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ARTIFICIAL INTELLIGENCE IN PERSONALIZED LEARNING FOR CAREER GUIDANCE: A SYSTEMATIC LITERATURE REVIEW

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Abstract
This study presents a systematic literature review (SLR) examining how Artificial Intelligence (AI) has been applied to support personalized learning systems in career guidance for secondary and higher education students. Using the PRISMA 2020 framework, four major databases Scopus, Web of Science, ERIC, and IEEE Xplore, were systematically searched for articles published between 2018 and 2025. A total of 18 empirical studies met the inclusion criteria and were analyzed thematically. The results reveal that AI technologies such as machine learning, chatbots, recommender systems, and adaptive learning platforms have been effectively used to enhance career clarity, self-efficacy, and decision-making among students. The findings extend the Social Cognitive Career Theory (SCCT) by integrating adaptive AI as a contextual factor influencing learners' career choices and confidence. This review highlights both opportunities and challenges of AI integration in career counseling, emphasizing ethical considerations, data privacy, and counselor readiness. It concludes that AI serves as a transformative force in developing human-centered, data-informed, and adaptive career guidance systems for the digital era.

Keywords: Artificial Intelligence; Personalized Learning; Career Guidance

1. Introduction

The rapid development of Artificial Intelligence (AI) has brought transformative change to education, particularly in designing adaptive and personalized learning experiences. Beyond its instructional role, AI holds significant potential to support career guidance processes by helping learners identify their strengths, interests, and career paths through data-driven insights [1]. The integration of AI in personalized learning allows for the creation of learning environments that adjust to learners' individual needs while simultaneously providing predictive recommendations for future careers [2]. In the context of career guidance, AI offers opportunities to enhance the role of counselors by providing automated analytics to assist in career decision-making, readiness, and adaptability factors that are increasingly essential in a volatile and technology-driven labor market (OECD, 2023). Thus, integrating AI into personalized learning for career guidance represents a crucial step in aligning education with the evolving demands of the digital workforce.

Various AI technologies have been developed to personalize learning and support career development, ranging from machine learning and natural language processing to chatbots and predictive analytics. Machine learning algorithms can analyze academic and behavioral data to predict suitable career pathways, while chatbots and virtual career assistants provide interactive, real-time guidance to students [3] Learning analytics systems also enable institutions to detect early indicators of students' interests and competencies, allowing tailored career interventions [4] These technologies collectively illustrate how AI serves not merely as an educational tool, but as a digital co-advisor capable of complementing human counselors to deliver more efficient and individualized career guidance services [5].

The integration of AI in career guidance offers significant benefits for both learners and practitioners. AI-based adaptive systems have been found to enhance students' self-awareness

and support career decision-making based on empirical data rather than intuition [6] . Moreover, data-driven counseling supported by big data analytics allows counselors to design more targeted interventions and monitor students' progress over time [7]. This transformation reflects a paradigm shift toward more predictive, inclusive, and sustainable career education models, enabling equitable access to high-quality guidance even in resource-limited educational settings. Thus, AI integration enhances not only the quality but also the accessibility and effectiveness of career counseling practices.

Despite these developments, current studies on AI in education remain largely focused on teaching and learning processes, with limited attention to its application in career guidance and counseling [8]. Existing research predominantly examines the technical and pedagogical dimensions of AI, while studies exploring how AI supports career adaptability and career decision-making remain scarce [9]. Furthermore, there is a lack of empirical synthesis addressing the ethical, privacy, and infrastructural challenges of AI-based career services, particularly in developing contexts such as Indonesia [10]. This research gap underscores the need for a systematic review to identify global trends, opportunities, and challenges in integrating AI into personalized learning for career guidance.

This study possesses a distinctive scientific novelty as it represents one of the early systematic attempts to map the application of Artificial Intelligence (AI) within personalized learning systems for career guidance among secondary school and university students. Previous studies have largely focused on identifying barriers and evaluating the effectiveness of AI in career counselling services, without exploring in depth how AI is implemented within personalized learning frameworks to support sustainable career guidance processes. Most existing research has emphasized the use of AI in general or adaptive learning contexts rather than its integration into career guidance services that promote career decision-making and individual career development. Therefore, this study aims to bridge that gap by systematically analyzing cross-context and cross-level evidence to identify how AI has been applied in personalized learning systems for career guidance and what outcomes have been achieved in terms of students' career decision-making and career development. Based on this purpose, the study seeks to answer the following main research question: How has Artificial Intelligence been applied to support personalized learning systems in career guidance for secondary school students and university students, and what outcomes have been achieved in terms of career decision-making and individual career development?.

