



Components and Strategies for Personalized Learning in Higher Education: A Systematic Review

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Abstract. Disruptive technology has influenced education worldwide, particularly during the COVID-19 pandemic. Notably, the compelling rise and massive changes in the e-learning industry have shifted education due to technological advancement. Also, in Industrial Revolution 4.0 (digitalization), the virtual learning environment has mushroomed as everything goes digital through MOOCs, gamification, mobile learning, social learning, wearable learning, and personalized learning. This way, teachers can personalize instruction based on each student's skills and learning style. This article systematically and critically synthesizes empirical research from 40 studies published between 2011 and 2021 to depict the complex nexus of personalized learning in higher education. The studies' descriptive statistics reviewed included the research designs, participant characteristics, and settings. Then, the findings of the qualitative content analysis indicate the major themes. The inclusive criteria were grounded on (1) peer-reviewed studies, (2) studies concerning personalized learning in higher education contexts, and (3) studies published within the last ten years. Google Scholar, one of the most popular web-based databases, was used to search for these articles. It links to other web-based databases, such as Proquest, ERIC, and the websites of journal publishers. In the corpus of forty studies, case studies in non-EFL departments were the most preferred study design for personalized learning research in higher education. Besides, this systematic review revealed four prevalent findings in defining personalized learning, underpinning theories, and identifying personalized learning components and strategies. This study shows how early studies were done and how they relate to future research and practice, especially the research gap.

Keywords: Components · Higher education · Personalized learning · Strategies · Systematic review

1 Introduction

Disruptive technology has influenced education around the world. Notably, the rapid change occurred during the COVID-19 pandemic. Many educators have evolved their

teaching paradigm to be more technology-mediated since the traditional classroom suddenly shifted into an online classroom [1–3]. Therefore, teachers at any level of education sharpen their knowledge and skills in embracing technology in the classroom. Teachers' practice integrating technology synchronously and asynchronously to engage students in online classroom interaction. In this regard, technology is not the primary inducement for adaptability but rather a crucial enabling aspect (Gordon, 2014; Keamy et al., 2007, cited in [4]). Technology and new pedagogies must be addressed to retain students longer and personalize learning (Johnson et al., 2012, cited in [4]). Moreover, if this persists, the demand for online education, such as e-learning platforms, will increase as the urge for remote collaboration rises during this pandemic.

We have witnessed a compelling rise and massive changes in the e-learning industry (Dondi & Delrio, 2006, cited in [5]). As everything goes digital, the virtual learning environment mushrooms in Industrial Revolution 4.0 (digitalization). The future of e-learning will include Massive Open Online Courses (MOOC), gamification, mobile learning, social learning, wearable learning, and personalized learning. Remarkably, the next Industrial Revolution 5.0 is personalization. This way, to meet the needs of their students, today's educators are embracing personalized methods of instruction to take into account students' varying specific skills and convenient modalities of cognition [5].

In a significant shift, the e-learning environment has evolved into the Smart Learning Environment (SLE), as indicated by Peng et al. [6]. SLE provides capabilities of documenting the learning process, detecting learning scenarios, being cognizant environment, and linking learning communities. This shift will be reinforced by a revamped teaching style and personalized adaptive learning.

In 1998, John Dewey's views supported the creation of personalized learning (PL) theories, including experiential, learner-centered learning, social learning, curricular extension, and change resilience [7]. According to Xie et al. [8], the phrases "personalized learning" and "adaptive learning" are different ideas but are sometimes used interchangeably. Xie et al. [8] noted that they could meet different learning needs using different strategies. Personalized learning occurs without identifying the learner's individual abilities to execute tasks. On the other hand, adaptive learning can be based on a learner's performance without individualized data. Also, individual qualities and preferences may affect progress or performance. However, as outlined by Xie et al. [8], "personalized learning" and "adaptive learning" share the ability to adjust to learners' needs. If limited to technology-enhanced learning, "personalized learning" and "adaptive learning" are confusing.

