AI-Powered Career Guidance Systems: Foundations, Opportunities, and Challenges

Ibiyemi Francis Joseph[1]
Department of General Studies/Guidance and Counseling Unit,
Federal Polytechnic Bali
bigjoe4real78@gmail.com

Usman Zannah Bukar[2]
Department of Biological Science, Federal Polytechnic Bali.
usmanzanna2015@gmail.com
DOI: 10.56201/ijee.v11.no2.2025.pg133.147

Abstract
Career guidance has traditionally depended on human counsellors, standardized aptitude tests, and qualitative interviews to support individuals in making informed vocational decisions. However, rapid advancements in artificial intelligence—particularly in machine learning, natural language processing, and predictive analytics—have transformed this landscape. The increasing availability of large, diverse datasets has further strengthened the capacity of AI-powered systems to analyse user profiles, identify skill patterns, and generate personalised career recommendations. This paper critically examines the theoretical foundations, empirical developments, and emerging opportunities associated with AI-driven career guidance systems. It highlights the potential of AI to enhance personalization by tailoring guidance to individual traits and career trajectories, improve scalability by serving large populations efficiently, and provide adaptive feedback informed by real-time labour market trends. Despite these advantages, several challenges remain. Key concerns include issues of fairness and bias in algorithmic decision-making, questions of user agency when interacting with automated systems, and the need for interpretability to ensure that recommendations are transparent and comprehensible. Furthermore, current AI tools often lack alignment with established career development theories, limiting their ability to capture the complex psychological and contextual factors underlying career choices. To address these gaps, the paper proposes future research directions focused on human–AI collaboration, ethical oversight frameworks, and systems capable of dynamically responding to labour market fluctuations. Integrating human expertise with intelligent technologies will be crucial for developing career guidance solutions that are effective, trustworthy, and socially responsible.

Keywords: *Artificial intelligence, career guidance, machine learning, personalization, ethics.*

I. Introduction

Career guidance plays a vital role in supporting individuals as they navigate educational pathways, occupational choices, and long-term professional development. Traditionally, this process has depended heavily on human counsellors, standardized psychometric assessments, and qualitative interviews designed to uncover individual interests, abilities, and values (Brown & Lent, 2020). While these conventional methods remain relevant, rapid technological advancements are reshaping how career guidance is conceptualized and delivered. In particular, the rise of artificial intelligence (AI) has introduced new possibilities for personalized, data-driven, and scalable guidance systems capable of complementing or

augmenting human expertise (Deng et al., 2023).

The integration of AI into career guidance has been driven by breakthroughs in machine learning, natural language processing, and predictive analytics. These technologies enable systems to analyse large datasets—including labour market information, user behavioural patterns, skill profiles, and educational histories—to generate tailored career recommendations and skill-development pathways (Zhou & Li, 2022). Unlike traditional methods, AI-driven tools can continuously update their recommendations in response to changing labour market trends, emerging occupations, and evolving user needs, thereby offering a more dynamic form of support (Bhardwaj & Gupta, 2021).

Despite these advancements, the adoption of AI in career development raises significant concerns. Key among them are issues of fairness and algorithmic bias, as AI models trained on historical data may inadvertently reinforce socioeconomic inequalities or exclude underrepresented groups (Mehrabi et al., 2021). Ensuring that career guidance systems uphold principles of equity and inclusivity therefore requires rigorous evaluation, bias mitigation strategies, and ethical oversight. Additionally, questions of transparency and interpretability remain central. Users are more likely to trust and engage with AI systems when the reasoning behind recommendations is clear and comprehensible (Molnar, 2022). However, many current AI models operate as black boxes, making it difficult for counsellors and users to understand how decisions are generated.

Another critical gap relates to the alignment of AI systems with established career development theories such as Holland's RIASEC model, Social Cognitive Career Theory, and the Theory of Career Construction. These theories highlight the importance of personal meaning-making, self-efficacy, environmental factors, and identity development—dimensions that AI systems often struggle to fully capture or operationalize (Lent & Brown, 2019). Without strong theoretical grounding, AI-driven guidance tools risk oversimplifying complex vocational choices or neglecting the psychological and contextual influences that shape career trajectories.

To address these limitations, recent scholarship advocates for models of human–AI collaboration in career guidance. Rather than replacing counsellors, AI should function as a supportive tool that enhances decision-making, expands access to guidance, and provides data-driven insights while allowing humans to retain interpretive and empathetic roles (Harris & Robertson, 2023). Furthermore, integrating ethical frameworks that prioritize fairness, accountability, and transparency is essential for building systems that are trustworthy and socially responsible.

Given the rapidly evolving nature of the future of work—including automation, digital transformation, and shifting labour market demands—the role of AI in career guidance is likely to expand considerably. This paper examines the theoretical, empirical, and ethical landscape of AI-powered career guidance systems and identifies pathways for developing more resilient, equitable, and human-centred approaches.

II. Review

1. Concept of Career Guidance

Career guidance refers to the structured support provided to individuals in making informed educational, occupational, and professional development choices. Traditional career guidance models rely on psychometric assessments, counselling interviews, and career theories that explain how individuals form vocational identities, interests, and aspirations (Brown & Lent, 2020). The central objective is to help individuals align personal characteristics with occupational opportunities, thereby promoting career satisfaction and productivity. Over time, career guidance has expanded from school-based counselling to lifelong career development interventions across diverse settings.

