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A Systematic Review of Intelligent Systems: Enhancing Education and Career Development through Personalized Learning and Automated Assessment

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Peer Review Information	Abstract
<i>Submission: 1 Sept 2025</i> <i>Revision: 28 Sept 2025</i> <i>Acceptance: 12 Oct 2025</i> Keywords <i>E-learning, personalized learning, automated assessment, career guidance, recommender systems, AI-powered interview preparation.</i>	E-learning and intelligent systems have become critical in modern education, especially with recent global shifts towards online learning. This paper surveys multiple recent advances including personalized e-mentoring, agent-based search models, automated programming assessment systems, AI-driven career guidance frameworks, recommender systems for academic advising, and interview preparation platforms. Key challenges, methodologies, and experimental results are summarized to inform future developments.

Introduction

A. Background

The advent of the digital era has driven a profound shift in education, moving instruction away from uniform, conventional classroom settings toward highly flexible and dynamic online environments. E-learning platforms, initially basic content providers, have matured into complex, intelligent digital systems. Concurrently, the highly volatile global employment landscape, marked by rapid technological change and the integration of AI, necessitates continuous upskilling and reliable career strategies. This landscape creates an urgent need for intelligent systems capable of providing continuous support throughout an individual's academic and professional journey, spanning adaptive education to automated career guidance [1], [2].

B. Importance of the Topic

Incorporating Artificial Intelligence (AI) and Machine Learning (ML) into educational and career growth sectors offers considerable societal and economic benefits. Adaptive e-learning platforms are crucial for addressing diverse learning speeds and preferences, which directly translates to enhanced engagement, improved knowledge retention, and superior learning results [1], [3]. Moreover, sophisticated career guidance tools are essential for cushioning the shock of job market changes, helping workers quickly acquire new skills and efficiently linking individual competencies with employment opportunities [2], [4]. Gaining deep insight into the most recent advancements in these linked fields is vital for practitioners and researchers developing solutions that are effective, widely applicable, and fair.

C. Key Definitions

For the purpose of this review, several core terms must be established:

- **Personalized E-Learning:** An educational approach where the learning environment, content, and pace are dynamically adapted to the individual student's goals, knowledge, and learning style [1], [5].
- **Intelligent Career Guidance:** Systems that utilize AI/ML (such as natural language processing and recommender systems) to analyze a user's profile, predict career paths, and recommend tailored skill development or job opportunities [2], [6].
- **Automated Assessment:** The use of software and algorithms to automatically score, grade, and provide feedback on student submissions, including short answers, programming code, and even spoken language [6], [7].

D. Objective of the Review

This paper aims to provide a systematic and critical survey of recent advances (primarily within the last decade) in the field of intelligent systems applied to education and career development. Specifically, the objectives are to:

- 1) Categorize and compare the primary methodologies used for personalized learning and adaptive support.
- 2) Summarize the techniques for automated assessment of both technical (e.g., programming) and soft skills (e.g., interview performance).
- 3) Identify the architecture and performance metrics of AI driven career guidance and job recommendation platforms.
- 4) Highlight current limitations, prevalent research gaps, and emerging ethical considerations in deployment.

E. Scope and Limitations of the Review

This review focuses primarily on academic literature and technological advancements published in major engineering and computer science databases (e.g., IEEE Xplore, ACM Digital Library). The scope is limited to systems that employ **AI or advanced data mining techniques** for personalization, assessment, or guidance, excluding purely descriptive or conceptual papers. The time frame emphasizes research published from approximately **2014 to the present** to capture contemporary trends. Specific attention is given to the areas of **recommender systems, natural language processing (NLP) for assessment, and deep learning models** for career path prediction.

F. Overview of the Structure

The remainder of this paper is structured as follows. Section II reviews the landscape of personalized e-learning, focusing on adaptive content and e-mentoring systems. Section III details recent advances in automated assessment, covering programming, free-text responses, and soft skills. Section IV analyzes the evolution of intelligent career guidance frameworks, including resume parsing and job recommendation systems. Section V presents a comprehensive discussion of the identified trends and challenges. Finally, Section VI concludes the paper and suggests promising avenues for future research.