Personalized learning (PL) is a latent approach to meeting future educational demands in the general context. This technique may offer new possibilities for boosting learners' learning capacities (Bentley & Miller, 2004, cited in [9]). However, Järvelä [9] further articulates the factors that must be addressed to maintain the learner's innate skills, flexibility, initiative, focus, and enthusiasm. The processes include the development of critical abilities, strengthening students' cognitive performance and retention, fostering learning, partnership in understanding, establishing innovative assessment instruments, and technology's usability as a personal cognitive and social device [9].

Personalized learning adapts to each student's passion, attributes, and needs, following Patrick, Kennedy, and Powell (2013, cited in [10]). In sum, it promotes adaptability

to enhance mastery and lets learners control how, what, when, and where they learn. Groff (2017, in [11]) considers personalized learning to be an umbrella phrase that encompasses other educational ideas, such as learning analytics, differentiated learning, and adaptive learning. Individualization, student-centeredness, and a dynamic learning environment are closely allied with these educational tenets. A distinguishing characteristic of customized learning is its emphasis on student autonomy and choice. This worldview ultimately transforms the higher education system, as observed by Ryan and Tilbury (2013, referenced in [4]), who note that pedagogical notions modify teaching and learning and produce a more flexible, technologically advanced higher education system.

This systematic review aims to understand how personalized learning components and strategies are applied in online higher education by analyzing empirical investigations done within the recent decade. Specifically, this review investigates personalized learning components and strategies in online higher education environments. Moreover, the systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses standards.

2 Literature Review

2.1 What is Personalized Learning?

Many facets of student-centered instruction can be alluded to as personalized learning. According to Stephens [12], some researchers and institutions propose some definitions. The five main parts of PL are flexible learning, redefining the role of the teacher, project-based experiential learning, a student-driven learning path, and a mastery/competency-based pace [13]. Personalized learning is closely related to the educational paradigm shift regarding the student-centered approach. This new paradigm regards learner differences and controls technology highly. Educators and learners co-plan an individualized educational experience [14]. In addition, personalized learning promotes the growth of more profound learning abilities, such as logical reasoning, problem-solving, collaboration, effective communication, and academic attitudes [15]. Personalized Learning is a strategy in which students increasingly participate in meaningful, authentic, and decided tasks to exhibit desired outcomes [16]. In other words, student agency is highly promoted in PL.

Moreover, the instruction strategy is defined in PL. PL focuses on students' needs, learning plans, potential, flexibility, and parent involvement in student learning [17]. To encourage mastery of skills and content and to offer flexibility and assistance, PL should adapt technology in learning instruction to students' learning requirements, strengths, and interests [18, 19].

Teacher-student interaction plays a pivotal role in PL. In a PL environment, students actively contribute to their learning process as they have a voice in establishing close, intimate relationships with their peers, instructors, and other adults. In this case, the teacher guides the student's journey [20]. In addition, PL incorporates parents, supports smaller class sizes and one-on-one connections between teachers and students, considers diverse

learning styles and digital availability, and fosters student-driven engagement. Therefore, students can improve the learning process, diverse learning environments, access to technology, teacher and parent development programs, and curriculum selection.

2.2 Personalized Learning Components

Shemshack, Kinshuk, and Spector [21] portray personalized learning components which thus comply with Peng et al.'s depiction [6].

2.2.1 Learning Styles

Tseng et al. [22] suggested merging two data sources on learning styles and activities, such as learning effectiveness and concentration level. Moreover, learning accomplishment may be leveraged as a determining factor to personalize student learning materials. However, Hwang et al. [23] contended that learning styles are one of the most prevalent characteristics to consider when building adaptive learning systems, but few studies have examined whether students can choose the most appropriate systems based on their learning styles.

2.2.2 Cognitive Styles

Personalized learning strategies require learning characteristics such as personality and cognitive types [24]. The relationship between learning profile and ability, academic achievement, or classroom instruction and learning environment is noteworthy. However, the more mature and competent students are, their interests and skills will likely shift.