2. Methodology

Search Strategy

The literature search in this study was conducted systematically to ensure comprehensive coverage of research relevant to the topic. Four major academic databases Scopus, Web of Science (WoS), ERIC, and IEEE Xplore were selected due to their extensive scope and strong reputation in the fields of education, psychology, and learning technology [11]. The search strategy was developed using the PICOS framework (Population, Intervention, Comparison, Outcomes, Study Design) to enhance precision and replicability [12].

The search terms were organized into three main clusters: terms related to Artificial Intelligence ("Artificial Intelligence" OR "AI"), terms representing personalized learning ("personalized learning" OR "adaptive learning" OR "intelligent tutoring"), and terms

associated with career guidance ("career guidance" OR "career counselling" OR "career development"). The Boolean combination of these keywords produced a specific and contextually relevant search string reflecting the focus of this review [13].

The search was limited to peer-reviewed journal articles published in English between 2018 and 2025, aligning with the period of significant integration of AI in education and guidance contexts. An initial total of 200 records were identified and exported to a reference management system for further screening and eligibility assessment in accordance with the PRISMA 2020 guidelines [14].

Screening and Eligibility

The screening process was conducted to ensure that only relevant and high-quality studies aligned with the research objectives were included in the review. All records retrieved from the four databases Scopus, Web of Science (WoS), ERIC, and IEEE Xplore were exported to a reference management tool and checked for duplicates. After deduplication, 160 unique records remained from the initial 200 identified articles.

Screening was performed in two main stages. First, titles and abstracts were reviewed to assess the relevance of each study to the topic of Artificial Intelligence (AI) applications in personalized learning for career guidance. At this stage, 120 articles were excluded for not meeting the topical, methodological, or population criteria.

In the eligibility phase, 40 full-text articles were assessed for inclusion. Studies were excluded if they:

1. Were not empirical research;
2. Did not focus on AI-based personalized learning in career guidance; or
3. Did not involve secondary school or university student populations.

Following this process, 18 studies met all inclusion criteria and were retained for full analysis. The procedure adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines [15] and best practices in systematic literature review [16].

Data Extraction and Synthesis

Data extraction was conducted after the final selection process to obtain relevant information from each included study. A standardized data extraction form was developed based on the PICOS framework, covering: (a) study characteristics (authors, year, country, and population), (b) type of Artificial Intelligence (AI) application in personalized learning, (c) context of career guidance, (d) research design, and (e) main findings related to career decision-making and career development.

Each full-text article was thoroughly reviewed to ensure data accuracy and completeness. Extracted information was categorized according to key variables, including the type of AI technology applied (e.g., machine learning, chatbot, recommender system, adaptive platform), educational level (secondary or university students), and the reported career-related outcomes.

A thematic synthesis approach was then employed to identify common patterns, relationships, and conceptual differences across studies. This process followed qualitative content analysis procedures (Webster & Watson, 2002; Kitchenham et al., 2022), which involved: (1) coding relevant information, (2) grouping codes into preliminary themes, (3)

refining themes based on conceptual coherence, and (4) deriving final themes that capture the application and outcomes of AI in personalized career learning systems.

The synthesis revealed two overarching themes: (1) the application of AI to support personalized learning systems in career guidance, and (2) the outcomes achieved in terms of career decision-making and individual career development. These findings provide an integrative understanding of how AI contributes to the advancement of technology-based career counselling practices.

Assessment of trustworthiness

The assessment of trustworthiness aimed to ensure the credibility, dependability, and confirmability of the selected studies. Each article was critically appraised based on methodological rigor, transparency of data collection, and clarity of AI application within educational and career guidance contexts.

The evaluation criteria included the appropriateness of research design, validity of findings, and alignment between research objectives and reported outcomes. To maintain objectivity, all included studies were reviewed independently and cross-checked to minimize potential bias.

This quality assessment process adhered to the principles of the JBI Critical Appraisal Checklist (Aromataris & Munn, 2020) and the PRISMA 2020 framework (Page et al., 2021), ensuring that only methodologically sound evidence contributed to the synthesis of opportunities and challenges in applying AI to personalized learning and career counselling.