Personalized E-Learning And Adaptive Support

The central goal in personalized e-learning is to move beyond static content provision toward dynamic architectures that adjust instantly to the learner's specific context and requirements. This section explores key innovations in personalized assistance, intelligent e-mentoring, and the application of recommender systems.

A. Adaptive Learning Frameworks and E-Mentoring

Adaptive instructional designs rely heavily on precise student modeling to forecast or analyze learner behavior [5]. A new framework introduces an intelligent e-mentor that dynamically customizes course content based on the student's existing knowledge, preferences, and learning expectations, resulting in significantly enhanced engagement and learning effectiveness [1]. Similarly, an agent-based intelligent e-learning model proposes a personalized search engine that improves results by analyzing web browsing history and knowledge levels, thereby alleviating information overload [8]. Furthermore, modern systems utilize review dashboards that recommend customized learning material by automatically connecting incorrect quiz answers back to the corresponding instructional pages, proving beneficial for improved quiz performance [3].

B. Recommender Systems in Education

Recommender Systems (RS) have become fundamental to Technology Enhanced Learning (TEL), guiding both students and instructors toward relevant educational resources [9]. Research emphasizes that incorporating contextual information is vital for creating smarter systems that can more accurately anticipate user needs [9]. The scope has broadened to include recommendations

specifically for teachers, profiling their ICT competence based on their interactions with learning repositories to optimize the selection of learning objects [10]. In university settings, RS

are increasingly deployed for academic advising, where hybrid strategies generally yield the best results, though deployment often remains limited to experimental environments [6].

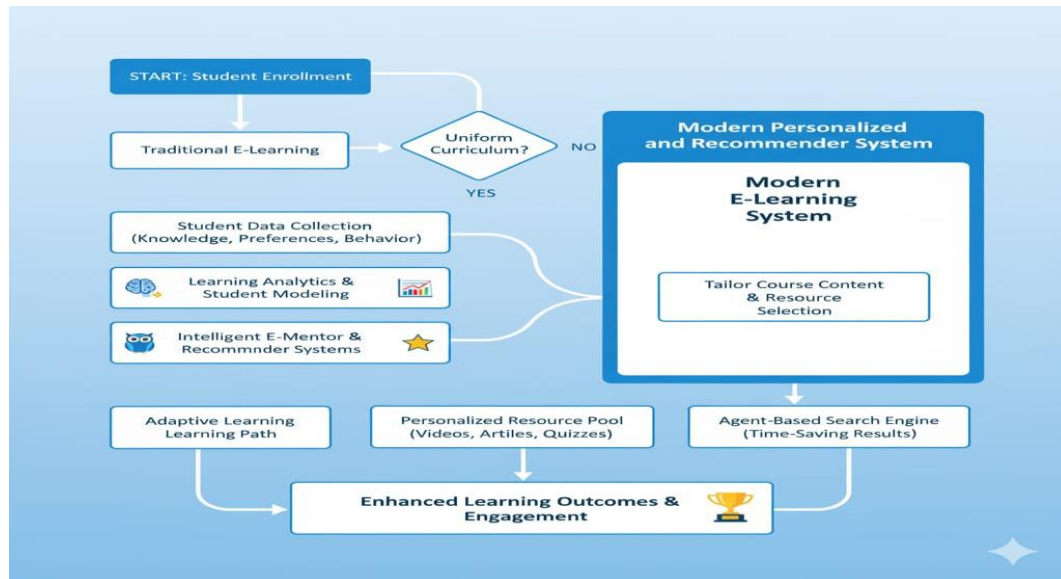


Fig. 1: Modern Personalized E-Learning System Flow.

C. Learning Analytics (LA) for Improvement

Learning Analytics uses student-generated data from Learning Management Systems (LMS) to facilitate necessary interventions and refine the learning environment [11]. Systematic studies indicate that the effects of LA are often categorized into the learning environment, process, and outcomes. Most analyses prioritize outcomes, suggesting a greater need for multi-categorical evaluation approaches [11]. A persistent issue is maintaining privacy while ensuring data remains useful for LA applications;

techniques have been proposed to protect learner data effectively without significantly sacrificing utility [8].