2.2.3 Self-Reflection and Self-Regulated Learning

Self-reflection and self-regulation are crucial to the progressive development of learning, which is a complex process. Self-regulated learning (SRL) is one of the essential research fields in education over the past two decades, according to Panadero [25], who identified the cognitive, metacognitive, behavioral, motivational, and emotional/affective elements of learning as well as the data available to researchers. A dynamic, personalized learning model can give learners a more enjoyable and exciting learning experience while considering their goals and requirements. Researchers and academics have access to several models and approaches for personalized learning. However, in the context of SRL, no age or level of learner preparation is considered to ensure that the learner is ready to self-regulate their learning.

2.2.4 Flexible Pacing

Most educators and academics postulate that personalized learning allows pupils to study at their own pace. Sturgis and Patrick (2010, as described in [26]) reiterate that well-designed technology systems enable personalized learning by tracking individual progress and advocating personalized learning pathways.

2.2.5 Tools and Systems

Numerous instruments and techniques offer everyone an exceptional learning opportunity. Smart Learning Environments (SLE) are necessary to facilitate personalized learning by aiding students in obtaining their learning objectives. In this way, SLE tools can foster essential elements of personalized learning, including students' awareness, recommendations, self-reflection, assessment, feedback, and motivation [6, 27].

2.2.6 Smart Learning Environments

Chatti and Muslim [27] highlight that SLE must foster sensitivity, suggestion, self-reflection, assessment, constructive criticism, and enthusiasm to facilitate personalized learning. Hwang (2014, as referenced in [28]) proposed that an SLE may provide quick and adaptive support to learners by examining their needs from several viewpoints in real-time.

2.2.7 Intelligent Tutoring Systems

Another system that supports personalized learning experience is intelligent tutoring systems (ITS), which employ computational algorithms or models to deliver immediate feedback and learning instructions to learners without human teachers. ITS incorporates built-in expert systems to monitor a learner's performance and personalize instructions based on adaptation to the learners' learning style, current knowledge level, and appropriate teaching strategies in e-learning systems [26].

2.2.8 Data Mining and Learning Analytics

Zhu, M. H. Yu, and P. Riezebos [30] pointed out that data mining (DM) and learning analytics (LA) are two applications in education that keep making use of big data. Big data is frequently described as massive in volume, swift in velocity, diverse in variety, exhaustive in scope, attempting to capture entire populations, social in nature, flexible, and versatile (Kitchin, 2014, cited in [31]). DM and LA support learning by registering learning data to evaluate learning methods, predict expected performance, and uncover faults. LA can be essential in analyzing data from diverse learning environments, promoting personalized activities based on learners' needs and goals, and supporting learners optimally. Chatti and Muslim [27] also noted the increased interest in LA to promote personalized learning. Siemens and Baker (2012, as cited in [28]) defined LA as using students' information and research models to separate data and social links and guide learning. Zhang et al. (2018) supported the idea of LA and SLEs. Meanwhile, DM is used to create techniques to investigate the extraordinary information in instructive settings and to see better understudies and the settings in which they learn [32].

2.2.9 Wearable Devices

Borthwick et al. (2015, as quoted in [8]) brought up that with information technologies for learning applications implemented on mobile and wearable devices, differentiation of instruction and student involvement will evolve into a new trend. In addition, each of these

systems asserts that learning is a cyclical process comprised of various dynamic phases that involve goal formulation, planning, activating goals, and executing performance [25].

2.3 Personalized Learning Strategies

Regarding PL strategies, Keppell [33] proposed six personalized learning strategies: digital citizenship, seamless learning, learner engagement, learning-oriented assessment, lifelong and life-wide learning, and desire paths.