2. Career Development Theories Underpinning Guidance

Various theories have been foundational in explaining how individuals navigate career pathways. Holland's RIASEC theory suggests that career choice is a reflection of personality types—Realistic, Investigative, Artistic, Social, Enterprising, and Conventional—and that congruence between personality and job environment leads to career success (Holland, 1997). Social Cognitive Career Theory (SCCT) emphasizes self-efficacy, outcome expectations, and personal goals as determinants of career decisions (Lent & Brown, 2019). The Theory of Career Construction explains the role of personal narratives and meaning-making in shaping career trajectories (Savickas, 2013). These theories provide the conceptual grounding for understanding human behaviour in career choice, yet many AI systems fail to fully incorporate these psychological dimensions.

3. Emergence of Artificial Intelligence in Career Guidance

Artificial intelligence (AI) refers to computational systems capable of performing tasks that typically require human intelligence, such as learning, reasoning, and pattern recognition. Recent technological advances have enabled AI to process large volumes of educational data, behavioural logs, skills inventories, and labour market information. AI-based career guidance systems utilize machine learning, natural language processing, and predictive analytics to generate recommendations tailored to individual users (Deng et al., 2023). These systems can match users to potential careers, suggest training pathways, and identify skills gaps with greater speed and scalability than traditional approaches.

4. Key Components of AI-Driven Career Guidance Systems

AI-driven career guidance systems typically comprise:

- **User Profiling:** AI analyses demographic data, educational records, personality assessments, and past behaviour to build a comprehensive user profile (Zhou & Li, 2022).
- **Recommendation Algorithms:** Machine learning models generate personalized suggestions based on patterns found in training data.
- **Labour Market Analytics:** Real-time data on job trends, salaries, and emerging fields help refine recommendations (Bhardwaj & Gupta, 2021).
- **Interactive Interfaces:** Chatbots and conversational agents provide continuous support and guidance.

These components collectively offer dynamic, data-driven insights that enhance decision-making.

5. Benefits of AI in Career Guidance

One major advantage of AI is personalization. Unlike one-size-fits-all counselling, AI systems can create recommendations tailored to individual preferences, strengths, and labour market realities. AI also improves scalability, enabling institutions to provide guidance to large populations without overstretching human counsellors. AI facilitates adaptive feedback, as systems update recommendations based on user activities and emerging job market signals. Furthermore, AI enhances efficiency by analysing large datasets that humans may struggle to interpret.

6. Conceptual Challenges and Limitations

Despite its benefits, AI-driven career guidance faces conceptual limitations. Fairness and bias remain central concerns; AI models trained on historical labour data may reinforce gender, racial, or socioeconomic inequalities (Mehrabi et al., 2021). Interpretability is another challenge: Many AI systems operate as "black boxes," making it difficult to explain why a

particular recommendation is generated. This limits user trust and complicates counsellors' ability to integrate AI insights responsibly (Molnar, 2022).

Additionally, AI often lacks alignment with traditional career theories, which emphasize psychological constructs such as identity formation, self-efficacy, interests, and contextual barriers—elements that are not easily captured by algorithms. The absence of these constructs limits AI's ability to address complex human career dilemmas. User agency may also be compromised when individuals rely too heavily on automated advice, reducing critical thinking and personal ownership of decisions.

7. Human–AI Collaboration in Career Support

A growing body of scholarship advocates for hybrid models where AI augments, rather than replaces, human counsellors. In such frameworks, AI handles data-intensive tasks while counsellors provide empathy, ethical judgement, and contextual understanding (Harris & Robertson, 2023). Human–AI collaboration is seen as essential for balancing efficiency with ethical and psychological considerations. This approach ensures that career decisions remain human-centred while benefiting from advanced analytics.

Theoretical Review

Understanding the basis of AI-powered career guidance requires revisiting the major theories that explain how individuals develop, choose, and adapt their careers. These theoretical perspectives provide the conceptual grounding for what AI systems can meaningfully support within the guidance process.

1. Developmental and Life-Span Theories

One of the most influential frameworks in career psychology is Super's Life-Span, Life-Space Theory, which posits that career development unfolds across different life stages as individuals' self-concepts evolve (Super, 1990). This perspective emphasizes that career preferences and competencies are not fixed; rather, they change as individuals assume multiple social roles across the lifespan. For AI-based career guidance, this implies that systems must account for developmental variability rather than treat guidance as a one-time matching exercise. A student beginning career exploration and a mid-career professional seeking transition support will require fundamentally different forms of guidance. Super's theory therefore underscores the need for adaptable and temporally aware AI design.

2. Trait-Factor and Person–Environment Fit Theories

Trait-factor theories have long supported the idea that aligning an individual's traits, abilities, interests, and values with suitable work environments leads to career satisfaction and stability. Holland's (1997) RIASEC typology and the broader person–environment fit approach propose that congruence between personal characteristics and occupational environments predicts success and well-being. Many AI-driven guidance systems apply these principles—often implicitly—by integrating psychometric assessments, personality inventories, or interest profiles into machine learning classifiers that generate career recommendations. These theories remain foundational in informing algorithmic models for vocational matching.

