JUTLP
Journal of University Teaching & Learning Practice

Paragogy as an alternative solution to make students artists for their own learning: A systematic literature review

Ismu Sukamto[a], Yulia Ayriza[a], Hiryanto[a], Yoppy Wahyu Purnomo[a], and Sugito[a]
[a] Universitas Negeri Yogyakarta, Indonesia

Abstract

The cognitive capacity of humans typically reaches psychosocial maturity around the age of 18, providing students with a robust foundation to design their own lives. However, in higher education, many lecturers and students continue to rely on traditional lecture-based teaching as the predominant educational approach. This systematic literature review examines the application of paragogy in learning practices. Data for the review were collected from the Scopus, ERIC, and ScienceDirect databases, with article selection guided by the PRISMA method. The findings indicate that the implementation of paragogy is motivated by diminishing effectiveness in both reflective and collaborative interactions among peers, among other factors. The content and goals of paragogy implementation vary, with a primary focus on higher education students. These students, along with their peers, play a significant role in shaping their learning experiences. Key challenges include students' difficulties in grasping topics when unprepared, complications arising from managing large numbers of students and limited time in practical sessions, and other constraints encountered.

Editors

Section: Developing Teaching Practice
Senior Editor: A/Prof. Rebekkah Middleton
Associate Editor: Dr Eileen Pollard

Publication

Received: 22 December 2023
Accepted: 30 August 2024
Published: 2 September 2024

Citation

Sukamto, I., Ayriza, Y., Hiryanto, Purnomo, Y.W., & Sugito. (2024). Paragogy as an alternative solution to make students artists for their own learning: A systematic literature review. *Journal of University Teaching and Learning Practice, 21*(10). 10.53761/4q762b53

Introduction

The cognitive capacity of humans generally reaches maturity and psychosocial maturity at the age of 18 (Icenogle et al., 2019), a stage at which they typically have advanced to higher education. Students aged 18 to 25 are considered young adults, a phase where individuals are freed from the dependencies of childhood but have not fully embraced the normative responsibilities of adulthood (Ward et al., 2023). Nevertheless, educators should design learning experiences that grant freedom to students, considering that they already possess a strong foundation to design their own lives, including their educational paths (Mulholland, 2019). Students can be viewed as artists of their own education. Conversely, assigning adult roles, involving more interaction with the environment, to students can enhance their psychosocial maturity (Piotrowski et al., 2020). Additionally, learning from their own possessions and experiences will boost epistemic confidence, guiding them toward critical thinking (Lunn Brownlee et al., 2017). Therefore, it is essential for universities to develop self-directed learning that offers a more flexible framework (Mulholland, 2019) so that students can improvise based on their potential, thereby empowering and enhancing their cognitive capacity. This approach will guide students in unleashing their potential (Coffman & Draper, 2022).

In reality, based on research findings by Armellini et al. (2021), what transpires is insufficient to provide a quality experience for students as a whole. Lecture-based teaching remains a widely used and praised educational strategy by many teachers and students in higher education worldwide (Zhang & Maconochie, 2022). This indicates that educators have not optimized their instructional design. Furthermore, instructors tend to implement what they perceive as the best approach, often from their own perspective. Educators and students should establish a positive partnership, where instructors position themselves as equals to students, acting as catalysts for student engagement (Armellini et al., 2021). This will foster a sense of high ownership among students, thereby cultivating high motivation for learning (Urhahne & Wijnia, 2023). In this partnership, both students and educators contribute and gain opportunities and learning experiences (Matthews et al., 2018).

The embodiment of student-centered learning will increasingly enhance both the soft skills and hard skills of students when they are given the freedom to determine their own learning sources in acquiring knowledge (Nggadas et al., 2022). Those with diverse knowledge backgrounds and experiences are likely to be oriented towards the realities and dynamics in the field (Tohir, 2020). Direct engagement with these realities can help avoid deviations in interpretation arising from the subjectivity of instructors (Jerome & Elwick, 2020). Additionally, through interaction with these realities, their social competence will also develop simultaneously (Hariyanto et al., 2022). This is crucial because it is in this realm that human beings are irreplaceable by robotic technology, which is now beginning to emerge. Furthermore, the era of disruptive technology is causing these competencies to erode. Students are becoming more individualistic. This is evidence that the integration of technology into education (Corneli & Danoff, 2011a) also has negative effects on other aspects. The rapid development of science and technology poses a challenge to maintaining the social sensitivity of students (Herlo, 2014). Nevertheless, technology is important to be applied so that students can adapt to a life where technology is beginning to replace human roles in certain aspects. However, learning must still consider the needs of students as social beings.

The alternative solution to shift from an individualistic paradigm towards self-directed learning begins with the evolution of pedagogy into paragogy. Pedagogy strongly supports individual learning with the principles of mastery learning, where student learning proficiency is highly individualized (Guskey, 2010). On the other hand, paragogy is oriented towards collaborative learning with the assistance of digital technology (Laal & Laal, 2012). Paragogy becomes a distinctive feature of learning in the technology era, not only adapted from pedagogy but also grounded in the concepts of andragogy in the context of peer learning (Herlo, 2014). Paragogy is a peer-to-peer learning theory that offers a flexible framework for knowledge production (Corneli & Danoff, 2011a). The development of paragogy applies Knowles' andragogy principles in learning situations that involve peer interactions (Mulholland, 2019). This considers the condition where adult students may lack an understanding of self-directed learning (Corneli & Danoff, 2011a), requiring encouragement in the learning process. This encouragement can be facilitated through interactions

with peers, distinguishing it from heutagogy where students receive support from instructors on their journey (Mulholland, 2019). In the context of paragogy, the role of the educator is absent; only learners are involved in the learning process. This means that students need to overcome the tendency to only confirm knowledge they already possess, a tendency that emerges when the teacher-student context is applied. Instead, they must confront and understand differences as an integral part of the learning process. All students share responsibility for a process in which they can grow and develop together (Freire, 2020). The competence to collaborate efficiently within a diverse team is a valuable aptitude that can be applied across various situations (Mitka et al., 2023).

Paragogy addresses the challenge of creating a context for self-directed learning that is not individualistic, allowing students to collaboratively learn with the assistance of peer connections in the digital era (Boud & Lee, 2005), enabling them to design their own learning contexts. This will shape the social skills of students, which are increasingly degraded in the current era of disruptive technology. Therefore, paragogy is one of the efforts to create an educational environment among peers by sharing learning situations and experiences utilizing information technology (Tsay & Brady, 2010), ensuring that social interactions continue to be formed as a human necessity. Through paragogy, students not only depend on educators for learning materials but can also provide these materials to other students (Blaschke, 2019) within a discussion group (Suhaimi et al., 2020). This condition also allows for the creation of a conducive and relaxed learning environment, encouraging students to communicate actively.

The proposed systematic review by the researchers is a recent inventory that proves beneficial for creating artistic learning. While systematic literature reviews have been conducted, these articles discuss paragogy as part of Education 4.0, comparing it with heutagogy and cybergogy (Bizami et al., 2023; Mukul & Büyüközkan, 2023; Ramírez-Montoya et al., 2022; Tajudin et al., 2020). However, these articles do not delve into the implementation of paragogy at the practical level. Therefore, a more in-depth systematic review at this practical level becomes crucial, considering that recent developments in science and technology have shifted human life toward individualistic virtual environments. Moreover, learning behaviors in higher education seem to still be influenced by pedagogical learning patterns from the school level. The implications of this study will serve as a reference for university educators to more easily implement alternative learning approaches that align with the psychosocial conditions of students and the development of digital learning environments.

In conclusion, this systematic review paper focuses on the main research questions as follows:

Research Question 1 : In what context does paragogy become an alternative solution (limited to issues, learning content, objectives, educational levels, and learning environments)?

Research Question 2 : To what extent do learners play a role in their own learning, and what challenges do they face (especially at the practical level)?

Literature

Learning initiated by peers can encourage participatory activities involving educational and informational resources from diverse sources because activities built collaboratively are usually supported by the learning experiences within that group (Corneli, 2012). Peer learning emphasizes the sharing of knowledge and ideas among students in a reciprocal partnership (Keppell et al., 2006). Additionally, peer learning has a significantly positive impact on environmental mastery, personal development, constructive interpersonal relationships, achievement of life goals, and self-acceptance (Hanson et al., 2016). This represents a concept of social skills that needs to be developed in the current era of disruptive technology, where learners tend to be more individualistic.

In response to the demands of scientific and technological advancements, the concept of paragogy has emerged. Paragogy represents a new concept within the field of education (Pedagogy). It characterizes critical studies and peer-learning practices adapted from the classic pedagogy concept, incorporating the latest ideas from andragogy into the

context of peer learning (Herlo, 2014). Paragogy addresses the challenges of creating useful and supportive contexts for collaborative self-directed learning by leveraging peer connections in the digital era (Corneli, 2012). The concept of paragogy can guide the design and implementation of learning analysis to improve both individual learning outcomes and balanced collaboration (Boud & Lee, 2005).

Nowadays, there are various new ways to establish peer learning networks; students can learn from each other using a variety of digital applications that they can choose themselves, such as using WhatsApp and Telegram (Panah & Babar, 2020), as technology can facilitate flexible learning networks. Paragogy enables each student to define their learning in agreed-upon ways and contribute to the learning of others (Riandi, 2022). Currently, online technology has reached a point where building a rich online learning environment is possible (Alam, 2022). The flexibility resulting from these peer interactions helps shape students' construction of the ideal student (Chiu et al., 2021). This is further reinforced by the impact of the COVID-19 pandemic, which forced learning to be conducted only online (Alismaiel et al., 2022). This condition is a major consideration to be examined, not only because paragogy is a new field in education that has not been extensively studied, but it is also crucial to develop it into an alternative technology-assisted learning model that is expected to be highly relevant in the future.

Another advantage of the paragogy concept is its reinforcement of cooperative learning amid the critical nature of individualistic learning in this technological age. Engagement in cooperative learning serves as a strong predictor of students' academic performance (Tsay & Brady, 2010). The additional benefits of cooperative learning, supported by technology in online networks, allow students to collaborate through agreed-upon applications such as Virtual Class, Google Meet, Google Classroom, Zoom, or other social media platforms like WhatsApp groups (Merelo et al., 2022). The choice of the application is determined by group consensus. The online learning environment greatly facilitates students in seeking learning resources, educational materials, and learning methods that can be shared freely and widely according to the intended objectives. This can promote learning for and from one another within a specific community (Herlo, 2014).