Automated Assessment And Soft Skill Evaluation

Automated assessment has evolved beyond basic scoring to include sophisticated evaluation of complex submissions such as programming code, free-text answers, and subtle behavioral skills observed during interviews.

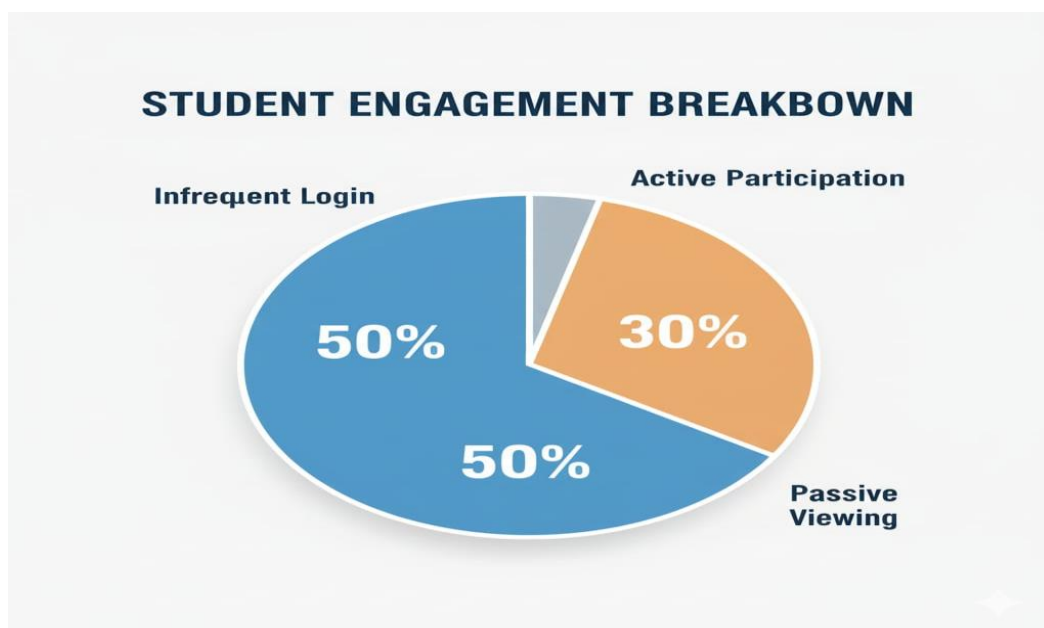


Fig. 2: Student Engagement Breakdown Example.

A. Assessment of Technical and Written Skills

For coding assignments, Automated Programming Assessment Systems (APAS), exemplified by platforms like "Edgar," provide support across diverse languages, featuring detailed logging and advanced analytics to handle the complexities of grading large university classes efficiently [7], [12]. In free text evaluation, systems utilize advanced Natural Language Processing (NLP) methods, such as the

B. Evaluation of Soft Skills and Interview Performance

The necessity of evaluating non-technical competencies, like communication and leadership, has driven innovation in virtual interview and mock practice platforms.

- **Multimodal Fusion:** One approach predicts soft skills in video interviews using Multi-modal Window-Consistency Fusion (MWCF) networks. These networks capture consistent behavioral expressions across verbal and visual channels and integrate expert interviewer knowledge to enhance predictive power [14].
- **Generative AI Interviewers:** Generative AI models, often utilizing Retrieval-Augmented Generation (RAG) with Large Language Models (LLMs), are used to create dynamic, unique, and context-aware virtual interviewers that deliver personalized feedback [5], [15]. This technology is vital for building realistic practice simulations [16].
- **Physiological Data:** More experimental work explores multi-modal emotion recognition, combining data like EEG signals and facial expressions to detect instantaneous emotional states. This has applications for assessing engagement and stress levels during learning or interview simulations [17].

Intelligent Career Guidance And Resume Analysis

Intelligent systems play a pivotal role in talent acquisition and professional re-skilling by automating processes ranging from detailed resume analysis to the recommendation of highly targeted career paths.