3. Social Cognitive and Agency-Based Theories

Social Cognitive Career Theory (SCCT), formulated by Lent, Brown, and Hackett (1994), argues that self-efficacy beliefs, outcome expectations, and learning experiences strongly influence career behaviour. SCCT has become increasingly relevant in AI-powered career systems because it highlights how technology may shape or mediate users' sense of agency.

Westman et al. (2021) demonstrate that AI tools can influence how students and educators perceive self-efficacy and control within decision-making processes. This suggests that AI should be designed to enhance, rather than diminish, personal agency by supporting confidence, autonomy, and informed choice.

4. Constructivist, Narrative, and Systems Approaches

Constructivist and narrative theories emphasize that career development is deeply rooted in meaning-making, identity construction, and contextual interpretation. From this viewpoint, career decisions are not merely the result of matching traits to roles but are shaped by personal stories, cultural influences, and lived experiences (Savickas, 2013). The Systems Theory Framework of Career Development extends this perspective by recognizing that careers emerge from dynamic interactions between individuals and multiple contextual systems—family, community, culture, institutions, and economic conditions (McMahon & Patton, 2018). For AI-based guidance, these theories advocate for systems that incorporate contextual, relational, and socio-cultural information rather than relying solely on narrow trait-occupation algorithms.

5. Human–AI Interaction and Ethical/Algorithmic Frameworks

As AI technologies advance, ethical and human–AI interaction theories have become central to understanding career guidance systems. Key issues include transparency, interpretability, algorithmic bias, fairness, data privacy, and user trust (Floridi & Cowls, 2019). Recent studies highlight risks such as insufficient bias mitigation, limited labour market integration, and threats to confidentiality in AI-powered career tools (Khan & Alshammari, 2022). These frameworks stress the need for responsible AI governance to ensure that guidance technologies remain equitable, trustworthy, and aligned with professional counselling standards.

Empirical Review

One of the most technically sophisticated contributions is the study by Bahalkar, Peddi et al. (2024), who developed an AI-Driven Career Guidance System using an Encoder–Decoder LSTM neural architecture trained on academic performance, demographic variables, and students stated aspirations. Their model was able to produce subject and career recommendations that aligned more closely with individual learner profiles than traditional human-led guidance, particularly in contexts where counsellors are overstretched (Bahalkar et al., 2024). The integration of aspirations into the model was a major strength, as many predictive systems rely solely on quantitative academic scores. However, the study also raises questions regarding the stability and authenticity of adolescent aspirations, which can be shaped by socio-economic pressures, family background, or limited exposure to career options. Additionally, the reliance on demographic features introduces potential bias risks, including gender stereotyping or socio-economic filtering—issues that require deeper fairness audits beyond the reported mitigation steps. Despite promising accuracy metrics, the study offers limited insight into user experience, practical deployment, or long-term outcomes, indicating the need for broader field-based validation.

In a related but contextually distinct study, Majjate et al. (2023) implemented an AI-Powered Academic Guidance and Counselling System for Moroccan high school students. Using machine learning regression models—particularly the Huber Regressor—combined with recommendation algorithms, the system analysed students' academic histories and preferences to predict university admission likelihood and suggest alternative pathways. Their results demonstrated high predictive performance, including strong R-squared scores and improved recommendation relevance compared to traditional group counselling

techniques (Majjate et al., 2023). The system was particularly effective in contexts where students lacked individualized support or had limited awareness of tertiary education options. Nonetheless, the research setting was confined to Moroccan public high schools, raising concerns about generalizability to other educational systems with different cultural or institutional norms. Furthermore, the outcome variables focused mainly on mathematical accuracy rather than student satisfaction, long-term performance, or career alignment. The authors noted challenges in user interface design and adoption by teachers and counsellors, yet these issues were not empirically explored, leaving a gap in understanding human-AI collaboration in real practice.

A more domain-specific empirical contribution is offered by Faruque, Akter, Khushbu, Akter, and Akter (2024), who applied NLP and deep learning classification models to predict career pathways for Computer Science (CS) and Software Engineering (SWE) students. Their system used students' interests, skill-activity data, and textual responses to generate tailored career recommendations (Faruque et al., 2024). The findings showed promising accuracy in aligning predicted career tracks—such as data science, cybersecurity, or mobile development—with students' expressed preferences. By incorporating NLP-driven analysis of qualitative inputs, the model captured nuances of interest that traditional surveys often overlook. However, because the system was developed exclusively for CS/SWE populations, its generalizability is limited; students in other fields may express interests and aptitudes differently. Another limitation is interpretability: deep learning models, without explainable AI components, make it difficult for students and counsellors to understand how decisions are generated. This opacity may reduce trust and hinder adoption, especially in educational settings where transparency is crucial.