Paragogy

Paragogy is a peer-to-peer learning theory that offers a flexible framework for knowledge production (Corneli & Danoff, 2011a). Paragogy development applies Knowles' andragogy principles in learning situations involving peer interaction (Bassendowski, 2016; Mulholland, 2019), where students support each other's learning on the basis of equality. However, at the praxis level, paragogy is different from andragogy. Andragogy focuses on students but learning is determined by lecturers (Oishi et al., 2024), meanwhile, paragogy is characterized by students taking the initiative to identify their own learning needs and set learning goals, either independently or in collaboration with peers, with or without the assistance of lecturers. In andragogy, learning is multidirectional, involving interactions between more knowledgeable lecturers and less knowledgeable students, but it does not imply any lack of intelligence on the part of the students (Knowles et al., 2020). Paragogy theory was developed to take the opposite side of andragogy. Lecturers and peers are seen as well-rounded who can create societies or study groups where students can learn more than when they are self-employed (Amiruddin et al., 2023). Paragogy takes scaffolding even further, as relationships among peers are characterized by being equal. The conditions of exchange are duplex, that is: they work bi-directionally and mutual learning is achieved when students connect with each other, share ideas, and engage in dialogue. This is especially true when learning technology advances and the in-depth spread of social media to many formal and informal learning spaces (Antipuesto & Tan, 2020; Chan et al., 2019). Thus, paragogy is considered superior to andragogy in finding more synergies with explanatory frameworks that emerge from digital learning such as connectedness (AlFuqaha, 2013).

Paragogy extensively leverages its collaborative learning environment, distributed network, and online community to develop their knowledge (Kamel Boulos et al., 2016). It's like the concept of connectivity (Herlo, 2014), Students and their peers together form their own learning networks to achieve common interests (Amiruddin et al., 2023). Thus,

paragogy becomes very flexible (Tajudin et al., 2020) so that it allows for expansion or scalability, both by adding networks between students and improving its performance (Corneli & Danoff, 2011b).

This paradigm of paragogy allows students and their peers to develop artistic learning like an artist (Mulholland, 2019), where they design simple principles that consider how they are, and how to shape their learning environment. They, which are made up of individuals; identifying themselves collectively forms the organizational structure in which they carry out a particular operation. It is important to engage students in complex social dynamics. This is also to avoid intuitive decision-making that often fails to achieve the expected results (Korherr et al., 2022). This is a crucial element to facilitate collaboration between the D-I-T (Do It Together) approach and formal educational institutions to effectively connect with the reality that exists in the wider community.

There are 5 principles compiled by Corneli & Danoff (2011a) to set up a peer learning environment. First, *Context as a de-centred centre*, where a group of students with different characters create a shared learning context (Drăgoi et al., 2020). Second, *Meta-learning is a font of knowledge*, where students and their peers develop their learning practices to find not only ways to learn, but also ways to support their peers who are working on learning (Kittur & Salunke, 2020). Third, *Peers are equal but different*, where students can be givers of knowledge as well as recipients of knowledge (Ouhrir et al., 2019). Fourth, *Learning is distributed and nonlinear*, where each student in a peer community is responsible for a distinct aspect of a learning project, making cross-disciplinary connections with knowledge networks, providing and receiving mutual feedback, and integrating their findings (Lee & Rofe, 2016). Lastly, *Realise the dream, then wake up!*, where students act as independent agents, participating voluntarily and only as they find it necessary (Corneli & Danoff, 2011b).

Method

Literature search

The first author independently conducted a literature search for primary research papers using the electronic databases Scopus, ERIC, and Science Direct. The search took place during September and October 2023 without restricting specific years. The search terms were defined in English and included "paragogy," "peeragogy," and "peer-to-peer learning." As a result, the author identified 1356 studies.

Study selection criteria

The author established four criteria for the selection of studies to ensure that the chosen studies meet the requirements for a systematic literature review. Firstly, selected studies must employ an experimental design. Secondly, studies should provide information that encompasses issues, learning content, objectives, educational levels, and learning environments, to address RQ1. Thirdly, studies must furnish information on learning activities that depict the roles of students and challenges faced during learning, to address RQ2. Fourthly, the research samples should consist of students from formal education.

All 1356 studies were filtered based on these criteria. The authors screened studies by title and abstract, excluding discussion papers and off-topic studies. Exclusions were applied to studies containing non-empirical data, those not peer-reviewed (conference papers), those not written in English, and those lacking the keywords ("paragogy," "peeragogy," and "peer-to-peer learning") in the title, abstract, and/or keywords. Additionally, studies reporting samples not derived from formal education were excluded. Consequently, 16 studies meeting all selection criteria were included. The process of study inclusion and exclusion is illustrated in Figure 1.

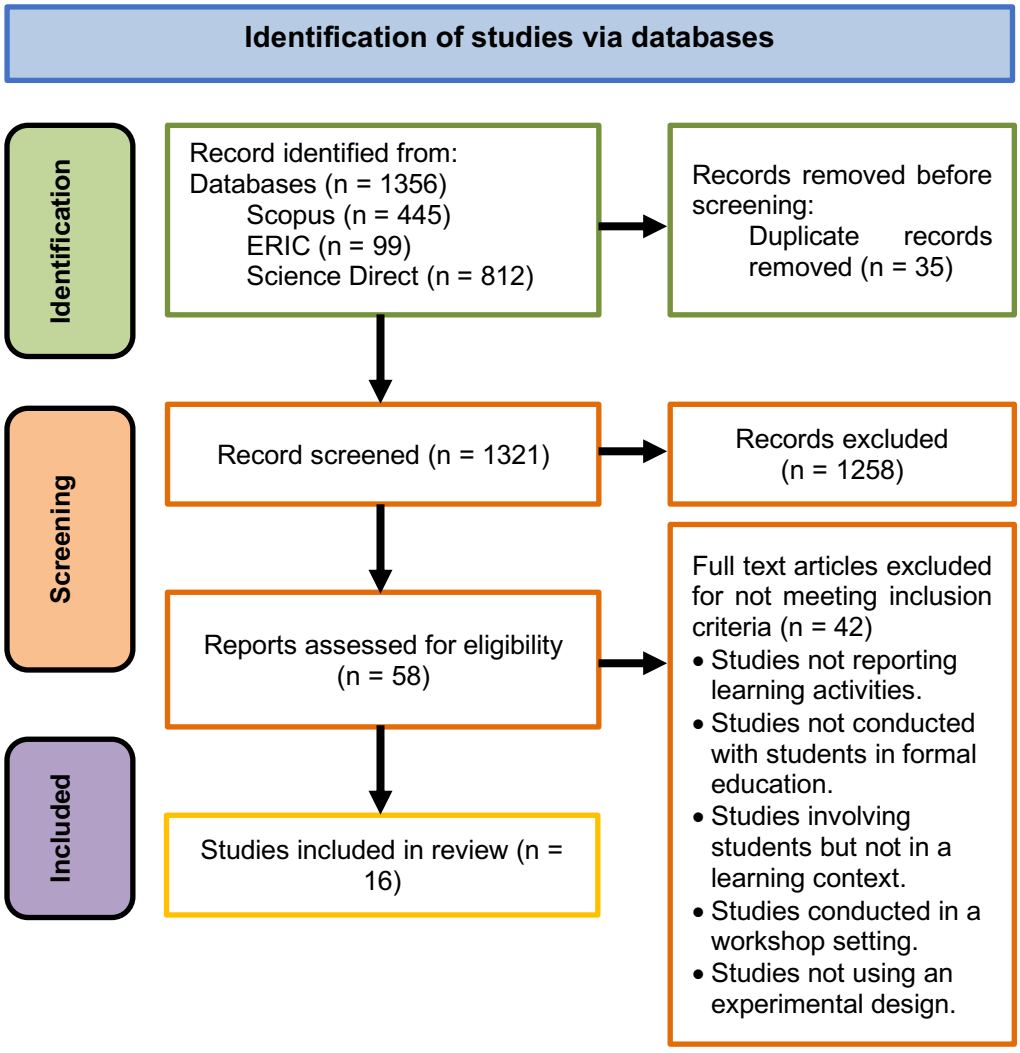

Figure 1

The inclusion and exclusion processes of primary studies

Quality assessment

The author employed standard quality assessment criteria for qualitative studies developed by Kmet et al. (2004) on the selected studies. The assessment form comprised fourteen quality indicators with detailed guidelines. Considering the research methods used in the selected studies and the objectives of this article, the author utilized only five quality indicators: 'Question/objective sufficiently described? Study design evident and appropriate? Subject (and comparison group, if applicable) characteristics sufficiently described? Results reported in sufficient detail? Conclusions supported by the results?'. Scoring criteria included three categories: a score of 2 for complete studies, 1 for partial studies, and 0 for studies not meeting the criteria. Quality assessment was independently conducted by the third and fourth researchers. The assigned scores, both full and partial, were summed and divided by the total possible score. The author then established a threshold value for the quality score at 55%, indicating a relatively liberal cut-off point. Based on the calculations, the overall quality scores for the selected studies ranged from 60 to 100%, with an average score of 85%, indicating that the quality was sufficient for inclusion in the analysis.

Coding study characteristics

The studies deemed eligible were coded based on the author's name, publication year, gender, average age, and country. As indicated in Table 1, the selected studies were conducted between 2014 and 2023. The research sample comprised college-level students, although the proportion of males and females was not explicitly detailed in most studies. The average age of the students was 25.94 years, although this age range did not encompass all studies. The majority of research was conducted in the USA (31.25%) and the UK (25%), followed by India (6.25%), Malaysia (6.25%), Turkey (6.25%), Texas (6.25%), Morocco (6.25%), and Germany (6.25%). All studies were published in peer-reviewed journals and written in English. Additionally, all studies investigated interventions to achieve significance.