2.3.1 Digital Citizenship

Digital literacy is an integral component of personalized education. Students are expected to improve their digital literacy since they play a crucial role in a digital society. Using digital technologies effectively will be crucial for finding and keeping a job in the future. Digital literacies will enable mobile and nomadic learners as they navigate varied learning venues with ease.

2.3.2 Seamless Learning

Seamless learning refers to what was earlier regarded to be different, separate components [34]. For example, in-class and out-of-class activities, academic and non-academic circumstances, curricular and co-curricular interactions, and on-campus and off-campus experiences are now one piece, tied together to appear continuous. These ideas build seamless university learning environments: (1) revitalize institutions; (2) Set a common goal for learning; (3) cultivate a common language; (4) boost cross-functional communication and collaboration; (5) envisage how student culture affects student learning; (6) concentrate on structural reforms.

Also, seamless learning refers to bridging learning across settings, technologies, and activities [35]. Maintaining continuity and fluidity between contexts or environments, whether physical, virtual, or hybrid [35, 36].

In PL, students need to promote strategies for learning reflection, connecting with peers, and awareness of the influence of new learning spaces on their learning engagement.

2.3.3 Student Engagement

Following Coates [37], student engagement is characterized by active and collaborative learning, strenuous academic activities, constructive dialogue with academic staff, the development of educational experiences, and a sense of legitimacy and support from university learning communities. Besides, aligning pedagogical, technical, and administrative issues is necessary to establish a captivating learning environment. As a multidimensional phenomenon, engagement measures intrinsic involvement, educational outcomes, and learners' involvement in learning. In addition, it investigates the impact of university education quality on student learning and the relationships between students and their universities [37]. Time, effort, and resources are crucial to student engagement,

as students devote themselves to activities to enhance their university education, such as time spent on campus or studying and in-class and out-of-class learning experiences (Krause, 2005, cited in [38]). Learners must be empowered and supported to make involvement meaningful in this situation. Consideration must also be given to adopting ways to aid students in actively engaging in their studies and coping with challenging situations. Personalized learners will need to understand how a learning environment promotes engagement. The evaluation must be tailored and contextualized to the student's learning path in next-generation learning environments. Thus, a learning-focused assessment has the potential to help achieve this objective.

2.3.4 Learning-Oriented Assessment

Learning-oriented assessment is a potential approach used to emphasize the assessment of learning approaches. Carless et al. [39] advocated for three fundamental elements of learning-oriented assessment: assessment tasks, student involvement in the assessment processes, and forward-looking feedback. The focus of assessment tasks is the development of an assessment comprising the learning outcomes. Then, by integrating students into the assessment process, students become aware of the evaluation's characteristics and components. We provide forward-looking feedback by delivering actionable feedback to the learner. Active learning assists students in understanding the significance of assessment. In other words, through self-evaluation, reflection, and self-regulation, active learners can assess the quality of their work.

2.3.5 Lifelong and Life-Wide Learning

Personalized learning necessitates a confident disposition and drive. A lifelong learner embraces change and is intrinsically motivated to continue learning throughout their lifetime. Watson [40] states that lifelong and life-wide learning includes formal and informal learning as well as self-motivated learning. Moreover, life-wide learning emphasizes learning experiences across various areas, sites, and settings. Life-wide learning acknowledges that a person's life comprises numerous parallel and interconnected journeys and experiences [41]. Notably, the core consists of the intrinsic motivation to continue learning throughout one's life. Personalized learners must also create learning pathways that correspond to their life circumstances.

2.3.6 Desire Paths

There is a shortcut to achieving learning goals in the learning process usually taken by learners. In PL, students are eager to adapt their learning experiences to their circumstances, needs, and career goals. Therefore, they must refine their learning journey continuously by considering their desired paths at various stages of their learning journey [42].