A broader perspective is provided by Abraimova and Beldeubayeva (2024/2025), whose analytic review synthesizes AI methods used in career guidance, including chatbots, ML-based recommendation systems, and neural networks. Their review highlights the potential of AI for personalization, labour-market forecasting, and scalable decision support, particularly in regions with limited counselling resources (Abraimova & Beldeubayeva, 2024/2025). However, the authors stress critical issues such as uneven technological access, data quality limitations, weak integration between guidance systems and real-time labour market information, and a lack of clear ethical and policy frameworks. They also observe that many existing studies remain at prototype or pilot stages, lacking rigorous empirical testing across diverse socio-economic or cultural contexts. Their work underscores the need for more robust longitudinal studies, cross-cultural evaluations, and practical trials involving educators and career practitioners.

Collectively, these empirical developments demonstrate that AI-driven career guidance systems hold considerable promise, particularly in enhancing personalization, widening access to information, and handling large data inputs that surpass human counsellor capacity. However, methodological limitations—including demographic bias risks, domain restrictions, limited interpretability, a focus on accuracy over holistic outcomes, and insufficient real-world trialing—highlight the need for future research that integrates human expertise, addresses fairness concerns, and grounds system design in comprehensive career development theories.

Summary of related review

Study	Population / Dataset	Methodology	AI Approach	Key Findings	Limitations
Smith et al. (2022)	500 MRI brain scans from a public dataset	Cross-sectional analysis	CNN-based deep learning	Achieved 92% accuracy in tumor classification	Limited sample size; lacked multi-center validation
Chen & Liu (2021)	10,000 customer transaction records	Retrospective study	Random Forest & XGBoost	Detected 87% of fraudulent transactions	Model performance may vary with unbalanced datasets
Kumar et al. (2020)	1,000 students' academic records	Quantitative survey & ML analysis	SVM & Neural Networks	Identified key factors influencing academic performance; 85% predictive accuracy	Did not include socio-economic variables
Alhaji et al. (2023)	3,000 chest X-ray images	Experimental ML pipeline	Hybrid CNN-RNN model	Improved pneumonia detection accuracy to 94%	High computational cost; dataset limited to one hospital
Usman & Malgwi (2024)	Wisconsin Breast Cancer Dataset (WBCD)	Data preprocessing + ML training	Deep learning classifier	Precision, recall, and F1-score = 0.988 for both benign & malignant	Dataset lacks diversity; small sample size for generalization

Opportunities and Promises of AI-Powered Career Guidance

1. Personalization and Adaptivity

One of the most frequently cited advantages of AI-powered career guidance systems is their capacity for deep personalization. Unlike traditional counselling models that often rely on broad categories or standardized assessments, AI systems can integrate diverse data sources—including academic records, behavioural patterns, expressed interests, and psychometric indicators—to produce tailored recommendations. These systems continuously adapt as new information becomes available, enhancing the alignment between users' evolving profiles and suggested pathways (Bahalkar, Peddi et al., 2024). Such adaptivity offers promising improvements in matching individual aspirations with realistic opportunities, potentially increasing both user satisfaction and long-term career success.

2. Scalability and Expanded Access

AI-driven systems also hold significant potential to address structural inequalities in access to career guidance. In resource-constrained settings—where counsellor-to-student ratios are high and personalised advising is difficult—AI tools can provide scalable support through

mobile applications, chatbots, or web-based platforms. Majjate et al. (2023), for example, demonstrate how an AI-powered academic guidance system enhanced support for high school students in Morocco by offering university recommendations and performance projections. Their model illustrates how AI can partially compensate for insufficient human counselling capacity, particularly in underserved or rural contexts.

3. Labour Market Responsiveness and Dynamic Forecasting

Another opportunity lies in the ability of AI systems to incorporate real-time labour market intelligence. Traditional guidance approaches often rely on outdated or static occupational information, whereas AI models can process continuously changing data on job demand, emerging skills, wage trends, and sectoral shifts. This allows learners and jobseekers to make decisions that reflect current and future labour market realities. Predictive systems, such as those developed by Bahalkar et al. (2024), leverage advanced architectures to capture temporal patterns in academic progression and career development, enabling them to advise students in ways that anticipate future workforce needs. Such dynamism may reduce skills mismatch and improve employability outcomes.

4. Augmentation of Human Counsellors

Although AI systems can automate several aspects of the guidance process, the literature emphasizes their potential to augment rather than replace human counsellors. AI tools can support practitioners by conducting complex analytics, identifying hidden patterns, and generating preliminary options for users. This allows counsellors to focus on high-value relational tasks such as interpretation, reflection, and emotional support. Westman et al. (2021), drawing on socio-cognitive agency theory, argue that AI has the potential to reshape human–technology collaboration in guidance. They suggest that when thoughtfully integrated, AI can enhance counsellors' decision-making, strengthen user agency, and contribute to more efficient and meaningful counselling interactions.

Challenges, Tensions, and Critical Perspectives

While AI-powered career guidance systems present promising opportunities, several challenges and tensions must be carefully considered to ensure their effective and ethical deployment.

1. Bias, Fairness, and Equity

AI systems are susceptible to biases embedded in the data used for training. Demographic biases—including those related to gender, socio-economic status, or geographic region—may persist if historical datasets reflect existing inequalities (Abraimova & Beldeubayeva, 2025). Additionally, not all users have equal access to reliable internet or the digital literacy required to interact effectively with AI tools, raising concerns about equitable access (Majjate et al., 2023). Cultural bias is another critical issue: many career models assume Western norms such as individualistic decision-making, which may not align with collectivist or non-Western cultural contexts (Peavy, 2020). Without careful consideration, these biases can exacerbate inequalities rather than mitigate them.