Table 1

Characteristics of selected studies

ID	Author (s), Year	% Sample Sex		Mean Age	Country
		Male	Female		
1	(Sims et al., 2022)	-	-	23,25	UK
2	(Lee & Rofe, 2016)	-	-	-	UK
3	(Sabari et al., 2022)	-	-	-	Malaysia
4	(Ouhrir et al., 2019)	59,66	40,34	-	Morocco
5	(Adaca & Tamay Başagaç Gül, 2020)	-	-	-	Turkiye
6	(Hepper, 2021)	-	-	30,33	Germany
7	(Kittur & Salunke, 2020)	-	-	-	USA
8	(Chambers et al., 2023)	42,86	57,14	24,25	UK
9	(Abirami et al., 2022)	-	-	-	India
10	(Luhach, 2020)	-	-	-	India
11	(Bracken et al., 2021)	-	-	-	USA
12	(Park, 2020)	-	-	-	USA
13	(Ellis et al., 2014)	-	-	-	UK
14	(Rodriguez, 2020)	-	-	-	USA
15	(Talley & Smith, 2018)	-	-	-	Texas
16	(Denke et al., 2020)	-	-	-	USA

Data analysis

The authors manually analyzed and synthesized the 16 selected articles, involving thematic analysis using a deductive approach (Nowell et al., 2017). Themes were formulated based on the research questions, namely: (i) the context of paragogy implementation; dan (ii) the roles of learners and challenges in paragogy learning. The authors utilized the constant comparative method (Maykut & Morehouse, 2002). For the first theme, the authors compared and broke down raw data through an inductive reasoning process into the following sub-aspects: issues, learning content, objectives, educational levels, and learning environments. Meanwhile, for the second theme, the authors compared the study results based on the roles of learners and the challenges they faced during paragogy learning. In the concluding phase, the second and fifth authors critically assessed the draft article to grant final approval for the version intended for submission.

Results

The systematic review on paragogy is focused on 16 articles. Subsequently, the description of the results and discussion is presented in two categories according to the formulation of the research questions.

Research question 1: Learning context with paragogy

Table 2 presents data on the context in which paragogy becomes an alternative solution. In this case, the study context is limited to the focus on issues, learning content, objectives, educational levels, and learning environments.

Table 2

Contexts where paragogy becomes an alternative solution

Author (s), Year	Contexts of Paragogy Implementation				Learning Environment
	Issues	Course / Learning content	Objectives	Educational levels	
(Sims et al., 2022)	The increased dependence on this system during remote teaching has unforeseen implications, such as a reduction in peer interactions.	Not explicitly mentioned. Based on the presented figure, one of the subjects identified falls into the category of Science studies.	To provide insights into the potential use of Virtual Reality Learning Environments (VRLE) directed towards collaborative activities led by students.	Higher education; 7 students aged 18-34 in the first study; 32 students and 1 teacher (aged 18-54) in the second study.	Blended learning
(Lee & Rofe, 2016)	There is tension between traditional teaching practices and the new design capabilities offered by digital ICT.	Research methods	To consider the 'flipped' assessment model.	Not specified, but a preliminary study was conducted on higher education students.	Online learning
(Sabari et al., 2022)	Learning that assimilates the use of gadgets is required.	Oral pathology	To investigate the outcomes of different teaching and learning methods in oral pathology.	Higher education; 47 third-year dental students.	Offline learning
(Ouhrir et al., 2019)	Students' difficulty in taking notes and understanding most of the teacher's speech is due to the students' limitations in the French language.	Physiology and anatomy	To understand the impact of educational videos created by students on peer-to-peer learning.	Higher education; 126 students in the first year of a professional degree in teaching.	Blended learning
(Adaca & Tamay Başagaç Gül, 2020)	The Six-Step Protocol (SPIKES) does not allow for effective interaction between healthcare providers, patients, and patient families.	Communication skills in the veterinary medicine curriculum	To enhance veterinary medicine students' skills in delivering bad news.	Higher education; 67 senior students.	Offline learning
(Hepper, 2021)	The community is not yet open-minded in accepting credible	Forestry and biology education	To establish a long-term project that enables	Early vocational education for	Offline learning

	sources from peers and self-conducted research.		intergenerational learning.	the agricultural profession; 116 students (aged 17-54)	
(Kittur & Salunke, 2020)	Students experience difficulties in completing learning activities while others excel.	Linear control systems	To determine whether the collective learning styles of students collectively influence team performance	Higher education; 121 students.	Offline learning
(Chambers et al., 2023)	It was necessary to rapidly convert large amounts of teaching to an online platform.	It is not explicitly mentioned, but it is closely related to medical content.	To understand the acceptance of students and tutors towards the Facebook online learning platform.	Higher education; 7 medical students in years 2–4 of the Bachelor of Medicine program	Online learning
(Abirami et al., 2022)	The current generation of students tends to pay less attention in class.	Python programming	To enhance students' problem-solving skills.	Higher education; 62 students	Blended learning
(Luhach, 2020)	The high-level challenges in academic writing experienced by students in the physical classroom community.	Argumentative essay writing	To enhance students' knowledge of the academic writing genre, specifically argumentative essay writing, within an online discourse community.	In higher education; 40 undergraduate students, Semester Even 2019-2020, Faculty of Law.	Online learning
(Bracken et al., 2021)	Peer-to-peer learning is underutilized as a resource for pre-medical students to learn about the medical profession.	A pre-medical humanities course.	To encourage peer-to-peer learning in academic medicine.	Higher education; 67 premedical students.	Online learning
(Park, 2020)	In the context of the broader society, the phenomenon that occurs involves various complex and intricate disciplines.	Urban design; and regional planning and design	To better understand the opportunities for peer-to-peer learning and student collaboration.	Higher education; 90 undergraduate and graduate students.	Offline learning
(Ellis et al., 2014)	With the increasingly phenomenal technological advancements, it is necessary to find the best ways to prepare students to face emerging challenges	Field of business studies	To explore the use of the Internet in peer-to-peer learning environments in vocational education and training	Higher education; in the article, a general Further Education College trains more than 10,000	Online learning

				students every year.	
(Rodriguez, 2020)	Low- and middle-income countries do not provide training to ensure that students are ethically engaged in global health undergraduate programs.	Global bioethics	To apply what students learn about global bioethics practices.	Higher education; medical and postgraduate students.	Offline learning
(Talley & Smith, 2018)	The development of specific video lecture content for flipped courses becomes a daunting task for instructors.	A construction estimating course	To explore the effectiveness of peer-to-peer video content in facilitating student learning.	Higher education, 1 class of undergraduate and graduate students.	Blended learning
(Denke et al., 2020)	Difficulties in activating and assessing the pedagogical relationship between Information Literacy (IL) and metacognition.	Related to psychology concepts	To explore the use of constructivist pedagogy in enhancing the visibility of the relationship between metacognition and Information Literacy (IL).	Higher education; 129 students.	Offline learning

Based on Table 2, the implementation of paragogy is driven by the decreasing effectiveness, reflectiveness, supportiveness, and collaboration among peers in learning. Additionally, the rapid developments in the field of ICT necessitate changes in the learning environment, and the increasing complexity of challenges faced, limitations in language proficiency, reduced student attention in class, neglect of credible information sources from peers, and student ethical issues are also considerations in implementing paragogy. Courses or learning materials delivered in paragogy vary widely, including subject areas such as social sciences, material and environmental science, psychology, engineering, computer science, and business. The implementation of paragogy aims to enhance collaborative activities among peers both in offline and online learning, improve problem-solving skills and the ability to deliver bad news, introduce the latest learning methods in the current digital era, and achieve other more specific goals. The target of paragogy implementation is exclusively higher education students. Paragogy is implemented in higher education through offline, online, and blended learning modes.

Research question 2: The role of learners and challenges in the implementation of paragogy

Table 3 presents data on the role of learners in their own learning and the challenges they face.

Table 3

The role of learners in their own learning and the challenges faced

Author (s), Year	The role of learners in learning practices	Challenges
(Sims et al., 2022)	CloVR facilitates peer learning activities as its main feature. Learners fill, curate, and organize the virtual mind palace to initiate the experience. Learners invite peers into a specific CloVR example of their mind palace. A shared environment is formed and synchronized, accessible through the web. Learners are represented as low-fidelity	A VR-mediated environment that combines a memory palace and spaced repetition method

	anthropomorphic avatars. The "host" learner can interact with one or more peers (assumed to be a maximum of 5 peers). The "host" learner can guide their peers through their own mind palace journey, interacting with artifacts related to the discussion topic. Colocation in the virtual mind palace allows learners to discuss topics together with a better understanding of context and leverage various e-learning resources, including 3D models, voice recordings, and images. Students interact with peers in an online environment (MOOC) by providing feedback on each other's work (e-tivity) with anonymous peer assessment. The provided questions can be repeated until the asker receives sufficient feedback. E-activity emphasizes self-reflection and peer support as assessment tools for learning. Discussions are moderated by the Associate Tutor team, the Community Mentor team. Face-to-face interaction with peers is possible on a small scale through Talkabouts and offline meetings.	would be a valuable, useful, and desirable learning tool. However, there may be differences in system perception depending on the expertise of the learners.
(Lee & Rofe, 2016)	Discussions are conducted in two stages. First, formed and facilitated by the course instructors. Second, initiated by students in a more informal manner. There is an emphasis on multi-dialog informal forums. Peers come from different cultural and professional backgrounds worldwide. This mimics real-world research experiences by involving professionals.	MOOC with a top-down delivery model makes the MOOC experience inconsistent with diverse and individualized learning processes. This results in MOOC reverting to one-to-many communication rather than fostering a conversation. E-moderators need to be professionally trained.
(Sabari et al., 2022)	Students are organized into small groups and encouraged to use mobile devices for discussions during the class. Various games and activities have been conducted throughout the academic year. Games include Kahoot!, treasure hunts, riddles, and crossword puzzles. After each lecture, students present impromptu summaries of specific topics to assess their understanding. The content of the games is created by the lecturer to align with the lecture topics and syllabus.	Students who are unable or fail to prepare adequately before the lesson may feel marginalized or confused, making it challenging for them to grasp the taught topics, rendering the activities futile.
(Ouhrir et al., 2019)	In the first step, first-year students in the professional teaching program produce video capsules (resources for the physiology and anatomy courses) in groups ranging from 2 to 6 members. The videos are submitted by students at the end of the semester after studying all course content. In the second step, the videos are evaluated by teachers in both subjects to determine their quality and accuracy of content. Only 12 video capsules are selected and made available to first-year students (2017/2018). The video, with a maximum length of 8 minutes, is uploaded in advance to allow students to view and download it at their convenience. It serves as a preparatory resource for the flipped classroom model. The video, along with other digital materials available in the workspace, is intended to enhance student interaction during face-to-face classes. These in-person sessions, which	Replicating this on a university scale, especially with a large number of students, is not an easy task. The responsibility falls on the shoulders of both technical teams and educators.