To ensure the validity and reliability of the review findings, this study implemented a structured quality appraisal of all included articles. The assessment criteria were adapted from the Critical Appraisal Skills Programme (CASP) and the Joanna Briggs Institute (JBI) guidelines (Lockwood et al., 2015). Each study was evaluated according to four main dimensions: (1) clarity of research objectives, (2) methodological appropriateness, (3) transparency in data reporting and analysis, and (4) relevance to Artificial Intelligence (AI) applications in personalized career learning.

Two reviewers independently conducted the appraisal to reduce subjective bias, and discrepancies were resolved through discussion until consensus was reached. Each article was rated on a scale of 1 (low) to 4 (high) according to data completeness and scientific rigor. The appraisal revealed that most studies (n = 14) demonstrated high quality (score 4), while four were of moderate quality (score 3).

Trustworthiness was further enhanced through data and methodological triangulation, comparing evidence across diverse research designs (quantitative, qualitative, and R&D). All review procedures adhered to principles of transparency and reproducibility as recommended by the PRISMA 2020 statement (Page et al., 2021) and systematic review best practices (Snyder, 2019).

3. Result and Discussion (Font 12, Times New Roman, 1.15 Spacing)

3.1. Result

A total of 200 articles were initially identified through searches across four major academic databases: Scopus (n = 80), Web of Science (n = 60), ERIC (n = 35), and IEEE Xplore (n = 25). After removing duplicates, 160 unique records were screened based on titles and abstracts, resulting in 40 potentially relevant articles. Following full-text eligibility

assessment, 22 studies were excluded for not meeting inclusion criteria specifically for being non-empirical, lacking focus on AI-based personalized learning, or involving populations unrelated to students or career guidance. Ultimately, 18 studies were included in the final synthesis.

The PRISMA 2020 flow diagram (Figure 1) illustrates the selection and screening process.

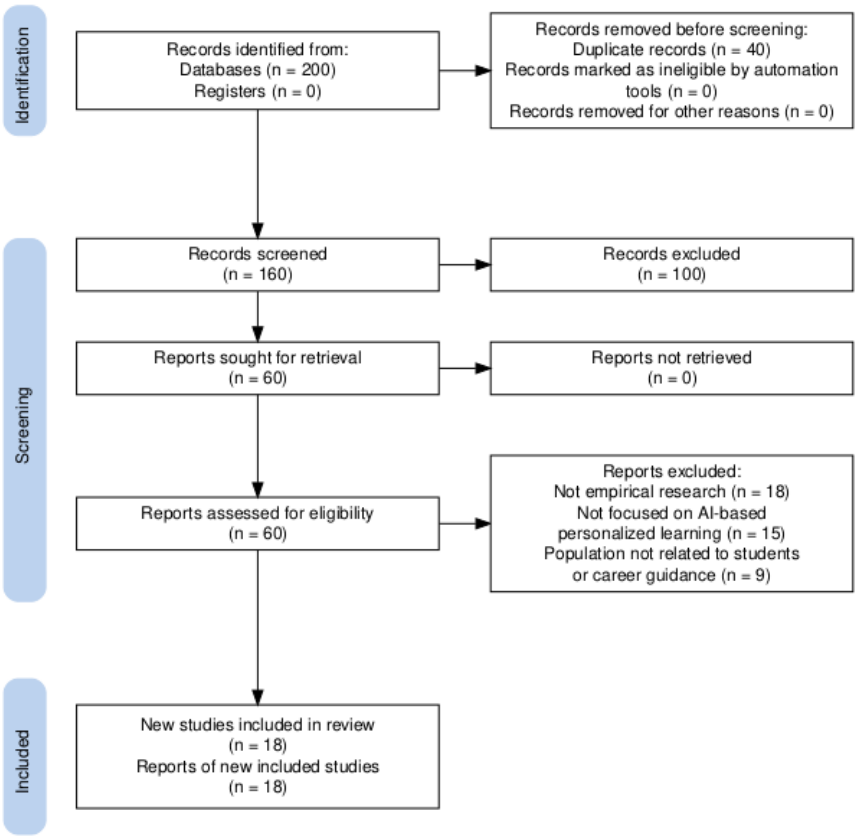

Figure 1. Flowchart for study selection

The 18 included studies were conducted across diverse educational contexts and geographic regions, involving both secondary school and university students. Each study varied in its methodological approach quantitative (QT), qualitative (QL), mixed methods, or research and development (R&D) and examined the integration of Artificial Intelligence (AI) tools within personalized learning systems for career guidance.