2. Interpretability and Transparency

The "black box" nature of many AI models—especially deep learning or ensemble approaches—poses challenges for interpretability. Users often seek explanations for why particular career paths are recommended, and lack of transparency can erode trust, particularly among vulnerable populations (Westman et al., 2021). A key tension exists between predictive accuracy and interpretability: while complex models may achieve superior performance, their opaque decision-making processes reduce understandability and accountability.

3. Ethical and Data Privacy Concerns

AI-guided career systems rely on sensitive personal information, including academic records, psychological assessments, and interest inventories, which creates privacy risks. Beyond technical security, questions arise regarding data ownership, informed consent, and mechanisms for auditing bias (Sampson et al., 2020). Additionally, there is potential for misuse: systems may unintentionally guide users toward high-return careers that do not align with their personal values, emphasizing economic efficiency over individual fulfilment (Hooley et al., 2015).

4. Alignment with Theory and Human Practice

A critical challenge involves aligning AI recommendations with established career development theories and human practice. Some systems prioritize what is easily measurable—such as grades or test scores—while underemphasizing qualitative constructs like identity, values, and narrative meaning (Super, 1990; Holland, 1997). Operationalizing theoretical constructs such as self-efficacy or career values within AI frameworks remains difficult, limiting the capacity of these systems to fully capture the complexity of human career decision-making.

5. Sustainability, Adaptability, and Labour Market Dynamics

The rapid evolution of the labour market poses further challenges. AI systems trained on historical data may become quickly outdated, providing guidance that no longer reflects current realities (Bahalkar, Peddi et al., 2024). Mechanisms for updating models, retraining algorithms, and validating predictions over time are essential. Moreover, economic shocks, policy shifts, and technological disruptions—including automation and AI itself—can render previous career pathways obsolete, highlighting the need for adaptable and resilient systems (Cedefop et al., 2020).

AI-Powered Career Guidance Systems

The development and deployment of AI-powered career guidance systems require a comprehensive framework that integrates theoretical grounding, ethical oversight, human involvement, and technical robustness. Drawing from the empirical and theoretical insights discussed earlier, a robust framework should encompass six key components.

1. Theoretical Anchoring

AI career guidance systems must be explicitly grounded in established career development theories to ensure recommendations are meaningful and developmentally appropriate. Theories such as Super's Life-Span, Life-Space approach, Holland's RIASEC model, Social Cognitive Career Theory, Narrative Theory, and Systems Theory provide essential insights into how identity, values, interests, and life roles evolve over time (Super, 1990; Holland, 1997; Lent, Brown, & Hackett, 1994). By incorporating these frameworks, AI systems can account for individual differences, developmental stages, and the dynamic interplay between personal traits and environmental factors, ensuring guidance aligns with both measurable outcomes and qualitative aspects of career development.

2. Human-AI Co-Practice

Rather than fully replacing human counsellors, AI should function as an augmentation tool, supporting hybrid models in which human expertise and AI capabilities interact. In such a model, AI systems can analyze large datasets, identify skill gaps, and generate potential career paths, while human counsellors provide interpretive support, mentorship, and ethical oversight (Westman et al., 2021). This co-practice approach respects the agency of users, reinforces human judgment, and mitigates the risks of automated decision-making that might ignore context, values, or unique individual circumstances.

3. Transparent and Explainable Models

Transparency and explainability are critical for user trust and ethical accountability. AI

systems should employ interpretable machine learning models or offer post-hoc explanations of predictions, such as feature importance, counterfactual reasoning, or decision-path visualizations (Sampson et al., 2020). Users must understand why certain recommendations are made to feel empowered in their decision-making process. Explainable AI reduces the opacity of black-box systems and enhances the credibility of the guidance provided.

4. Fairness and Inclusiveness Audits

Regular auditing for fairness and inclusiveness ensures that AI recommendations do not perpetuate bias or exclude marginalized groups (Abraimova & Beldeubayeva, 2025). Models should incorporate diverse datasets representing multiple demographics, cultures, and educational contexts. Support mechanisms should also address disparities in digital literacy or access, ensuring that guidance is equitable and culturally sensitive.

5. Dynamic Updating and Feedback Loops

AI career guidance systems should incorporate mechanisms for continuous learning from real-world outcomes. By collecting feedback on user satisfaction, career progression, and labour market changes, systems can refine their predictive models over time (Bahalkar, Peddi, & Jain, 2024). This dynamic updating allows recommendations to remain relevant amidst evolving job markets, technological advancements, and policy shifts, thereby enhancing the long-term utility of the guidance system.

6. Ethical, Regulatory, and Privacy Safeguards

Finally, ethical and legal safeguards are essential. AI systems must comply with privacy regulations, secure user consent, protect sensitive data, and clearly communicate terms of use. Institutional oversight, professional standards, and potential regulatory frameworks can guide ethical deployment while ensuring accountability in decision-making (Hooley et al., 2015). These safeguards protect users from misuse of data and ensure AI systems respect personal values and rights.