A. Resume Information Extraction (Parsing)

Accurate and efficient resume parsing forms the bedrock of contemporary Human Resources (HR) technology. Modern models combine Named Entity Recognition (NER) with Keyword

hybrid Automatic Short Answer Grading (ASAG) built on BERT, which employs customized multi-head attention mechanisms to boost semantic comprehension and scoring dependability [6]. Ongoing research continues to develop methods for generating personalized quizzes for English texts by converting text into semantic networks and adapting questions based on the individual learner's competence and error patterns [13].

and Pattern Matching to process diverse resume layouts with impressive accuracy [18]. Even more advanced systems employ the transformer architecture, leveraging the multilingual BERT model to extract critical data (personal details, education, experience) from unstructured CVs in various languages [18]. These tools demonstrate high precision and recall, significantly streamlining resume management [19].

B. AI-Driven Job Recommendation and Matching

Job recommender systems are specifically designed to optimize the matching process between candidate skills and open positions. These advanced systems typically incorporate:

- **Deep Learning and Similarity:** Techniques that merge Word2Vec with LSTM-RNN models to assess skill congruence and predict highly suitable professional profiles, thereby fostering adaptive and continuous career growth [4], [17].
- **Hybrid Filtering:** Systems that intelligently combine content-based and collaborative filtering algorithms, employing machine learning and NLP to analyze vast datasets of job listings and generate exceptionally accurate, tailored recommendations [4], [20].
- **Workforce Re-education:** A particularly critical application is the AI-driven Career-Guide framework, engineered for rapid re-skilling in quickly changing job markets. It analyzes resumes to suggest promising new job opportunities alongside personalized learning curricula, utilizing custom deep neural networks for large-scale, automated career transition support [2].

Discussion, Challenges, And Future Directions

The widespread integration of intelligent systems across personalized learning and career guidance signifies a monumental move toward providing individuals with predictive,

continuous, and adaptive support throughout their lives.

A. Synthesis of Key Trends

A prominent trend is the growing reliance on ****multimodal data fusion**** (e.g., combining text analysis, code performance, facial cues, and physiological signals) to construct comprehensive and nuanced profiles of students

and candidates [5], [15]. Another major development is the broad adoption of Generative AI for creating dynamic, personalized content, such as custom interview questions and individualized learning pathways [5], [15]. Furthermore, recommender systems have evolved from simple resource filtering tools into sophisticated instruments that influence major academic and career decision making [6].

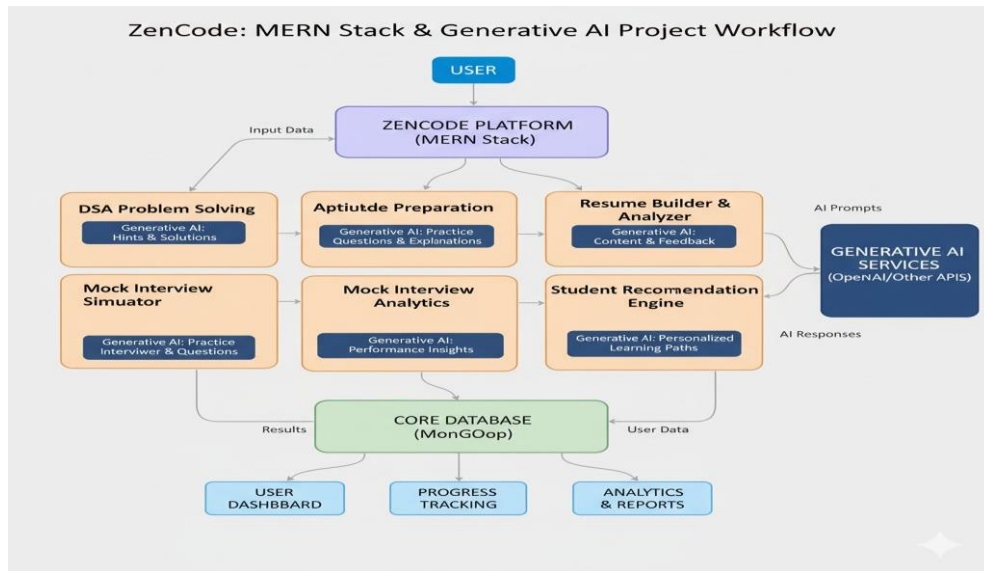


Fig. 3: ZenCode: MERN Stack & Generative AI Project Workflow).