	accommodate approximately 60 students and last for one and a half hours each week, integrate video content with additional contributions and supplements. At the end of the semester, students are surveyed to assess the perceived value of the videos.	
(Adaca & Tamay Başagaç Gül, 2020)	Students were randomly divided into three groups: 24 in Experimental Group A (EGA), 20 in Experimental Group B (EGB), and 23 in the Control Group (CG). Standardized Clients (SC), two trained female professionals, were used in the learning scenarios. During Session I (a recorded activity), all groups interacted with the SC in a simulated clinical setting. In Session II, both EGA and EGB received theoretical training on communication skills and delivering bad news specific to veterinary medicine. They reviewed recordings of their own and their peers' performances to facilitate self-assessment and peer feedback. In Session III, EGA students engaged in role-playing exercises with one another in a simulated clinical environment, with an observer assigned to provide guidance. During the interaction, one student played the client, and the other played the veterinarian. In Session IV, all groups made contact with SC.	There were issues identified that were disruptive regarding the evaluation of delivering bad news.
(Hepper, 2021)	In 2011 and 2020, two groups of students were tasked with exploring a grassland area and determining the natural forest ecosystem located between the forest and the river, as well as the forest adjacent to it. The active learning situation aligned with the local government's program to reforest this area. Students were assigned to assess the potential of the natural-forest ecosystem in groups (three members per group, with one group consisting of four members). Each group conducted several circular sample takings, each with an area of 10 m2, around the river, with the nearest circle edge 2 m from the riverbank. Three sample areas were located in the grassland, one at the forest edge, and three others inside the forest. In total, 112 circles were measured in 2011 and 120 circles in 2020. Similar activities were carried out in 2012 and 2021 with a focus on the beech forest habitat. Students were asked to determine whether the selected area was considered a natural forest or not. The determination process followed the pattern from 2011 and 2020, starting 2 meters from the forestry service road, with a total of 126 samples in both years.	Technical constraints are not presented in the article.
(Kittur & Salunke, 2020)	Students were divided into groups based on criteria: at least one student in each team had a balanced preference for active/reflective and visual/verbal learning styles, while others could have different learning style preferences to ensure the success of completing tasks. Students were grouped into 16 teams for Section A and 14 teams for Section B, each consisting of 4 members, except for one or two teams in Section B, which had 5 members. In the learning process, student groups initially solved assignment problems manually while being introduced to the basic features of the Matlab simulation tool to complete the assignment activities. Subsequently, students spent one week completing simulations and verifying the manually obtained results. Finally, students documented all the steps taken in the assignment activities and submitted a report.	There were few teams that wanted to form their own teams.
(Chambers et al., 2023)	In this case, there are two roles for students. The first is students as learners, i.e., second to fourth-year medical students; and the second is students as tutors, i.e., final-year medical students. Tutors play a role in producing online teaching materials that will be uploaded on Facebook. The online material includes surveys and assessments.	The response rate to participate in this research is low.

	Tutors and learners engage in group discussions in the comment section.	
(Abirami et al., 2022)	Students are asked to solve problems by writing procedures, drawing flowcharts, and then manually coding in their notebooks. All students are informed of the deadlines for each previous task, and faculty will track their time management. The solutions (recorded in the notebooks) are then reviewed individually by the students and continued with modifications. Then, the solutions are randomly distributed to their peers (each student does not receive their own work). With the one-on-one concept, peers discuss the solutions and provide detailed comments along with the student's name, recorded in the notebook. Afterward, the notebooks are returned to their owners. Each student reads the given comments and, if necessary, engages in a discussion. Next, the notebooks are redistributed (the notebooks are placed in different hands). This time, two peers will review the notebook together. Finally, outside the classroom, coding challenges are arranged on platforms like HackerRank, HackerEarth, and similar ones with time constraints. Time limits are set to discourage copying practices. All students attempt the code until the cases are solved. If a student encounters problems, faculty members provide necessary instructions. Peers must teach students having difficulties upon request. Students' activities are monitored through leaderboards and submissions.	During the learning practice, there was a possibility of chaos occurring.
(Luhach, 2020)	Discourse community learning is conducted ~online through the learning management system. Students in groups are given topics to write individual argumentative essays in weeks 1 to 4 (including the pre-test). Then, they engage in written interaction in an online discourse community in weeks 5 to 7.	Technical constraints were not specified in the article.
(Bracken et al., 2021)	Initially, students create a series of readings posted on an online blog and go through a peer-review process. This task is performed by and for medical students. The assignment comprises seventeen brief articles, each approximately 500 words in length, supported by scholarly sources within the field of medical humanities, and distributed over a fourteen-week semester. Research participants were tasked with reading all seventeen in-Training blog posts and then choosing three for in-depth analysis, which involved writing short critical reflections of approximately 250–500 words each.	Technical constraints were not specified in the article.
(Park, 2020)	In this case, the author only narrates the roles of students in the learning practices in Case Studios I and II. Case Studio I: Over the initial thirteen weeks, students work independently on individual design tasks at various locations within the project area, receiving feedback from instructors and guest jury members. During this period, students also engage in implicit and voluntary collaboration, such as sharing data. In the final three weeks, students work together to identify overlapping areas and address design issues not covered by their individual work. Collaboration sessions are strategically integrated into the workflow. Additionally, a postgraduate student, who is not part of any team, is designated as the collaboration facilitator. Case Studio II: Employing the inverse collaboration model, students first collaborate in teams for the initial three weeks to conduct research, inventory, and analysis of the study area. Subsequently, each	Guiding students in the right direction and ensuring that they perform well and learn something from the collaborative process required a significant amount of time and effort.

	student undertakes individual research on the shared theme of sustainable regional growth. Note: Collaborative tasks are only performed to support the main part of the design development.	
(Ellis et al., 2014)	In the article, the learning timeline is not explicitly presented. Nevertheless, it can be inferred that students learn in groups. The group discussions cover topics presented through the Self-Organised Learning Environments (SOLEs) approach as well as the traditional approach. Student groups go through learning with one of these approaches. After completing and being assessed on their tasks, the groups rotate, and the cycle is repeated. This allows groups that initially learned with the SOLEs approach to subsequently learn with the traditional approach, and vice versa. During the SOLEs approach, students implicitly use tools such as Skype, Google Hangouts, YouTube, and others to interact. Younger students tend to choose video content, while older students prefer text-based content. In practice, instructors facilitate students to achieve their desired goals.	Initially, the SOLEs approach appeared somewhat confusing, and educators exhibited a skeptical attitude.
(Rodriguez, 2020)	Students (1 class comprising 20 individuals) were divided into four groups with five students in each group. Each small group received a die, five pawns of different colors, a stack of scenarios printed on pieces of paper placed inside an envelope, and a game board. The starting box was drawn in the bottom-left corner, with more boxes forming a slightly winding path from the starting box to the finish box in the top-right corner. In each team, the student with the highest die roll went first, and the game proceeded counterclockwise from the initial student. (The die was no longer used.) All students place their game pieces on the starting box. The first student draws a scenario card from the envelope and reads it aloud. After sharing the scenario, the student follows the instructions on the card, placing the card face down on the table or in the middle of the game board. Each subsequent student follows suit, drawing a scenario card, reading it aloud, and following the card's instructions. Most scenarios initially include instructions for students on what to do with their game pieces. The movement options include forward, backward, return to the start, and lose a turn. Scenarios with forward movement mean students are using resources constructively by building and assessing their own and others' knowledge, developing an understanding and respect for the places they propose to research, and evaluating and adjusting the research they propose so they can work within the community. Scenarios with backward movement mean that students have poor planning or a lack of follow-up in their research. Scenarios that make students return to the start indicate poor planning of the students' research proposals, suggesting interventions not trained by the students, and a lack of respect for the host community. Finally, scenarios that make students lose a turn, which means their research stops to reconsider or refocus their research. In addition to scenarios with specific movement directions, the game also includes scenarios that require students to discuss and determine the next steps.	Some students felt that the learning activity was not a game at all, attributing it to the movement of scenarios; some students complained about the lack of clear answers.
(Talley & Smith, 2018)	The students choose their own topics based on a list provided by the instructor while developing the necessary videos for the course. Except for the first semester, students can watch videos from the previous semester as an introduction to the course content and for	A lot of effort is needed to refine some videos, so the topics should be

	inspiration. All students have access to the university's laboratories for the purpose of film production. The instructor also provides brief tutorials to support the students' work. Graduate students work independently to produce videos during the semester (first and second semesters). They are encouraged to use their undergraduate classmates as assistants or actors for the videos. In the third and fourth semesters, students are also assigned the same project, and they work in teams to produce one video per team.	included in the list for the next semester.
(Denke et al., 2020)	In the class session preceding the scaffolded IL session, each instructor randomly divided the students into five groups, with each group member assigned to read one of five selected popular press articles as homework. These articles, related to psychology concepts that would be covered in the upcoming semester, were of comparable length and written in an accessible style. During the IL session, two project researchers facilitated activities based on a modified jigsaw pedagogical approach. Students first individually reflected on their assigned articles by summarizing them, evaluating their strengths and weaknesses, and describing their personal reactions (Part A). Next, they met with peers who had read the same article to discuss their reflections and develop deeper insights (Part B). Finally, students joined groups with members who had read different articles, taking on the role of experts to share their findings (Part C). Throughout the session, students worked on individual worksheets designed to foster metacognitive thinking and enhance their understanding of IL skills.	Students found it challenging to identify weaknesses due to their preference for the articles; a large class size or limited class time could make the jigsaw activity less conducive.

Based on Table 3, students collectively organize the flow of learning according to their preferences. To trigger such conditions, several alternatives are provided, such as: virtual experiences through specialized tools (CloVR) where students organize the content (artifacts) of the virtual environment where they interact with their peers; online environments with various tasks; games; video production; simulations and role-playing; direct experiences in nature; activities on social media, LMS, blogs, Skype, Google Hangouts, YouTube, and others; problems to find solutions; architectural design in the studio; and reviewing articles. Initiation is also done by posing a series of questions to a group of students to lead to deeper discussions. Furthermore, students are given assignments both individually and in groups, and the results become the subject of discussion with peers and other groups. They work in groups of 3-5 people, some involving professionals to support student group work. Some apply specific criteria in forming groups, such as considering learning style preferences, senior-junior dynamics (classroom learning experience), and specific age ranges. The learning arrangement can be self-directed by students.

With such learning practices, there are weaknesses that arise in the implementation of paragogy. One of them is that students who are unable to or do not prepare before the lesson may find it difficult to understand the topics and show a low response. Furthermore, non-verbal interactions among students are challenging in online learning. Team composition becomes a problem for some students. Moreover, student interaction in online learning tends to be more one-to-many than a conversation and allows for chaos. Having a large number of students in one class or time constraints poses difficulties in the practice of learning. Finally, the course material is assessed as too dense to complete, and other specific technical constraints, such as differences in perception systems based on learners' expertise in VR-mediated environments, also arise.