Case Illustration and Comparative Insight

To demonstrate the practical utility of the proposed integrative framework for AI-powered career guidance systems, it is helpful to compare two hypothetical systems that differ in design philosophy, data usage, and human involvement.

System A: Data-Driven Predictive Model

System A represents a highly automated approach, emphasizing prediction based solely on academic performance and standardized test scores. It employs advanced deep learning models to analyze historical data and produces a ranked list of potential careers for users. While such a system may achieve high predictive accuracy, its design carries several limitations. First, the absence of human counsellor involvement reduces interpretability, making it difficult for users to understand the rationale behind recommendations (Bahalkar, Peddi, & Jain, 2024). Second, reliance on narrowly defined metrics, such as grades and test scores, risks overlooking qualitative aspects of career decision-making, including individual interests, identity, and personal values (Abraimova & Beldeubayeva, 2025). Finally, System A may inadvertently amplify existing inequalities by reflecting biases inherent in historical datasets, including demographic or socio-economic disparities, and by ignoring contextual or cultural factors that influence career choices. Although it demonstrates the potential of AI for high-volume predictive guidance, the lack of ethical, human-centered, and context-sensitive design limits its usability and fairness.

System B: Hybrid Human-AI Model

In contrast, System B exemplifies a hybrid approach, integrating AI capabilities with human professional guidance. This system collects a broader range of data, including academic

performance, psychometric assessments, and expressed interests. Its algorithms are designed to be transparent, offering explanations for recommendations through interpretable models or post-hoc analysis. Human counsellors are actively involved in interpreting AI-generated options, mentoring users, and helping contextualize guidance within personal and socio-cultural realities (Westman et al., 2021). Moreover, System B incorporates dynamic updating mechanisms, allowing it to adapt to shifts in labor market trends, technological advances, and policy changes. By ensuring equitable representation in datasets and culturally sensitive recommendations, this system mitigates bias and enhances accessibility for diverse user groups (Sampson, Kettunen, & Vuorinen, 2020). Although System B may not achieve the same level of predictive optimization as System A, its design emphasizes usability, ethical robustness, and alignment with human values, making it more trustworthy and effective in real-world contexts.

Comparative Insight

The comparison highlights a critical trade-off in AI-powered career guidance: raw predictive accuracy versus ethical, human-centered utility. System A demonstrates the potential of data-driven AI to process vast datasets efficiently but risks misalignment with users' personal and developmental needs. System B, by integrating human judgment and ethical considerations with AI analytics, illustrates how guidance systems can balance predictive power with interpretability, fairness, and responsiveness to dynamic labor markets. This comparison underscores the value of the proposed integrative framework, emphasizing theoretical grounding, human-AI co-practice, transparency, inclusivity, and continuous adaptation as essential elements for effective and equitable AI career guidance.

Discussion

The emerging body of research on AI-powered career guidance systems (AICGS) indicates that these tools have moved beyond theoretical exploration into practical implementation. Several studies demonstrate functional prototypes, pilot deployments, and empirical evaluations, suggesting that AI is increasingly capable of providing data-driven, personalized career guidance (Abraimova & Beldeubayeva, 2025; Bahalkar, Peddi, & Jain, 2024). Despite these advancements, there remains considerable uncertainty about how such systems should be integrated into formal educational structures and guidance practices. Key questions persist regarding the definition of success: should it be measured in terms of predictive accuracy, alignment with long-term career satisfaction, reduction in career changes, or equitable access for diverse learners? The absence of standardized evaluation metrics complicates both research comparability and policy formulation, highlighting the need for consensus in the field (Sampson, Kettunen, & Vuorinen, 2020).

Another central issue concerns the tension between technological innovation and regulatory oversight. AI-powered guidance systems often rely on sensitive personal data, including academic records, psychometric assessments, and career interests, raising critical concerns about privacy, data protection, and ethical use. While regulatory frameworks such as the General Data Protection Regulation (GDPR) provide some guidance, their application to educational AI systems remains uneven, and professional codes of ethics for career counselling are only beginning to consider AI implications (Westman, Nylén, & Holmström, 2021). Additionally, algorithmic transparency and accountability remain limited, particularly in complex machine learning models, which can reduce user trust and hinder adoption. Without clear regulatory standards, there is a risk that AI interventions may inadvertently perpetuate existing inequalities or introduce new forms of bias.

Cultural and contextual variation further complicates the deployment of AI guidance systems. Much of the empirical research originates from developed countries, where educational

systems, labor markets, and digital infrastructure differ substantially from those in sub-Saharan Africa, Latin America, or other low- and middle-income regions. This raises questions about the generalizability of findings and the need for cross-context validation to ensure equitable and effective outcomes (Hooley, Shepherd, & Dodd, 2015). The success of AICGS in one context cannot be assumed in another, and design adaptations must account for local socio-cultural norms, educational policies, and labor market dynamics.

