear ethical guidelines. As Johnson and Lee (2020) emphasize, educator preparedness is vital for successful technology adoption. Addressing these challenges requires systemic support—such as integrating AI training into professional development, allocating resources for capacity-building, and fostering collaboration between educators and technologists. These efforts are essential to ensure meaningful and ethical integration of generative AI with heutagogy. Table 2 outlines the main challenges, associated opportunities, and proposed solutions.

Table 2: Challenges, Opportunities, and Proposed Solutions in Integrating Heutagogy and Generative AI

Challenge	Opportunity	Proposed Solution
AI content alignment	Enhanced personalization	Ethical guidelines, regular validation, and educator review of AI outputs.
Educator readiness	Real-time adaptability	Institutional training programs and capacity-building for AI integration.
Accessibility and equity	Broader inclusion	Ensuring equitable access to technology and providing infrastructure support.
Ethical concerns in AI usage	Improved trust and transparency	Development of transparent AI policies and frameworks.

In summary, these challenges reflect a larger need for institutional policies and capacity-building to bridge the gap between AI innovation and heutagogical practice.

Theme 3: Opportunities for Enhanced Personalization

Participants widely recognized the potential of integrating heutagogy and generative AI to create personalized learning experiences. Generative AI was praised for adapting content in real time based on learner performance, enabling individualized learning paths.

“Generative AI can adapt in real time to student performance, making the learning experience incredibly personalized.” – Respondent E

Heutagogy was also seen as supporting flexibility and learner-centred design.

“Heutagogy allows for a more flexible curriculum, which can be further enhanced by AI’s capabilities.” – Respondent F

Approximately 80% of respondents reported that AI-driven feedback improved engagement and satisfaction, reinforcing the value of combining these approaches to address limitations in traditional asynchronous learning.

Discussion of Theme 3

These findings align with RO 3, highlighting how generative AI and heutagogical principles can work together to enable adaptive, personalized learning in asynchronous environments. Generative AI supports learners by adapting to performance in real time, while heutagogy encourages flexible, self-directed goals. Together, they offer a powerful model for engagement and learner autonomy. However, to ensure equitable access and trust, ethical issues such as AI bias and digital inclusion must be addressed. This integration presents a promising framework for reimagining education in the digital age.

Implications of this Study

This study demonstrates the potential of integrating heutagogy and generative AI to transform asynchronous learning into a more personalized and learner-centred experience. For educators, this approach provides tools to boost engagement and autonomy through adaptive content and assessments. Institutions are encouraged to invest in infrastructure and professional development to support AI-enabled pedagogies and align technology with heutagogical practices.

Policymakers should address challenges such as AI bias, unequal access, and ethical concerns by developing clear guidelines and promoting equitable use. Ensuring fair access to generative AI across diverse socioeconomic groups is essential. Inclusive design and implementation of these tools can help close educational gaps and meet varied learner needs. This study offers a foundation for developing innovative, inclusive models that respond to the demands of modern education and guide future research and practice.

Recommendations

In view of the need to enhance self-directed, inclusive, and personalized education, the following recommendations are proposed to effectively integrate heutagogy and generative AI into asynchronous learning environments:

1. To conduct professional development programs that train educators in using generative AI tools effectively within heutagogical frameworks.
2. To establish clear guidelines and ethical frameworks for the generative AI implementation in educational settings, establishing alignment with self-directed learning principles.
3. To conduct mixed-method studies to evaluate the heutagogy and generative AI effectiveness in improving learner engagement and autonomy in diverse higher education contexts.
4. To promote the adoption of generative AI to create personalized learning paths and adaptive feedback mechanisms, addressing the varying needs of learners.
5. To address issues of equity by ensuring access to generative AI tools for institutions and learners across diverse socioeconomic backgrounds.
6. To promote ethical use of generative AI, educators and institutions should take practical steps to reduce bias and improve transparency. This includes regularly reviewing AI-generated content, using tools that can explain their outputs, ensuring diverse data is used in AI systems, and giving educators the ability to adjust or reject AI content that does not align with learning goals or values.

Conclusion

Integrating heutagogy and generative AI into asynchronous learning environments provides a novel educational framework to address the limitations of traditional educational models by fostering personalized, flexible, and learner-centred experiences. This study highlights the significant potential of generative AI to amplify heutagogical practices, benefiting educators, institutions, and policymakers by aligning adaptive technologies with self-directed learning principles. However, it also underscores the ethical and practical challenges, such as AI bias, access inequalities, and educator readiness, calling for balanced implementation strategies. Future research should validate the proposed framework across diverse contexts and examine the long-term impact of generative AI on critical thinking, learner autonomy, and equity. Overall, this study provides a meaningful contribution to advancing personalized education while emphasizing the need for thoughtful and equitable adoption of AI technologies.

Declaration of Originality

This paper represents an original contribution that has not been previously published and is not currently under review for publication elsewhere.

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