B. Current Challenges and Limitations

Despite these powerful advancements, several significant obstacles must be addressed:

- 1) **Data Quality and Noise:** Real-world data collection frequently results in inconsistent and unreliable data, severely compromising the accuracy and trustworthiness of student models [5].
- 2) **Generalizability:** Many highly effective systems are currently validated only in controlled, laboratory settings, which limits confidence in their proven utility for diverse, large-scale, real-world deployment [6].
- 3) **Ethical and Privacy Concerns:** The necessary extensive collection of personal data (learning histories, resumes, interview recordings) raises critical concerns regarding privacy and the potential for algorithmic bias in both assessment and recommendation outcomes [8].
- 4) **Interpretability:** Deep learning models, while superior in predictive accuracy, often function as "black boxes," making it difficult for users, educators, and candidates to understand the underlying rationale for a specific score or recommendation.

B. Future Directions

Future research should focus on the following high-priority areas :

- **Deep Learning for Context:** Continued effort to integrate advanced deep learning techniques to better model context-dependency and individual personality traits within academic and career recommendations [6].
- **Privacy-Preserving LA:** Development and standardization of practical, effective techniques to preserve data privacy while retaining its analytic utility for Learning Analytics [8].
- **Unified Frameworks:** The creation of fully integrated, end-to-end systems that smoothly link personalized education (Section II) with targeted competency assessment (Section III) and predictive career mapping (Section IV), thereby providing a cohesive, lifelong guidance platform.

Conclusion

This review systematically surveyed recent advancements in personalized e-learning systems, automated assessments, and intelligent career guidance frameworks. The gathered

literature consistently points toward a future defined by highly adaptive and contextualized support systems, fueled by ongoing innovations in deep learning, NLP, and sophisticated recommender algorithms. Key findings underscore the effectiveness of intelligent e-mentoring in boosting student engagement [1], the capability of robust automated tools for assessing both coding proficiency and free-text quality [6], [7], and the significant promise of AI-driven frameworks, such as Career gAlde, for managing rapid, large-scale workforce re-skilling [2]. While the field demonstrates strong potential for delivering personalized, efficient educational and career interventions, major challenges remain. These include enhancing model resilience against bias, standardizing performance evaluation methods, and, most critically, rigorously addressing the privacy and ethical implications stemming from the large volume of collected learner data. Therefore, future research must prioritize real-world