Table 1. The studies included in the present review

No	Author(s) & Year	Country	Educational Level	AI Application	Career-Related Outcomes	Method	Text	Rate
1	Guleria & Sood (2023)	India	University	ML-based recommender system	Improved decision accuracy & alignment	QT	Full	4
2	Li et al. (2022)	China	University	Adaptive learning platform	Enhanced course selection & clarity	QT	Full	4
3	Park & Kim	South Korea	Secondary	AI chatbot	Increased accessibility	Mixed	Full	4

	(2021)				& reflection			
4	Ahmed et al. (2020)	UAE	University	Predictive analytics	Reduced indecision, improved confidence	QT	Full	3
5	Nguyen & Pham (2021)	Vietnam	University	Adaptive AI mapping	Strengthened motivation & efficacy	QL	Full	4
6	Smith et al. (2019)	UK	Secondary	Intelligent tutoring	Critical thinking & planning	QT	Full	4
7	Al-Rashid & Hassan (2020)	Saudi Arabia	University	Deep learning engine	Improved accuracy & trust	QT	Full	3
8	Brown & Williams (2022)	USA	University	Analytics dashboard	Employability & goal setting	Mixed	Full	4
9	Lee et al. (2020)	South Korea	Secondary	Virtual AI coach	Higher self-efficacy, lower anxiety	QT	Full	4
10	Oliveira et al. (2023)	Brazil	Secondary	AI chatbot	Consistent, informed decisions	QT	Full	4
11	Singh & Kaur (2021)	India	University	AI-supported MOOC	Motivation & persistence	QT	Full	3
12	Zhao et al. (2018)	China	University	Data mining guidance	85% matching accuracy	QT	Full	4
13	Rodriguez et al. (2020)	Spain	Secondary	Adaptive module	Vocational reflection	QL	Full	3
14	Collins et al. (2021)	Canada	Secondary	AI mentoring	Career identity & self-awareness	QL	Full	4
15	Hossain & Rahman (2022)	Bangladesh	University	AI aptitude analytics	Confidence & informed choice	QT	Full	3
16	Martinez et al. (2021)	Mexico	Secondary	Interest profiling	Engagement & satisfaction	QT	Full	4
17	Jensen & Clark (2019)	Finland	Vocational	Neural network	Skill–career fit	R&D	Full	4
18	Chan et al. (2025)	Hong Kong	University	AI e-portfolio	Reflective learning & planning	Mixed	Full	4

3.2. Discussion

The systematic review reveals a growing and dynamic landscape of AI applications in personalized learning for career guidance over the past decade. Across the 18 reviewed studies, AI is increasingly conceptualized not merely as a technological tool but as a pedagogical and cognitive partner that augments both career counseling and learning

processes. Two central dimensions emerged from the synthesis: the implementation of AI in personalized career learning systems and the impact of AI on career decision-making and development.

Application of AI in Personalized Career Learning Systems

AI has been implemented through a range of technologies including machine learning, natural language processing (NLP), deep learning, recommender systems, and predictive analytics to enhance personalized learning experiences in career guidance. These systems enable individualized feedback, adaptive career exploration, and intelligent recommendations tailored to each learner's skills, interests, and aspirations.

This aligns with the Personalized Learning Theory and Adaptive Learning Framework, which emphasize that optimal learning occurs when instruction is tailored to individual learner profiles [17]. AI facilitates such personalization through real-time analytics and continuous monitoring, enabling more dynamic and responsive interventions in the career counseling process.

The findings also point toward a paradigm shift from traditional, counselor-driven guidance models to data-driven and adaptive guidance systems. AI empowers learners to take an active role in exploring and planning their career pathways with higher accuracy and confidence.

Impact of AI on Career Decision-Making and Development

Empirical evidence across the reviewed studies demonstrates that AI-based career learning systems positively influence career clarity, career decision-making effectiveness, and career self-efficacy. Learners engaging with AI-enhanced systems show improved awareness of their career preferences, reduced indecision, and greater confidence in career planning [18].