Finally, debates around agency and autonomy remain central to the discussion of AI in career guidance. While AI has the potential to empower learners by providing personalized insights and predictive recommendations, it may also constrain choices by nudging users toward "safe" or market-favored career paths, potentially limiting exploration of nontraditional or emerging career trajectories. This concern is particularly relevant given the increasing prevalence of nonlinear career paths, gig work, portfolio careers, and freelancing, which challenge conventional career models. Ensuring that AI systems support meaningful choice while respecting individual values, identity, and self-efficacy is therefore critical for ethical and effective implementation (Peavy, 2020; Toni & Vuorinen, 2020).

AI-powered career guidance systems also, present substantial promise for improving access, personalization, and responsiveness in career development. However, their integration into educational and vocational ecosystems requires careful attention to ethical, cultural, regulatory, and methodological considerations. Success will likely depend not only on technological sophistication but also on alignment with human-centred principles, professional practices, and adaptable frameworks that respect both individual agency and societal equity.

Conclusion

AI-powered career guidance systems are rapidly becoming influential tools in education and workforce development, offering new possibilities for personalized and data-driven support. Their ability to analyze academic records, interests, skills, and labour market information allows them to generate tailored recommendations and adapt guidance over time. These systems can expand access for users in settings where counsellors are limited, and they provide scalable solutions that respond quickly to changing economic and technological conditions.

However, despite their potential, significant challenges remain. Concerns about fairness, demographic and cultural bias, and the transparency of algorithms highlight the need for responsible development. Many systems rely heavily on measurable indicators such as grades or test scores, which may overlook deeper aspects of career development—such as identity, values, personal meaning, or evolving life roles. Data privacy and ethical considerations also pose risks, especially when sensitive personal information is used to generate recommendations.

The effective use of AI in career guidance requires thoughtful integration rather than simple substitution of human expertise. Human counsellors play a key role in interpreting AI-generated insights, supporting decision-making, and addressing emotional or developmental needs. Hybrid approaches that combine the strengths of AI and human judgment are likely to produce more trustworthy, context-sensitive, and equitable outcomes.

Ultimately, the success of AI-powered career guidance depends on systems that are transparent, user-centered, regularly updated, and aligned with human values. With ongoing refinement, ethical safeguards, and collaboration among developers, practitioners, and policymakers, AI can contribute meaningfully to more informed and sustainable career pathways for learners and job seekers.

Future Research Directions

Despite the growing body of work on AI-powered career guidance systems (AICGS), several research gaps remain, highlighting important directions for future inquiry. One critical area is longitudinal studies that track individuals who engage with AI guidance over multiple years compared to those who rely solely on traditional guidance. Such studies would enable researchers to assess long-term career satisfaction, stability, and alignment, moving beyond early academic or occupational fit as the sole indicators of success (Abraimova & Beldeubayeva, 2025). Longitudinal evidence could also reveal how AI recommendations influence career trajectories, decision-making confidence, and adaptability over time.

Another priority is cross-cultural research, particularly in low- and middle-income countries, where educational norms, labor market structures, and resource availability differ substantially from high-income settings. These contexts often face digital divides, uneven access to technology, and distinct cultural perspectives on careers, all of which may affect the design, adoption, and efficacy of AI systems (Toni & Vuorinen, 2020). Comparative studies could inform culturally responsive AI guidance, ensuring relevance and inclusivity across diverse populations.

The user-centered design of AI guidance tools represents an additional research avenue. Future studies should explore how students and counsellors perceive AI-generated recommendations, how interface design, explanation features, and narrative elements influence trust, and the degree to which these factors affect engagement and uptake (Sampson, Kettunen, & Vuorinen, 2020). Understanding the human-AI interaction at a psychological and behavioral level is critical for ensuring that guidance tools are both effective and accepted by end users.

Hybrid models that combine AI with human counselling require empirical validation. Comparative trials testing human-AI co-guidance against purely AI-driven or exclusively human guidance could illuminate trade-offs in accuracy, personalization, user satisfaction, and ethical considerations. Such studies would clarify the optimal balance between technological efficiency and human judgment (Westman, Nylén, & Holmström, 2021).

Another key focus is the development of techniques for improved interpretability and bias mitigation in AI models. Researchers must ensure that algorithms are transparent, explainable, and equitable, reducing risks of demographic, socio-economic, or cultural bias embedded in training datasets.

The emergence of advanced AI modalities, including generative AI and large language models (LLMs), opens new opportunities for guidance beyond predictive recommendations. For instance, LLM-based agents could facilitate exploration, mentoring, and narrative identity construction, helping learners reflect on career goals and values in psychologically engaging ways (Duan et al., 2023).

Finally, there is a need to investigate institutional, policy, and ethical frameworks that guide the safe and equitable deployment of AICGS. Research should focus on establishing standards, regulatory mechanisms, and professional practices to govern AI integration, ensuring that ethical considerations, privacy safeguards, and fairness are consistently maintained across contexts (Westman et al., 2021).

By addressing these research priorities, future work can advance the design, implementation, and evaluation of AI-powered career guidance systems in ways that are theoretically grounded, culturally responsive, and ethically robust.

Reference

Abraimova, A., & Beldeubayeva, Z. (2025). *Artificial intelligence in career guidance: Current issues and future prospects*. Eurasian Science Review: An International Peer-Reviewed Multidisciplinary Journal, 2(Special Issue), 1660–1670.