References

- N. Nouman, Z. A. Shaikh, and S. Wasi, "A novel personalized learning framework with interactive e-mentoring," *IEEE Access*, vol. 12, pp. 10428–10458, 2024, open Access.
- S. Ashrafi, B. Majidi, E. Akhtarkavan, and S. H. R. Hajiagha, "Efficient resume-based re-education for career recommendation in rapidly evolving job markets," *IEEE Access*, vol. 11, pp. 124350–124367, 2023, published 2 November 2023. [Online]. Available: <https://ieeexplore.ieee.org/document/10360356>
- F. Okubo et al., "Adaptive learning support system based on automatic recommendation of personalized review materials," *IEEE Transactions on Learning Technologies*, vol. 16, no. 2, pp. 190–202, 2023.
- R. S. Pundir, A. Dhasmana, U. Karakoti, A. Sikder, S. Sharma, and M. Manchanda, "Enhancing resume recommendation system through skill-based similarity using deep learning models," in *2024 International Conference on Inventive Computation Technologies (ICICT)*. Lalitpur, Nepal: IEEE, April 24–26 2024, added to IEEE Xplore June 7, 2024.
- J. Si, J. Song, M. Woo, D. Kim, Y. Lee, and S. Kim, "Generative ai models for virtual interviewers: Applicability and performance comparison," in *Proceedings of the International Conference on Innovation, Communication and Engineering (ICICE 2023)*. Bangkok, Thailand: IET, November 9–13 2023, added to IEEE Xplore June 19, 2024.
- N. Kamal, F. Sarker, A. Rahman, S. Hossain, and K. A. Mamun, "Recommender system in academic choices of higher education: A systematic review," *IEEE Access*, vol. 12, pp. 35475–35501, February 23 2024.
- I. Mekterović, L. Brkić, B. Milasinović, and M. Baranović, "Building a comprehensive automated programming assessment system," *IEEE Access*, vol. 8, pp. 81154–81172, 2020, open Access. [Online]. Available: <https://ieeexplore.ieee.org/document/9090707>
- A. Shah and S. Jain, "An agent based personalized intelligent e-learning," *International Journal of Computer Applications*, vol. 20, no. 3, p. 40, 2011.
- K. Verbert, N. Manouselis, H. Drachsler, E. Duval, X. Ochoa, M. Wolpers, and I. Bosnic, "Context-aware recommender systems for learning: A survey and future challenges," *IEEE Transactions on Learning Technologies*, vol. 5, no. 4, pp. 318–335, Oct.-Dec. 2012.
- S. Sergis and D. G. Sampson, "Learning object recommendations for teachers based on elicited ict competence profiles," *IEEE Transactions on Learning Technologies*, vol. 9, no. 1, pp. 43–56, Jan.-Mar. 2016.
- J. H. Knobbout and E. J. van der Stappen, "Where is the learning in learning analytics? a systematic literature review," *IEEE Transactions on Learning Technologies*, vol. 14, no. 3, pp. 373–387, 2020.
- M. Amelung, K. Krieger, and D. Rösner, "E-assessment as a service," *IEEE Transactions on Learning Technologies*, vol. 4, no. 2, pp. 162–174, 2011, published 26 August 2010. [Online]. Available: <https://ieeexplore.ieee.org/document/5466671>
- L.-C. Sung, Y.-C. Lin, and M. C. Chen, "An automatic quiz generation system for english text," in *Seventh IEEE International Conference on Advanced Learning Technologies (ICALT 2007)*. Niigata, Japan: IEEE, Jul. 2007. [Online]. Available: <https://ieeexplore.ieee.org/document/4302848>
- Y.-C. Chou, F. R. Wongso, C.-Y. Chao, and H.-Y. Yu, "An AI Mock interview Platform for Interview Performance Analysis," in *2022 10th International Conference on Information and Education Technology (ICIET)*. Matsue, Japan:

IEEE, April 9–11 2022, added to IEEE Xplore: 26 May 2022.

S. Rajbhar, S. Shelke, A. Singh, Y. Singh, and P. Shinde, "Alced Prep: AI Based Mock Interview Evaluator," in 2025 6th International Conference on Data Intelligence and Cognitive Informatics (ICDICI). Tirunelveli, India: IEEE, July 9–11 2025, added to IEEE Xplore: 02 September 2025.

J. E. Sharp, "Work in progress: Using mock telephone interviews with alumni to teach job search communication," in Proceedings of the 36th Annual Frontiers in Education Conference (FIE). San Diego, CA, USA: IEEE, October 27–31 2006, added to IEEE Xplore March 5, 2007.

A. Mankawade, V. Pungliya, R. Bhonsle, S. Pate, A. Purohit, and A. Raut, "Resume analysis and job recommendation," in 2023 IEEE 8th International Conference for Convergence in Technology (I2CT). Lonavla, India: IEEE, April 7–9 2023, added to IEEE Xplore May 23, 2023.

D. Vukadin, A. S. Kurdija, G. Delač, and M. Šilić, "Information extraction from free-form cv documents in multiple languages," IEEE Access, vol. 9, pp. 84559–84575, June 9 2021.

S. K. Kopparapu, "Automatic extraction of usable information from unstructured resumes to aid search," in 2010 IEEE International Conference on Progress in Informatics and Computing. Shanghai, China: IEEE, Dec. 2010. [Online]. Available: <https://ieeexplore.ieee.org/document/5701925>

E. J. Brown, T. J. Brailsford, T. Fisher, and A. Moore, "Evaluating learning style personalization in adaptive systems: Quantitative methods and approaches," IEEE Transactions on Learning Technologies, vol. 2, no. 1, pp. 10–22, January–March 2009 deployment validation to fully confirm the long-term impact of these models and ensure they foster an equitable digital landscape for learning and employment.