2.4 Personalized Learning in Higher Education

The rise and proliferation of the Internet and social media technologies boost educational change [43]. Consequently, learning in higher education has shifted to various

places and spaces we seamlessly navigate [42]. He explicates that future students will be able to transition between spaces without difficulty because they will be able to adapt to and utilize the affordances of the learning spaces with their mobile devices. The evolution toward personalizing education has influenced the location and environment of education. This way, students must be digital citizens with sophisticated literacies in embracing ubiquitous learning spaces. Consequently, there is a growing need to educate university instructors and students on leveraging the use of diverse learning environments. Moreover, addressing learning needs, preferences, and interests play a pivotal role in personalized learning. This way, the instruction is tailored to those different learners.

Higher education has recently witnessed a proliferation of personalized learning. The implementation of personalized learning has improved students' learning and retention (Foss, Foss, Paynton, & Hahn, 2014, cited in [44]). When designing online courses for higher education, they comply with the principle of personalized learning while considering students' basic needs, which affects their intrinsic motivation and learning. Some universities and colleges have developed various models and platforms to promote personalized learning. In this case, the role of technology is badly needed to enhance personalized learning for different learners, such as the emergence of MOOCs, mobile learning applications, and software. Markedly, PL in Higher Education seeks to promote each student's academic success by identifying his or her interests, needs, and aspirations and then aiding the planning and implementation of personalized academic plans [45].

3 Methods

This systematic review undertook a literature review to answer a question by applying a replicable search strategy. This study included or excluded studies according to explicit criteria (Gough, Oliver, & Thomas, 2012, cited in [46]). This multi-phase study analyzes peer-reviewed research publications on personalized learning in higher education throughout the past decade. Multiple searches and selections were conducted to identify publications eligible for comprehensive analyses.

3.1 Source Databases

Since the rise of online publications and open access resources, a broad search for scholarly literature has been conducted electronically. Google Scholar was selected because it links to other web-based databases, including ProQuest, ERIC, Springer, and journal publisher websites.

3.2 Searches and Selections

Several searches were performed on the source database using various keywords and search strategies, such as personalized/personalised, personalized/personalised learning, personalized/personalised pedagogy, and personalized/personalised learning in EFL and higher education. Then, focusing specifically on research examining personalized learning, the following inclusive criteria were applied: (1) peer-reviewed studies, (2) studies concerned with personalized learning in higher education contexts, and (3) studies published within the last ten years.

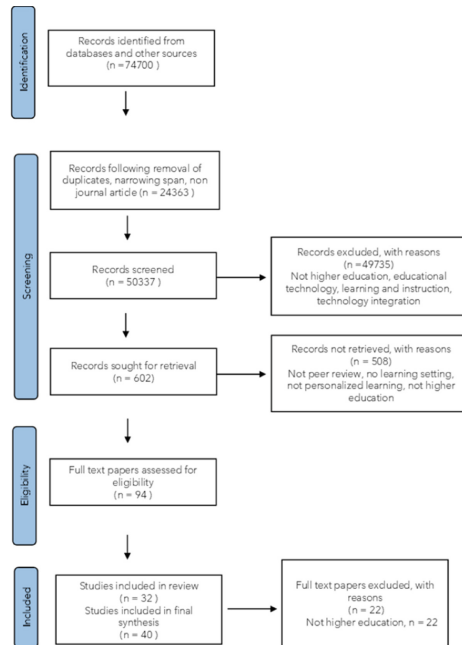


Fig. 1. Flowchart of the papers comprising the review.

3.3 Selection Criteria and Results

To meet the predetermined goals of the research, a set of selection criteria was established and used. Only English-language, peer-reviewed journal articles reporting empirical, theoretical, or conceptual, evidence-based studies were selected for further analysis. The following were excluded: (a) non-English publications, (b) conference proceedings or presentations, (c) reports of personal user experiences, (d) articles reporting no data or without enough data, and (e) studies not related to higher education, educational technology, learning, and instruction, technology integration.