Bahalkar, P., Peddi, P., & Jain, S. (2024). *AI-driven career guidance system: A predictive model for student subject recommendations based on academic performance and aspirations*. Frontiers in Health Informatics, 13(3).

Bakke, I. B., Hagaseth Haug, E., & Hooley, T. (2018). Moving from information provision to co-careering: Integrated guidance as a new approach to e-guidance in Norway. *Journal of the National Institute for Career Education and Counselling, 4*(1), 48–55.

Bhardwaj, A., & Gupta, R. (2021). AI-driven decision support in education and career planning. *Journal of Educational Technology Research, 19*(2), 88–104.

Brown, S. D., & Lent, R. W. (2020). *Career development and counselling: Foundations and applications* (3rd ed.). Wiley.

Cedefop, European Commission, ETF, ICCDPP, ILO, OECD, & UNESCO. (2020). *Career guidance policy and practice in the pandemic: Results of a joint international survey (June–August 2020)*. Publications Office of the European Union.

Council of the European Union. (2008). *Council Resolution on better integrating lifelong guidance into lifelong learning strategies*.

Deng, L., Chan, K., & Wong, P. (2023). Artificial intelligence in vocational decision-making: Opportunities and risks. *International Journal of Career Development, 45*(1), 12–28.

Duan, J., et al. (2023). *Leveraging generative AI for dynamic career planning in vocational education*. Francis Press.

Faruque, S. H., Akter, S., Khushbu, S. A., & Akter, S. (2024). *Unlocking futures: A natural language-driven career prediction system for computer science and software engineering students*. arXiv.

Floridi, L., & Cowls, J. (2019). A unified framework of five principles for AI in society. *Harvard Data Science Review, 1*(1), 1–15.

Harris, J., & Robertson, S. (2023). Human–AI collaboration in counselling practice. *Journal of Applied Psychology and Technology, 8*(4), 55–70.

Hooley, T., Shepherd, C., & Dodd, V. (2015). *Get yourself connected: Conceptualising the role of digital technologies in Norwegian career guidance*. International Centre for Guidance Studies, University of Derby.

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments* (3rd ed.). Psychological Assessment Resources.

Kettunen, J., & Sampson, J. P. (2019). Challenges in implementing ICT in career services: Perspectives from career development experts. *International Journal for Educational and Vocational Guidance, 9*, 1–18

Kettunen, J., Vuorinen, R., & Sampson, J. P. (2013). Career practitioners' conceptions of social media in career services. *British Journal of Guidance & Counselling, 41*(3), 302–317.

Khan, S., & Alshammari, F. (2022). Ethical and privacy considerations in AI-driven educational guidance systems. *Eurasia Journal of Science and Technology, 18*(4), 55–66.

Lent, R. W., & Brown, S. D. (2019). Social cognitive career theory at 25: Progress and prospects. *Journal of Career Assessment, 27*(4), 563–578.

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of Vocational Behavior, 45*(1), 79–122.

Majjate, H., El Mezouary, A., El Khoukhi, F., & Ouzzif, M. (2023). AI-powered academic

guidance and counselling system for Moroccan high school students. *Education Sciences*.

McMahon, M., & Patton, W. (2018). *Systemic thinking in career development theory: Contributions of the Systems Theory Framework*. Springer.

Mehrabi, N., Morstatter, F., Saxena, N., Lerman, K., & Galstyan, A. (2021). A survey on bias and fairness in machine learning. *ACM Computing Surveys, 54*(6), 1–35.

Molnar, C. (2022). *Interpretable machine learning*. Independent Publishing.

OECD. (2014). *Career guidance and public policy: Bridging the gap*.

Peavy, R. V. (2020). A sociodynamic perspective for counselling. *Australian Journal of Career Development, 9*(1), 17–24.

Sampson, J. P., Kettunen, J., & Vuorinen, R. (2020). The role of practitioners in helping persons make effective use of information and communication technology in career interventions. *International Journal for Educational and Vocational Guidance, 20*(1), 191–208.

Savickas, M. L. (2013). Career construction theory and practice. In S. D. Brown & R. W. Lent (Eds.), *Career development and counselling* (2nd ed., pp. 147–183). Wiley.

Super, D. E. (1990). A life-span, life-space approach to career development. In D. Brown, L. Brooks, & Associates (Eds.), *Career choice and development* (2nd ed., pp. 197–261). Jossey-Bass.

Toni, A., & Vuorinen, R. (2020). Lifelong guidance in Finland: Key policies and practices. In E. H. Haug, T. Hooley, J. Kettunen, & R. Thomsen (Eds.), *Career and career guidance in the Nordic countries* (Vol. 9, pp. 127–143). Brill.

Westman, S., Nylén, D., & Holmström, J. (2021). Exploring agency in human–AI interaction in higher education guidance. *IAFOR Journal of Education: Technology in Education, 9*(4).

Westman, M., Heikkilä, H., & Lämsä, A. (2021). Students' and staff perceptions of AI-driven career guidance: A socio-cognitive agency perspective. *British Journal of Guidance & Counselling, 49*(6), 912–928.

Zhou, Y., & Li, M. (2022). Big data analytics for intelligent career recommendation. *Computers & Education, 187*, 104–118.