Discussion

Research question 1: Learning contexts with paragogy

The background of implementing paragogy varies significantly, but generally, it is driven by the decreasing effectiveness of peer interactions—reflective, supportive, and collaborative—within the learning environment. This decline can be attributed to the advancement of Information and Communication Technology (ICT). The evolution of ICT has transformed educational practices, shifting from traditional classroom learning to virtual learning facilitated by smartphones or other gadgets. This transformation demands extra efforts to ensure that peer interactions remain facilitated, considering that previous research indicates that social interactions are more challenging in digital settings (Dumford & Miller, 2018; Janssen & Kirschner, 2020; Peimani & Kamalipour, 2021). Active measures are required to harness technology embedded in learning and positively influence social interactions (Weidlich & Bastiaens, 2019).

In facilitating paragogy in online learning, the technology used in learning must accommodate the practice of collaboration between peers in producing knowledge. Although Learning Management Systems (LMS) such as Moodle are highly effective in facilitating student-content interactions (Konstantinou & Epps, 2017) and are commonly utilized as the primary digital platform for courses in higher education (Cunningham, 2017), their functionality can be further enhanced through the integration of additional communication tools, such as Discord and Teams (Kahu et al., 2022), which can accommodate student-student and student-lecturer interactions. In addition, social networking sites, such as Facebook, Twitter, and Instagram, can also be applied informally by students (Manca, 2020). Researchs showed that such social media tools have the potential to increase student engagement (Cunningham, 2017; Nkomo et al., 2021).

Considering that paragogy emphasizes self-learning where the role of lecturers is greatly minimized, the use of AI is very necessary. For example, Khipulearn (López-Javaloyes et al., 2024), a learning platform based on the Customised Adaptive Learning Model (CALM), which offers a personalized learning experience. The platform utilizes an Artificial Intelligence (AI) algorithm to strategically select activities in accordance with the specific characteristics and needs of individual learners based on the results of student data analysis that includes their interaction with the platform, assessment results, and progress. Thus, the system will adjust the content, order, and presentation of the best learning materials according to the needs of each student (Gligorea et al., 2023). Additionally, AI-powered analytics can offer insights into learning patterns, helping students set goals and refine their strategies based on data-driven feedback. By integrating this AI technology, paragogy is enhanced through more customized, responsive, and self-paced learning opportunities that align with each student's path and pace. In certain contexts, AI chatbots can be considered for use. AI chatbots can provide contextual, direct, support and feedback, empowering students to navigate their educational journey with greater autonomy (Wu & Yu, 2024). Chatbots can also provide more natural conversational interactions with students (Divekar et al., 2022), so that it makes it easier for students to capture the meaning of their conversations.

Hence, contemporary education, particularly at the higher education level, needs to evolve and grant students the freedom to interact with peers, exchanging knowledge and new ideas that might have previously occurred informally and ad hoc (Homer, 2022). This consideration recognizes that students have reached psychosocial maturity (Icenogle et al., 2019), where they possess a solid foundation to design their own lives. Consequently, everyone can become both a teacher and a learner in paragogy (Mulholland, 2019). With paragogy, social interactions, especially with peers, can be activated and stimulated in the online environment to provide mutual feedback. Peer-to-peer feedback contributes to cognitive presence and supports the improvement of social presence (Sun et al., 2017). Engaging students in complex social dynamics is crucial. This approach helps avoid intuitive decision-making, which often fails to achieve the desired outcomes (Korherr et al., 2022). This learning bias will also shape students' personalities, beneficial for lifelong learning. It is essential for students to apply learning concepts even beyond formal education.

The results of this analysis also indicate that the implementation of paragogy in practice can be applied to both online and offline learning environments (Lee & Rofe, 2016). This suggests that advancements in science and technology can be addressed by incorporating paragogy into educational practices. Paragogy is an appropriate paradigm to apply

in the field of education today, especially at the higher education level. This consideration takes into account the current era's transition into a digitalized world where technology plays a significant role in human activities (Dornelles et al., 2022). This has facilitated individualistic activities for people (Twenge, 2023). Despite the benefits provided, technology also brings negative effects for individuals (disruptive technology) (Baimas-George et al., 2022). Many educators, as presented in the sample articles, feel that students are becoming too focused on virtual activities and interacting with people they may not know (Han et al., 2022). This tendency might lead students to engage in activities that do not reflect good ethics. Changes in human life have prompted a shift in education from traditional teaching methodologies toward Education 3.0, which is a new form of digital education (Watson et al., 2015). Therefore, through paragogy, teachers guide students to focus on collaborative learning with peers, which should be their world.

More deeply in the context of Education 3.0, paragogy is one of the educational paradigms that will answer the challenges of Education 3.0, where students can connect with their communities or even experts outside their educational institutions (Akyildiz, 2019) to support learning that they designed themselves. Self-regulation and independence (Agonács & Matos, 2019) support students to be able to have a personalised and self-defined scope by choosing virtual study spaces and local and international peer communities (Handayani et al., 2021). This mode greatly promotes creativity as students are encouraged to create and share knowledge and collaborate through social networking sites as one of the main components of the collaborative learning process (Blaschke et al., 2021; Qassrawi, 2023). Thus, the implementation of paragogy in education can equip students with collaboration skills as social beings and independence as lifelong learners.

So far, the application of paragogy in learning is directed towards diverse subjects. Consequently, there is a possibility that this approach can be applied in other fields of study. This considers that learning with the paragogy concept opens up the possibility of interacting with professionals in the learning practice. This means that students can learn from experts outside the classroom. Therefore, it is highly open for educators in various fields of study to implement this in their teaching.

In general, considering technological developments and new teaching trends, paragogy can be adopted by academics and decision-makers in higher education to develop online, flexible, and self-regulating learning practices while remaining oriented towards collaborative interaction of student-student, lecturer-student, and expert-student. In the context of online learning, digital tools that support the implementation of paragogy principles need to use adaptive learning platforms. With algorithms that can set the difficulty and type of content based on student preferences, the platform will deliver relevant material with the right level of complexity based on the needs of students (Hamzah et al., 2024). Considering that paragogy prioritizes collaboration between peers, digital tools must support collaborative activities. Discussion forum platforms (Teams) and social media groups (Facebook) (Thong et al., 2023) can be integrated in learning to facilitate peer-to-peer interaction and knowledge sharing. This interaction is very beneficial for students who are independently exploring topics to gain diverse perspectives. Student learning progress and engagement can be tracked through an LMS equipped with an analytics system (Sekhar et al., 2024). In addition to the needs of lecturers in monitoring student development, the data can be used as evaluation material for students related to their habits and learning outcomes. A fundamental aspect of paragogy is self-awareness and control over the learning journey of a group of individuals. Furthermore, the use of mobile learning applications that offer flexibility in accessing learning content anytime and anywhere also needs to be considered (Lin et al., 2023) considering that a group of students has a variety of learning styles, schedules, and paces. This flexibility will give students greater control over their learning environment.

Research Question 2: Learners' roles and challenges in implementing paragogy

In practice, considering that this is a new learning method, the learning process may be facilitated by a moderator at the beginning. This is important to ensure that the learning stays on track during the discussion sessions. However, gradually, the roles are fully handed over to the learners. Learners eventually become artists of their own learning (Mulholland, 2019). This will give rise to informal multi-dialogues within the forum, considering that learners are

adults with diverse cultural backgrounds. In the current digital world, interactions can take place virtually. In some cases or fields of study, dialogue can be supported by virtual objects (Virtual Reality) that can be experienced collectively by several learners to maintain and enhance the dialogue (Sims et al., 2022). Paragogy learning can extend beyond the classroom. Learners can go anywhere to meet professionals or environments that match their needs, either in groups or individually. They can still communicate effectively through social media with their smartphones, which have become an integral part of their lives (Iqbal & Bhatti, 2020). Thus, the concept of peer learning can still be implemented. This pedagogy is indeed designed to celebrate collective creativity and collaborative learning with peers, sharing situations and learning experiences in a social, active, and continuous process (Prasetya et al., 2022). The pursuit of collective creation, encompassing elements such as power-sharing, interactivity, collaboration, responsibility, meaning, and knowledge, fosters flexibility, reflection, and enhanced motivation for both students and educators (Bizami et al., 2023).

The role of peers goes beyond merely sharing best practices based on experiences in different environments (Beauchamp et al., 2022). It also involves constructive evaluation to find the best possible options for the next steps (Yang & Wang, 2023). Consequently, students can master academic knowledge more effectively through the assistance of online peer interactions (Nisar et al., 2021). Even though peer responses may not always offer practical solutions, they can serve as material for learners to reflect on, contributing to the variation in students' learning outcomes (Wilson et al., 2021). Peer-to-peer dialogues tend to be more dynamic compared to teacher-student dialogues. This is considering that interaction with peers can boost students' confidence in learning (Robertson & McCall, 2020). Additionally, students' roles alternate between practicing skills and providing feedback to their peers (Grover et al., 2022) . This indicates that peers can become partners contributing to consultation, collaboration, and mutual learning (Cruice et al., 2022), which enhances the development of personal skills such as conflict resolution, giving/receiving feedback, and intercultural communication (Donald & Ford, 2022). These interactions also contribute to retention (Hoiland et al., 2020), expectations, self-efficacy, resilience, and optimism (Nimmi et al., 2021). These peer interactions provide a satisfying learning experience, and students enjoy the interactions that may occur with international peers connected through public social media posts (Munoz-Escalona et al., 2022). Although interactions are not limited to peer-to-peer, teachers and students can still interact through chatting, virtual meetings, or by providing feedback in the comment section during streaming. These seemingly simple activities can enhance their understanding (Dimitrova & Mitrovic, 2022; Munoz-Escalona et al., 2022). The teacher serves as a guide, aiding students in their academic adventures, acting as a control in achieving targets, and serving as a consultation point when students face difficulties. However, the teacher is no longer the sole source of learning; instead, they act as illuminators for students to embark on their learning journeys.

However, behind all of this, there are equally significant challenges. There are substantial obstacles for teachers to assess students' abilities, considering that they are in different locations and engaged in various activities. Peer assessment might serve as an alternative, but it still has its drawbacks (Lee & Rofe, 2016). Moreover, virtual dialogues may be highly limited. Learners and teachers may not fully grasp the true meaning of the conversation since non-verbal data, such as body language, posture, and the use of physical space, which are integral to offline communication, are challenging to obtain (Drăgoi et al., 2020). Additionally, peer learning requires more time and resources compared to traditional learning approaches (Adachi et al., 2018). Considering these weaknesses, universities or faculties may establish specialized units to guide students in supporting peer learning (Donald & Ford, 2022). These trained students take the initiative in peer learning, addressing challenges faced by instructors (Brewer & Movahedazarhouligh, 2018).