In addition, the screening and selection process strictly adhere to the following criteria: (1). Research must focus on personalized learning in higher education settings. (2). Research must be empirical, evidence-based studies. Theoretical, conceptual, and literature review papers were meticulously read to enhance foundational knowledge and broaden empirical support for a more comprehensive grasp of personalized education. Subjective views and anecdotes articles were disqualified. The researchers analyzed all search results and agreed on whether each article should be included or excluded. After careful screenings and preliminary analyses, 40 research articles were chosen for an in-depth examination. The journals are various, such as Language Learning and Technology, International Journal of Emerging Technologies in Learning, Teaching Education, Journal of Research on Technology in Education, Assessment & Evaluation in Higher Education, Journal of Online Learning Research, Educational Technology, and Society, Education and Information Technologies, Journal of Personalized Learning, IEEE

Transactions on Learning Technologies, Journal of Computing in Higher Education, Computers and Education, and many others (Fig. 1).

3.4 Analysis Methods

Content analysis has bridged the gap between quantitative and qualitative literature review methods (e.g., [47]). Thus, inductive content analysis was conducted in this study. The researchers analyzed each admissible article to determine the following: research foci, theoretical frameworks, research designs, participants, and research contexts. Then, key findings were identified to generate the emerged themes and patterns. In the final step, all reviewed papers were coded for each theme.

4 Findings and Discussion

4.1 The Landscape of Personalized Learning in Higher Education Research Publications

A total of 40 empirical and evidence-based research articles focused on personalized learning in higher education within the last ten years were thoroughly reviewed, starting from 2011 to 2021. As can be seen in Table 1, studies on personalized learning in higher education were primarily conducted in 2020 and 2021 (18%). The second most conducted research was in 2019 (13%). Most (35%) of the empirical studies were presented as case studies. The second most prevalent type of personalized learning in higher education was experimental studies (20%), followed by design-based research (15%) and quasi-experimental (10%). The rest of the preferred types of research design on personalized learning in higher education studies were a correlation study (5%), comparative study, descriptive study, narrative study, action research, ethnography, and phenomenology (3%). Most (67,5%) of the studies reviewed involved students as the participants of the research, with a few studies focused on the teachers (20%) and the system (12,5%). Studies on personalized learning in higher education dominantly took place in the non-English as a Foreign Language (EFL) context (67,5%) rather than in the EFL context (32,5%).

The demography of reviewed studies depicts that personalized learning research has increased recently in the last three years. It indicates that personalized learning in higher education attracts stakeholders, such as teachers and institutions, to investigate in-depth analysis, particularly in a specific context. Indeed, a case study was found prevalently in the reviewed studies. Interestingly, the personalized learning research in the EFL context was still limited as it was dominantly conducted in the non-EFL context.

4.2 Defining Personalized Learning

In attempting to define the concept of personalized learning, 60% of studies ($n = 24$) were in this corpus. The other 40% of studies did not define personalized learning. In constructing their definitions, the authors of these 24 studies consulted diverse sources. The most popular definition of personalized learning within these studies focused on

learners' needs, interests, and goals (e.g. [44, 45, 48–57]), the pace of learning [44, 49, 57–59], competencies [48], role [60], characteristics [50, 56], the promotion of self-realization [61], aspirations [45], learning styles [53–55, 62, 63], knowledge background and self-directed learning ability [53, 58], motivation [54, 56], self-initiated, self-directed or self-prioritized [64, 65], and participation [66].

Overall, the definition of personalized learning in the reviewed studies has consistently pinpointed the learners' aspects seen from a diverse point of view. This student-centered learning fosters individual learners' learning capacities and conforms to perspectives made by Järvelä [9] and to some definitions cited in Stephens [12]. Significantly, the majority of definitions focusing on learners' interests, strengths, and needs investigated in the reviewed studies are comparable with previous studies conducted by Patrick, Kennedy, and Powell (2013, cited in [10]) to promote mastery of skills and content and provide flexibility and support [18, 19]. In addition, some definitions emphasize competency-based education or learner autonomy, whereas others emphasize individualized pacing or learning preferences consistent with Lokey-Vega and Stephens' theories [14].