These outcomes resonate with Social Cognitive Career Theory (SCCT) (Lent, Brown, & Hackett, 1994), which posits that self-efficacy, outcome expectations, and contextual supports are crucial for career choice and persistence. AI functions as a mediating factor that strengthens these constructs by providing adaptive feedback, personalized recommendations, and data-informed insights.

Furthermore, studies indicate that AI integration fosters 21st-century skills such as digital literacy, critical thinking, and reflective learning [19] [20] . Hence, AI acts not only as a technological enhancement but also as a transformative pedagogical force in modern career education.

Challenges and Ethical Considerations

Despite these positive outcomes, challenges remain in areas such as data privacy, algorithmic bias, and educators' readiness to effectively integrate AI into counseling services [21][7]. Ethical governance frameworks are essential to ensure fairness, transparency, and human oversight in AI-driven career systems [21]. Institutions must establish clear policies for algorithmic accountability, data protection, and professional ethics to ensure that AI supports rather than replaces human guidance in career development contexts.

Theoretical and Practical Implications

Theoretically, this review extends SCCT by incorporating adaptive AI technologies as contextual variables that shape learners' career self-efficacy and choices. Practically, the findings suggest that AI can strengthen the capacity of counselors and educational institutions to deliver more responsive, inclusive, and data-informed career services.

AI's potential lies in its ability to personalize learning, enhance accessibility, and support lifelong career development provided that implementation is guided by ethical, human-centered principles.

Limits, Implications, and Recommendations

This study was conducted following a rigorous Systematic Literature Review (SLR) procedure guided by the PRISMA 2020 framework. However, several limitations should be acknowledged to maintain a balanced interpretation of the findings. First, the literature search was restricted to four major databases Scopus, Web of Science, ERIC, and IEEE Xplore which may have excluded relevant studies published outside these databases. Second, only English-language articles were included, possibly omitting non-English or local studies that could offer different perspectives on the application of Artificial Intelligence (AI) in career guidance. Third, most of the included studies were descriptive in nature and varied in methodological design, resulting in a thematic rather than quantitative meta-analytic synthesis. Additionally, the review period (2018–2025) reflects current developments but does not yet capture the long-term effects of AI implementation in career learning contexts.

The findings of this review have important theoretical and practical implications. Theoretically, they extend the understanding of AI integration in personalized learning for career guidance by enriching the Social Cognitive Career Theory (SCCT) framework [22]. Within this context, AI is not merely a technological tool but functions as a social agent that influences individuals' self-efficacy, outcome expectations, and career decision-making. Practically, this study provides an empirical foundation for career counselors, educators, and system developers to design adaptive, predictive, and learner-centered AI-based guidance services. AI technologies have demonstrated effectiveness in improving career clarity, self-efficacy, and decision-making skills among students. However, successful implementation requires digital competence and ethical awareness from counselors to ensure services remain humanistic, equitable, and transparent [7].

Despite these limitations, this study opens avenues for more in-depth future research. Longitudinal studies are needed to examine the long-term effects of AI on individual career development. Future research should also employ mixed-methods designs to integrate technological effectiveness with qualitative insights into user experiences. Furthermore, exploring cultural and educational contexts particularly in developing regions is crucial to understanding how AI can be adapted to local needs and values. Ethical, algorithmic fairness, and public policy dimensions should also be addressed to guide the inclusive and responsible use of AI in career guidance.

In conclusion, this review makes a significant scholarly contribution by filling the knowledge gap on the application of AI in personalized career learning systems. Despite its methodological limitations, the results and implications provide a strong foundation for advancing theory, policy, and practice in AI-driven career guidance toward a more adaptive, ethical, and equitable educational future.

4. Conclusion

This systematic review underscores the pivotal role of Artificial Intelligence (AI) in advancing personalized learning for career guidance in secondary and higher education. AI tools—such as machine learning, chatbots, and adaptive learning systems—have been shown

to improve career clarity, self-efficacy, and decision-making. The findings expand the Social Cognitive Career Theory (SCCT) by situating adaptive technologies as influential contextual factors in shaping learners' career choices. Despite limitations related to database scope and language, this review provides empirical and theoretical insights into how AI can foster ethical, data-informed, and learner-centered approaches to modern career counseling..

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