Conclusion

The implementation of paragogy is motivated by the decreasing effectiveness, reflectiveness, supportiveness, and collaboration among peers in learning. Additionally, the rapid advancements in Information and Communication Technology (ICT) necessitate changes in the learning environment due to the increasing complexity of challenges, requiring the evolution of learning practices. Courses or learning content and the objectives of paragogy

implementation vary, indicating that paragogy can be applied across various fields of study with different goals while still emphasizing peer collaboration. The primary target for implementing paragogy is higher education, whether conducted online, offline, or through a combination of both.

Learners, together with their peers, take on a full role in designing the learning experience to construct knowledge and achieve goals. In some cases, educators still facilitate the initial learning and involve professionals. Essentially, collaboration among learners is stimulated through presenting problems to be solved in groups, mediated through experiences in virtual environments, games, video production, simulations, role-playing, direct experiences in nature or the studio, and reviewing articles. Crucial challenges include unprepared students struggling to understand topics, limitations in face-to-face conversations, and non-verbal interactions in online learning, as well as difficulties arising when the number of students is too large and time is limited.

Acknowledgements

I would like to thank you for supporting and funding this research. This article is an output of the Journal Article Writing course and a segment of doctoral research in the Department of Primary Education at Universitas Negeri Yogyakarta, Indonesia. Authors are supported by Beasiswa Pendidikan Indonesia (BPI), a scholarship program for graduate degrees which is organized by Balai Pembiayaan Pendidikan Tinggi (BPPT) as a body of Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi (Kemendikbudristek) and funded by Lembaga Pengelola Dana Pendidikan (LPDP) (01832/J5.2.3./BPI.06/9/2022).

Conflict of Interest

The authors disclose that they have no actual or perceived conflicts of interest. The authors disclose that they have not received any funding for this manuscript beyond resourcing for academic time at their respective university.

References

Abirami, A. M., Karthikeyan, P., & Thangavel, M. (2022). Peer-to-peer learning process (PPLP) framework to enhance problem solving skills. *Journal of Engineering Education Transformations*, *36*(Special Issue 2), 244–248. https://doi.org/10.16920/jeet/2023/v36is2/23035

Adaca, A. Ü., & Tamay Başagaç Gül, R. (2020). First experimental study in Turkey teaches veterinary students how to break bad news. *Journal of Veterinary Medical Education*, *47*(6), 720–727. https://doi.org/10.3138/JVME.2019-0030

Adachi, C., Hong-Meng Tai, J., & Dawson, P. (2018). Academics' perceptions of the benefits and challenges of self and peer assessment in higher education. *Assessment and Evaluation in Higher Education*, *43*(2), 294–306. https://doi.org/10.1080/02602938.2017.1339775

Agonács, N., & Matos, J. F. (2019). Heutagogy and self-determined learning: A review of the published literature on the application and implementation of the theory. *Open Learning: The Journal of Open, Distance and e-Learning*, *34*(3), 223–240. https://doi.org/10.1080/02680513.2018.1562329

Akyildiz, S. T. (2019). Do 21st century teachers know about heutagogy or do they still adhere to traditional pedagogy and andragogy? *International Journal of Progressive Education*, *15*(6), 151–169. https://doi.org/10.29329/ijpe.2019.215.10

Alam, A. (2022). Employing adaptive learning and intelligent tutoring robots for virtual classrooms and smart campuses: Reforming education in the age of artificial intelligence. In S. R.N., D. S., P. V., & B. M. (Eds.), *Lecture Notes in Electrical Engineering* (Vol. 914, pp. 395–406). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-981-19-2980-9_32

AlFuqaha, I. N. (2013). Pedagogy redefined: Frameworks of learning approaches prevalent in the current digital information age. *Journal of Educational Technology*, *10*(1), 36–45. https://doi.org/10.26634/JET.10.1.2302

Alismaiel, O. A., Cifuentes-Faura, J., & Al-Rahmi, W. M. (2022). Online learning, mobile learning, and social media technologies: An empirical study on constructivism theory during the COVID-19 pandemic. *Sustainability*, *14*(18), 11134. https://doi.org/10.3390/su141811134

Amiruddin, Baharuddin, F. R., & Setialaksana, W. (2023). Andragogy, peeragogy, heutagogy and cybergogy contribution on self-regulated learning: A structural equation model approach. *International Journal of Instruction*, *16*(3), 551–572. https://doi.org/10.29333/iji.2023.16330a

Antipuesto, J. L., & Tan, D. A. (2020). Enhancing student performance and engagement in mathematics via peeragogy. *Science International (Lahore)*, *32*(2), 159–164.

Armellini, A., Teixeira Antunes, V., & Howe, R. (2021). Student perspectives on learning experiences in a higher education active blended learning context. *TechTrends*, *65*(4), 433–443. https://doi.org/10.1007/s11528-021-00593-w

Baimas-George, M., Demartines, N., & Vrochides, D. (2022). The role of disruptive technologies and approaches in ERAS®: Erupting change through disruptive means. *Langenbeck's Archives of Surgery*, *407*(1), 437–441. https://doi.org/10.1007/s00423-022-02450-7

Bassendowski, S. (2016). Paragogy: Emerging theory. *Canadian Journal of Nursing Informatics*, *11*(4). https://cjni.net/journal/?p=5024

Beauchamp, G., Chapman, S., Risquez, A., Becaas, S., Ellis, C., Empsen, M., Farr, F., Hoskins, L., Hustinx, W., Murray, L., Palmaers, S., Spain, S., Timus, N., White, M., Whyte, S., & Young, N. (2022). Moving beyond the formal: Developing significant networks and conversations in higher education: reflections from an interdisciplinary European project team. *Teaching in Higher Education*. https://doi.org/10.1080/13562517.2022.2056833

Bizami, N. A., Tasir, Z., & Kew, S. N. (2023). Innovative pedagogical principles and technological tools capabilities for immersive blended learning: A systematic literature review. *Education and Information Technologies*, *28*(2), 1373–1425. https://doi.org/10.1007/s10639-022-11243-w

Blaschke, L. M. (2019). The pedagogy–andragogy–heutagogy continuum and technology-supported personal learning environments. In *Open and distance education theory revisited* (pp. 75–84). Springer. https://doi.org/10.1007/978-981-13-7740-2_9

Blaschke, L. M., Bozkurt, A., & Cormier, D. (2021). Learner agency and the learner-centred theories for online networked learning and learning ecologies. In S. Hase & L. M. Blaschke (Eds.), *Unleashing the Power of Learner Agency* (pp. 57–66). US: EdTech Books. https://edtechbooks.s3.us-west-2.amazonaws.com/pdfs/275/4296.pdf

Boud, D., & Lee, A. (2005). 'Peer learning'as pedagogic discourse for research education. *Studies in Higher Education*, *30*(5), 501–516. https://doi.org/10.1080/03075070500249138

Bracken, R. C., Major, A., Paul, A., & Ostherr, K. (2021). Reflective writing about near-peer blogs: A novel method for introducing the medical humanities in premedical education. *Journal of Medical Humanities*, *42*(4), 535–569. https://doi.org/10.1007/s10912-021-09693-3

Brewer, R., & Movahedazarhouligh, S. (2018). Successful stories and conflicts: A literature review on the effectiveness of flipped learning in higher education. *Journal of Computer Assisted Learning*, *34*(4), 409–416. https://doi.org/10.1111/jcal.12250

Chambers, J., Mistry, K., Spink, J., Tsigarides, J., & Bryant, P. (2023). Online medical education using a Facebook peer-to-peer learning platform during the COVID-19 pandemic: a qualitative study exploring learner and tutor acceptability of Facebook as a learning platform. *BMC Medical Education*, *23*(1). https://doi.org/10.1186/s12909-023-04268-3

Chan, C. G., Embi, M. A. Bin, & Hashim, H. (2019). Primary school teachers' readiness towards heutagogy and peeragogy. *Asian Education Studies*, *4*(1), 11. https://doi.org/10.20849/aes.v4i1.602

Chiu, Y. L. T., Wong, B., & Charalambous, M. (2021). 'It's for others to judge': What influences students' construction of the ideal student? *Journal of Further and Higher Education*, *45*(10), 1424–1437. https://doi.org/10.1080/0309877X.2021.1945553

Coffman, S., & Draper, C. (2022). Universal design for learning in higher education: A concept analysis. *Teaching and Learning in Nursing*, *17*(1), 36–41. https://doi.org/10.1016/j.teln.2021.07.009

Corneli, J. (2012). Paragogical praxis. *E-Learning and Digital Media*, *9*(3), 267–272. https://doi.org/elea.2012.9.3.267

Corneli, J., & Danoff, C. J. (2011a). Paragogy: Synergizing individual and organizational learning. *1st International Conference on Learning Analytics and Knowledge*, *26*(1), 205–215. https://upload.wikimedia.org/wikiversity/en/6/60/Paragogy-final.pdf

Corneli, J., & Danoff, C. J. (2011b). Paragogy. *Proceedings of the 6th Open Knowledge Conference, OKCon 2011, Berlin, Germany, June 30 July 1, 2011.*, *739*, 1–10. https://doi.org/10.1007/978-3-030-20629-1_6

Cruice, M., Aujla, S., Bannister, J., Botting, N., Boyle, M., Charles, N., Dhaliwal, V., Grobler, S., Hersh, D., Marshall, J., Morris, S., Pritchard, M., Scarth, L., Talbot, R., & Dipper, L. (2022). Creating a novel approach to discourse treatment through coproduction with people with aphasia and speech and language therapists. *Aphasiology*, *36*(10), 1159–1181. https://doi.org/10.1080/02687038.2021.1942775

Cunningham, P. D. (2017). Bridging the distance: Using interactive communication tools to make online education more social. *Library Trends*, *65*(4), 589–613. https://doi.org/10.1353/lib.2017.0020

Denke, J., Jarson, J., & Sinno, S. (2020). Making the invisible visible: Enhancing information literacy and metacognition with a constructivist activity. In *International Journal for the Scholarship of Teaching and Learning* (Vol. 14, Issue 2). https://doi.org/10.20429/ijsotl.2020.140207

Dimitrova, V., & Mitrovic, A. (2022). Choice architecture for nudges to support constructive learning in active video watching. *International Journal of Artificial Intelligence in Education*, *32*(4), 892–930. https://doi.org/10.1007/s40593-021-00263-1