4.3 Theoretical Underpinnings

In supporting personalized learning, 63% ($n = 25$) of studies employed a theoretical model in their research. Half of them ($n = 13$) used learning theories to support the concept of personalized learning in their studies. Theories on learning are related to self-determination theory [58], self-regulated learning [67], scaffolding [68], memory learning strategies, engagement model [61], Community of Inquiry [58], learning styles [62], achievement goal theory [56], and proximal zone development (ZPD) [58].

Moreover, another half ($n = 12$) of the studies used other theories of e-learning, or virtual environment, as they investigated the e-learning platforms or developed personalized learning models. Theories of e-learning include adaptive learning [69]; learner model [70]; ICSDR (Identity, Conceptualize and Connect, Storyboard, Develop, Review, Reflect, Revise) model [49]; virtual learning environment [60, 71]; item response theory (IRT) [57, 72]; fuzzy logic theory [72]; learning analytics [58]; and technology-enhanced personalized learning [73].

The balance portion of underpinning theories used in the reviewed studies demonstrates the learning theories juxtaposed with other e-learning or virtual environment theories to complement each other.

4.4 Personalized Learning Components

The personalized learning components occurred in the reviewed studies. However, all components were not available in the respective study. They were scattered in different studies. The most significant personalized learning components in the reviewed studies were tools and systems, documented in 25 studies (63%). Then, the learning styles component was reported in 23 studies (53%). In comparison, other components were distributed over the reviewed studies, such as self-reflection or self-regulated learning ($n = 13$, 33%), cognitive styles ($n = 12$, 30%), flexible pacing ($n = 6$, 15%), data mining and learning analytics ($n = 8$, 20%), wearable devices ($n = 7$, 18%), and smart learning environment ($n = 6$, 15%), and intelligent tutoring systems ($n = 4$, 10%).

The employment of nine components of personalized learning varied in each study, as seen in Table 2. The most significant number of components discussed in reviewed studies was two components. The studies conducted by Chaichumpa et al. [60]; Liman-Kaban [58]; Troussas et al. [59]; Hariyanto et al. [52]; Salinas and De-Benito [74]; Tsai et al. [31]; Sarwar et al. [75]; Hallman, [51]; Mudrak [54]; Turvey and Hayler [76]; Rahmani [64]; Gomez [50]; and Godwin-Jones [77], for instance, only investigated two of nine personalized learning components. Meanwhile, seven of nine components were revealed in one study by Nandigam et al. [73], and no study covered eight or nine components of personalized learning. This result indicates that all components of personalized learning proposed by Shemshack, Kinshuk, and Spector [21] and Peng et al. [6] have not yet been investigated in one study. This gap is beneficial for future studies investigating personalized learning components.

4.5 Personalized Learning Strategies

Most studies in this corpus ($n = 18$, 45%) elaborated on student engagement as a personalized learning strategy. Then, the learning-oriented assessment was employed in twelve studies (30%). Some studies ($n = 5$, 13%) revealed that digital citizenship is an essential strategy. Meanwhile, seamless learning and desire paths showed in an equal number of studies ($n = 4$, 10%, respectively)—finally, only one study (3%) investigated lifelong and life-wide learning as a personalized learning strategy, which was conducted by Hughes [78].

Various emergence was found in all reviewed studies, as seen in Table 3. The study's most prevalent ($n = 14$, 35%) investigated one personalized learning strategy. Interestingly, twelve studies (30%) did not reveal any strategies for personalized learning, and no study investigated five or six personalized learning strategies. The other studies examined two personalized learning strategies ($n = 8$, 20%), three personalized learning strategies ($n = 5$, 13%), and four personalized learning strategies ($n = 1$, 3%).

The result shown in Table 3 demonstrates that the personalized learning strategies proposed by Keppell [37] have not yet been examined entirely in the reviewed studies. The limited personalized learning strategies explored in the reviewed studies demonstrate that in-depth analysis has not yet been investigated in higher education.

Table 1. A summary of research studies in Personalized Learning in Higher Education

| Characteristics | N | % |
|-------------------------|----------|----------|
| Publication Year | | |
| 2011 | 2 | 5% |
| 2012 | 2 | 5% |
| 2013 | 3 | 8% |
| 2014 | 2 | 5% |
| 2015 | 4 | 10% |
| 2016 | 1 | 3% |
| 2017 | 3 | 8% |
| 2018 | 4 | 10% |
| 2019 | 5 | 13% |
| 2020 | 7 | 18% |
| 2021 | 7 | 18% |
| Research Design | | |
| Qualitative | | |
| Case Study | 14 | 35% |
| Comparative | 1 | 3% |
| Descriptive | 1 | 3% |
| Narrative | 1 | 3% |
| Action Research | 1 | 3% |
| Design-based | 6 | 15% |
| Ethnography | 1 | 3% |
| Phenomenology | 1 | 3% |
| Quantitative | | |
| Experiment | | |
| Experimental | 8 | 20% |
| Correlation | 2 | 5% |
| Quasi-Experimental | 4 | 10% |
| Participants | | |
| Students | 27 | 67,5% |
| Teachers | 8 | 20,0% |
| System | 5 | 12,5% |
| Context | | |
| EFL | 13 | 32,5% |
| Non-EFL | 27 | 67,5% |

Table 2. The frequency of personalized learning components in reviewed studies (Studies n = 40)

| PL Components | Studies | Percentage (%) |
|---------------|---------|----------------|
| 1 | 7 | 18 |
| 2 | 13 | 33 |
| 3 | 10 | 25 |
| 4 | 3 | 8 |
| 5 | 6 | 15 |
| 6 | 0 | 0 |
| 7 | 1 | 3 |
| 8 | 0 | 0 |
| 9 | 0 | 0 |

Table 3. The frequency of personalized learning strategies in reviewed studies (Studies n = 40)

| PL Strategies | Studies | Percentage (%) |
|---------------|---------|----------------|
| none | 12 | 30 |
| 1 | 14 | 35 |
| 2 | 8 | 20 |
| 3 | 5 | 13 |
| 4 | 1 | 3 |
| 5 | 6 | 0 |
| 6 | 0 | 0 |

5 Limitations

This systematic review attempted to abide by the methodology as strictly as possible. However, several obstacles were also encountered, resulting in the study's limitations. First, some searched articles in web-based databases and journal publisher websites cannot be accessible after applying the selection criteria. Then, it took longer to find more references. Second, the sampling strategy likely accounts for the limited number of studies (n = 40) due to the study's time constraints. It also applied to the number of themes investigated in the reviewed study. In conclusion, the results of this systematic review provide a preliminary view of the overall body of research identified during the search, and additional research is ongoing to provide a deeper understanding of additional facets of personalized learning.

6 Recommendations

In light of the study's limitations, this study identifies several areas that warrant further investigation. Although this study utilized the framework proposed by previous research to understand prior learning in higher education as a multifaceted construct with greater depth and breadth, it did so to comprehend previous learning as a complex phenomenon better. It implies that it is not sufficient to focus solely on measurable indicators of personalized learning but that a more complex effort must be made to uncover and investigate these indicators. Therefore, additional research is encouraged into other facets of personalized learning in higher education, especially in the context of EFL, which is still limited.

This analysis demonstrates the existence of research gaps concerning specific components and personalized learning strategies, which are not entirely applied in all reviewed studies. This finding encourages educators within higher education institutions to design or conduct the practice of personalized learning by applying all components and strategies. Notably, revealing new components and strategies will contribute more to the field.

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Authors' Contributions. In addition to performing the systematic review search and data extraction, IY reviewed the literature on personalized learning, drafted the review's method, findings, discussion, and conclusion sections, and created all graphs and tables. The article was revised and proofread by DS. The final manuscript has been read and approved by all writers.

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