Divekar, R. R., Drozdal, J., Chabot, S., Zhou, Y., Su, H., Chen, Y., Zhu, H., Hendler, J. A., & Braasch, J. (2022). Foreign language acquisition via artificial intelligence and extended reality: Design and evaluation. *Computer Assisted Language Learning*, *35*(9), 2332–2360. https://doi.org/10.1080/09588221.2021.1879162

Donald, W. E., & Ford, N. (2022). Fostering social mobility and employability: The case for peer learning. *Teaching in Higher Education*. https://doi.org/10.1080/13562517.2022.2145467

Dornelles, J. de A., Ayala, N. F., & Frank, A. G. (2022). Smart Working in Industry 4.0: How digital technologies enhance manufacturing workers' activities. *Computers & Industrial Engineering*, *163*, 107804. https://doi.org/https://doi.org/10.1016/j.cie.2021.107804

Drăgoi, V., Herlo, D., Dragoi, V., & Herlo, D. (2020). Aspects on e-learning during the COVID19 pandemic at the university. *17th International Conference on Cognition and Exploratory Learning in Digital Age, CELDA 2020*, 107–114. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85099607662&partnerID=40&md5=41d36e8efc39e1efb0df67c692116be4

Dumford, A. D. D., & Miller, A. L. L. (2018). Online learning in higher education: Exploring advantages and disadvantages for engagement. *Journal of Computing in Higher Education*, *30*(3), 452–465. https://doi.org/10.1007/s12528-018-9179-z

Ellis, C., Dyer, A., & Thompson, D. (2014). Riding tandem: An organic and collaborative approach to research in vocational education and training. *Research in Learning Technology*, *22*. https://doi.org/10.3402/rlt.v22.24614

Freire, P. (2020). Pedagogy of the oppressed. In *The Community Performance Reader* (30th Anniv). https://doi.org/10.4324/9781003060635-5

Gligorea, I., Cioca, M., Oancea, R., Gorski, A.-T., Gorski, H., & Tudorache, P. (2023). Adaptive learning using artificial intelligence in e-learning: A literature review. *Education Sciences*, *13*(12). https://doi.org/10.3390/educsci13121216

Grover, S., Pandya, M., Ranasinghe, C., Ramji, S. P., Bola, H., & Raj, S. (2022). Assessing the utility of virtual OSCE sessions as an educational tool: A national pilot study. *BMC Medical Education*, *22*(1), 1–7. https://doi.org/10.1186/s12909-022-03248-3

Guskey, T. R. (2010). Lessons of mastery learning. *Educational Leadership*, *68*(2), 52–57. https://uknowledge.uky.edu/edp_facpub/14

Hamzah, F., Abdullah, A. H., & Ma, W. (2024). Advancing education through technology integration, innovative pedagogies and emerging trends: A systematic literature review. *Journal of Advanced Research in Applied Sciences and Engineering Technology*, *41*(1), 44–63. https://doi.org/10.37934/araset.41.1.4463

Han, D.-I. D., Bergs, Y., & Moorhouse, N. (2022). Virtual reality consumer experience escapes: Preparing for the metaverse. *Virtual Reality*, *26*(4), 1443–1458. https://doi.org/10.1007/s10055-022-00641-7

Handayani, S. M., Yeigh, T., Jacka, L., & Peddell, L. (2021). Developing a heutagogy approach to promoting teacher competencies in Indonesia. *Cypriot Journal of Educational Sciences*, *16*(3), 939–951. https://doi.org/10.18844/CJES.V16I3.5765

Hanson, J. M., Trolian, T. L., Paulsen, M. B., & Pascarella, E. T. (2016). Evaluating the influence of peer learning on psychological well-being. *Teaching in Higher Education*, *21*(2), 191–206. https://doi.org/10.1080/13562517.2015.1136274

Hariyanto, Amin, M., Mahanal, S., & Rohman, F. (2022). Analyzing the contribution of critical thinking skills and social skills on students' character by applying discovery learning models. *International Journal of Education and Practice*, *10*(1), 42–53. https://doi.org/10.18488/61.v10i1.2907

Hepper, J. (2021). Making change visible -- an explorative case study of dealing with climate change deniers in forest education. *Journal of Teacher Education for Sustainability*, *23*(1), 58–68. https://doi.org/10.2478/jtes-2021-0005

Herlo, D. D. (2014). Paragogy. A new theory in educational sciences. *Educația Plus*, *10*(1), 35–41. https://uav.ro/jour/index.php/jpe/article/download/213/227

Hoiland, S. L., Reyes, S., & Varelas, A. (2020). The impact of a supplemental instruction program on diverse peer leaders at a two-year institution. *Journal of Peer Learning*, *13*, 5–20. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85128803549&partnerID=40&md5=cf012c5bc6ee0b6459c933271bde4f92

Homer, D. (2022). Mature students' experience: a community of inquiry study during a COVID-19 pandemic. *Journal of Adult and Continuing Education*, *28*(2), 333–353. https://doi.org/10.1177/14779714221096175

Icenogle, G., Steinberg, L., Duell, N., Chein, J., Chang, L., Chaudhary, N., Di Giunta, L., Dodge, K. A., Fanti, K. A., & Lansford, J. E. (2019). Adolescents' cognitive capacity reaches adult levels prior to their psychosocial maturity: Evidence for a "maturity gap" in a multinational, cross-sectional sample. *Law and Human Behavior*, *43*(1), 69–85. https://doi.org/10.1037/lhb0000315

Iqbal, S., & Bhatti, Z. A. (2020). A qualitative exploration of teachers' perspective on smartphones usage in higher education in developing countries. *International Journal of Educational Technology in Higher Education*, *17*(1). https://doi.org/10.1186/s41239-020-00203-4

Janssen, J., & Kirschner, P. A. (2020). Applying collaborative cognitive load theory to computer-supported collaborative learning: towards a research agenda. *Educational Technology Research and Development*, *68*(2), 783–805. https://doi.org/10.1007/s11423-019-09729-5

Jerome, L., & Elwick, A. (2020). Teaching about terrorism, extremism and radicalisation: Some implications for controversial issues pedagogy. *Oxford Review of Education*, *46*(2), 222–237. https://doi.org/10.1080/03054985.2019.1667318

Kahu, E. R., Thomas, H. G., & Heinrich, E. (2022). 'A sense of community and camaraderie': Increasing student engagement by supplementing an LMS with a Learning Commons Communication Tool. *Active Learning in Higher Education*, *25*(2), 303–316. https://doi.org/10.1177/14697874221127691

Kamel Boulos, M. N., Giustini, D. M., & Wheeler, S. (2016). Instagram and Whatsapp in health and healthcare: An overview. In *Future Internet* (Vol. 8, Issue 3). https://doi.org/10.3390/fi8030037

Keppell, M., Au, E., Ma, A., & Chan, C. (2006). Peer learning and learning-oriented assessment in technology-enhanced environments. *Assessment & Evaluation in Higher Education*, *31*(4), 453–464. https://doi.org/10.1080/02602930600679159

Kittur, J., & Salunke, M. (2020). Mixed learning styles: A strategy for team formation. *Journal of Engineering Education Transformations*, *33*(Special Issue), 434–441. https://doi.org/10.16920/jeet/2020/v33i0/150194

Kmet, L. M., Cook, L. S., & Lee, R. C. (2004). *Standard quality assessment criteria for evaluating primary research papers from a variety of fields*. Alberta Heritage Foundation for Medical Research. https://doi.org/https://doi.org/10.7939/R37M04F16

Knowles, M. S., Holton III, E. F., Swanson, R. A., & Robinson, P. A. (2020). *The adult learner: The definitive classic in adult education and human resource development* (9th ed.). London: Routledge. https://doi.org/10.4324/9780429299612

Konstantinou, G., & Epps, J. (2017). Facilitating online casual interactions and creating a community of learning in a first-year electrical engineering course. *Proceedings of 2017 IEEE International Conference on Teaching, Assessment and Learning for Engineering, TALE 2017*, *2018-Janua*, 128–133. https://doi.org/10.1109/TALE.2017.8252317

Korherr, P., Kanbach, D. K., Kraus, S., & Jones, P. (2022). The role of management in fostering analytics: the shift from intuition to analytics-based decision-making. *Journal of Decision Systems*. https://doi.org/10.1080/12460125.2022.2062848

Laal, M., & Laal, M. (2012). Collaborative learning: what is it? *Procedia-Social and Behavioral Sciences*, *31*, 491–495. https://doi.org/10.1016/j.sbspro.2011.12.092

Lee, Y., & Rofe, J. S. (2016). Paragogy and flipped assessment: Experience of designing and running a MOOC on research methods. *Open Learning: The Journal of Open, Distance and e-Learning*, *31*(2), 116–129. https://doi.org/10.1080/02680513.2016.1188690

Lin, J.-W., Huang, H.-H., & Tsai, C.-W. (2023). Mobile collaborative learning with social network awareness. *Journal of Computer Assisted Learning*, *39*(5), 1690–1700. https://doi.org/10.1111/jcal.12826

López-Javaloyes, J.-L., Real-Fernández, A., García-Sigüenza, J., Llorens-Largo, F., & Molina-Carmona, R. (2024). Tools to support the design of network-structured courses assisted by AI. In Z. P., I. A., & I. A. (Eds.), *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics): Vol. 14722 LNCS* (pp. 53–64). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-031-61672-3_4

Luhach, S. (2020). Recreating discourse community for appropriating HOCs in law undergraduates' academic writing. *IAFOR Journal of Education*, *8*(4), 151–170. https://doi.org/10.22492/ije.8.4.09

Lunn Brownlee, J., Curtis, E., Spooner-Lane, R., & Feucht, F. (2017). Understanding children's epistemic beliefs in elementary education. *Education 3-13*, *45*(2), 191–208. https://doi.org/10.1080/03004279.2015.1069369

Matthews, K. E., Dwyer, A., Hine, L., & Turner, J. (2018). Conceptions of students as partners. *Higher Education*, *76*, 957–971. https://doi.org/10.1007/s10734-018-0257-y

Maykut, P., & Morehouse, R. (2002). Beginning qualitative research. In *Beginning Qualitative Research*. https://doi.org/10.4324/9780203485781

Merelo, J. J., Castillo, P. A., Mora, A. M., Barranco, F., Abbas, N., Guillen, A., & Tsivitanidou, O. (2022). *Chatbots and messaging platforms in the classroom: An analysis from the teacher's perspective*. https://doi.org/10.1007/s10639-023-11703-x

Mitka, M. M., Narayanswamy, S., & Smith, I. (2023). Developing teamwork in a multidisciplinary, multicohort curricular context: A case study of vertically integrated projects. *Journal of University Teaching and Learning Practice*, *20*(4). https://doi.org/10.53761/1.20.4.14

Mukul, E., & Büyüközkan, G. (2023). Digital transformation in education: A systematic review of education 4.0. *Technological Forecasting and Social Change*, *194*, 122664. https://doi.org/https://doi.org/10.1016/j.techfore.2023.122664

Mulholland, N. (2019). *Re-imagining the art school: Paragogy and artistic learning*. Springer Nature. https://doi.org/10.1007/978-3-030-20629-1

Munoz-Escalona, P., de Crespo, Z. C., Marin, M. O., & Dunn, M. (2022). Collaborative online international learning: A way to develop students' engineering capabilities and awareness to become global citizens. *International Journal of Mechanical Engineering Education*, *50*(1), 89–104. https://doi.org/10.1177/0306419020934100

Nggadas, D. E. P., Wadu, H., Nenabu, G., Liliweri, A., & Astawa, I. N. D. (2022). The impact of freedom to learn in kampus merdeka at Karyadarma University Kupang, East Nusa Tenggara. *JPP (Jurnal Pendidikan Dan Pembelajaran)*, *29*(1), 39–48. https://doi.org/10.17977/um047v29i12022p039

Nimmi, P. M., Kuriakose, V., Donald, W. E., & Muhammed Nowfal, S. (2021). HERO elements of Psychological Capital: Fostering career sustainability via resource caravans. *Australian Journal of Career Development*, *30*(3), 199–210. https://doi.org/10.1177/1038416221106

Nisar, S., Mahboob, U., Khan, R. A., & Rehman, D. (2021). Challenges of peer assisted learning in online clinical skills training of ophthalmology module. *BMC Medical Education*, *21*(1), 1–6. https://doi.org/10.1186/s12909-021-02959-3

Nkomo, L. M., Daniel, B. K., & Butson, R. J. (2021). Synthesis of student engagement with digital technologies: A systematic review of the literature. *International Journal of Educational Technology in Higher Education*, *18*(1), 34. https://doi.org/10.1186/s41239-021-00270-1

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International Journal of Qualitative Methods*, *16*(1), 1–13. https://doi.org/10.1177/1609406917733847

Oishi, J., Sato, T., Miller, R. T., Nagata, S., Fuchikami, M., Shimizu, S., Matsumoto, T., Yamaguchi, T., & Kim, S. E. (2024). Japanese graduate students' experiences in online international development and peace through sport courses using english-medium instruction during the covid-19 pandemic. *International Journal of Educational Reform*, *33*(2), 221–245. https://doi.org/10.1177/10567879221094302

Ouhrir, S., Lotfi, S., & Talbi, M. (2019). Online peeragogy: Effects of videos developed by students on peer learning and their impact on academic results. *International Journal of Emerging Trends in Engineering Research*, *7*(11), 576–583. https://doi.org/10.30534/ijeter/2019/287112019

Panah, E., & Babar, M. Y. (2020). A survey of WhatsApp as a tool for instructor-learner dialogue, learner-content dialogue, and learner-learner dialogue. *International Journal of Educational and Pedagogical Sciences*, *14*(12), 1198–1205. https://publications.waset.org/10011648/a-survey-of-whatsapp-as-a-tool-for-instructor-learner-dialogue-learner-content-dialogue-and-learner-learner-dialogue

Park, S. (2020). Rethinking design studios as an integrative multi-layered collaboration environment. *Journal of Urban Design*, *25*(4), 523–550. https://doi.org/10.1080/13574809.2020.1734449

Peimani, N., & Kamalipour, H. (2021). Online education in the post covid-19 era: Students' perception and learning experience. *Education Sciences*, *11*(10). https://doi.org/10.3390/educsci11100633

Piotrowski, K., Brzezińska, A. I., & Luyckx, K. (2020). Adult roles as predictors of adult identity and identity commitment in Polish emerging adults: Psychosocial maturity as an intervening variable. *Current Psychology*, *39*(6), 2149–2158. https://doi.org/10.1007/s12144-018-9903-x

Prasetya, E. P., Nuraeni, N., & Shabir, M. (2022). Teachers'perception of peeragogy in online learning during the covid-19 pandemic. *Journal of English Educational Study (JEES)*, *5*(2), 141–151. https://doi.org/10.31932/jees.v5i2.1781

Qassrawi, R. (2023). Education 3.0 underpinned with the heutagogical approach for a smooth shift to distance learning in higher education. *International Journal of Education and Practice*, *11*(1), 1–13. https://doi.org/10.18488/61.v11i1.3238

Ramírez-Montoya, M. S., Castillo-Martínez, I. M., Sanabria-Z, J., & Miranda, J. (2022). Complex thinking in the framework of Education 4.0 and open innovation—A systematic literature review. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*(1), 4. https://doi.org/https://doi.org/10.3390/joitmc8010004

Riandi, R. (2022). Inducing constructivism and post-method in the paradigm of paragogy: A proposed learning framework for literacy practice in EFL context. *International Conference on Madrasah Reform 2021 (ICMR 2021)*, 292–299. https://doi.org/10.2991/assehr.k.220104.044

Robertson, J. M., & McCall, V. (2020). Facilitating creativity in dementia care: The co-construction of arts-based engagement. *Ageing and Society*, *40*(6), 1155–1174. https://doi.org/10.1017/S0144686X18001575

Rodriguez, S. B. (2020). Using a game for undergraduate global health students in the united states to practice applying ethical research principles. *Learning and Teaching: The International Journal of Higher Education in the Social Sciences*, *13*(1), 87–101. https://doi.org/10.3167/latiss.2020.130106

Sabari, N. S. I., Roslan, N. N., Yazid, F., & Ibrahim, N. (2022). Peeragogy teaching method in oral pathology course. *Journal of International Dental and Medical Research*, *15*(2), 707–711. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85133757612&partnerID=40&md5=838a054ce2fcc48babec41eb2138c5c6

Sekhar, C. C., Tangudu, N., Pydisetti, V., Payli, P., Narindi, A., & Enni, C. (2024). Multimodal AI-embedded blockchain security approach for smart student monitoring. In *The Future of Mobile Computing* (pp. 259–288). Nova Science Publishers, Inc. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85196946578&partnerID=40&md5=71e3c224d4da1ce98bad40c30ded7420

Sims, R., Chang, B., Bennett, V., Krishnan, A., Aboubakar, A., Coman, G., Bahrami, A., Huang, Z., Clarke, C., & Karnik, A. (2022). Step into my mind palace: Exploration of a collaborative paragogy tool in VR. *Proceedings of 2022 8th International Conference of the Immersive Learning Research Network, ILRN 2022*. https://doi.org/10.23919/iLRN55037.2022.9815936

Suhaimi, N. A., Adnan, M., & Puteh, M. (2020). Promoting transformative mathematical learning through heutagogy, paragogy and cybergogy approaches. *Palarch's Journal Of Archaeology Of Egypt/Egyptology*, *17*(10), 481–497. https://doi.org/10.48080/jae.v17i10.4374

Sun, Y., Franklin, T., & Gao, F. (2017). Learning outside of classroom: Exploring the active part of an informal online English learning community in China. *British Journal of Educational Technology*, *48*(1), 57–70. https://doi.org/10.1111/bjet.12340

Tajudin, N. M., Suhaimi, N. A., Adnan, M., & Puteh, M. (2020). Synergizing mathematical learning at higher institution through heutagogical approach. *Universal Journal of Educational Research*, *8*(6), 2646–2653. https://doi.org/10.13189/ujer.2020.080648

Talley, K. G., & Smith, S. (2018). Asynchronous peer-to-peer learning: Putting student projects to work in future classes. *Advances in Engineering Education*, *6*(3). https://hdl.handle.net/10877/9086

Thong, C. L., Lim, W. L., & Islam, S. (2023). Perception of co-supervisors in doctoral education towards mobile information systems for higher education in Malaysia. In S. G. & W. J. (Eds.), *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics): Vol. 14052 LNCS* (pp. 296–306). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-031-35921-7_21

Tsay, M., & Brady, M. (2010). A case study of cooperative learning and communication pedagogy: Does working in teams make a difference? *Journal of the Scholarship of Teaching and Learning*, 78–89. https://scholarworks.iu.edu/journals/index.php/josotl/article/view/1747

Twenge, J. M. (2023). *Generations: The real differences between gen z, millennials, gen x, boomers, and silents—and what they mean for America's future*. Simon and Schuster. https://www.simonandschuster.com/books/Generations/Jean-M-Twenge/9781982181611

Urhahne, D., & Wijnia, L. (2023). Theories of motivation in education: An integrative framework. In *Educational Psychology Review* (Vol. 35, Issue 2). Springer US. https://doi.org/10.1007/s10648-023-09767-9

Ward, J. T., Link, N. W., & Forney, M. (2023). Mental and physical health, psychosocial maturity, and desistance in young adulthood. *Journal of Developmental and Life-Course Criminology*, *0123456789*. https://doi.org/10.1007/s40865-023-00224-3

Watson, W. R., Watson, S. L., & Reigeluth, C. M. (2015). Education 3.0: Breaking the mold with technology. *Interactive Learning Environments*, *23*(3), 332–343. https://doi.org/10.1080/10494820.2013.764322

Weidlich, J., & Bastiaens, T. J. (2019). Designing sociable online learning environments and enhancing social presence: An affordance enrichment approach. *Computers and Education*, *142*. https://doi.org/10.1016/j.compedu.2019.103622

Wilson, A., Howitt, S., Holloway, A., Williams, A. M., & Higgins, D. (2021). Factors affecting paramedicine students' learning about evidence-based practice: A phenomenographic study. *BMC Medical Education*, *21*(1), 1–12.

https://doi.org/10.1186/s12909-021-02490-5

Wu, T., & Yu, Z. (2024). Bibliometric and systematic analysis of artificial intelligence chatbots' use for language education. *Journal of University Teaching and Learning Practice*, *21*(6). https://doi.org/10.53761/6jmnst54

Yang, L., & Wang, Y. (2023). Application of a peer learning and assessment model in an undergraduate pharmacy course. *BMC Medical Education*, *23*(1). https://doi.org/10.1186/s12909-023-04352-8

Zhang, Y., & Maconochie, M. (2022). A meta-analysis of peer-assisted learning on examination performance in clinical knowledge and skills education. *BMC Medical Education*, *22*(1), 1–14. https://doi.org/10.1186/s12909-022-03183-3