

# Certification-Driven Strategies for Enhancing Generative AI

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**Abstract**—This paper highlights the critical need for national functional certifications designed explicitly for generative AI, addressing the challenges its rapid advancement poses. The current educational and accreditation systems are struggling to keep pace with the fast-evolving demands of the AI field, resulting in a gap between the skills required by industries and those possessed by the workforce. To close this gap, the paper proposes a structured certification program that aligns educational curricula with industry needs, ensuring that professionals gain both theoretical knowledge and practical skills in generative AI. A key element of this certification program is fostering collaboration between industry and academia. This partnership is vital for developing educational content that is not only relevant but also practical, directly preparing students for real-world applications. By closely aligning academic training with industry requirements, the program aims to produce professionals adept at implementing generative AI technologies across various sectors, effectively bridging the gap between education and practice. The paper also emphasizes the importance of maintaining the quality and credibility of the certification system through continuous assessment and regular updates. Such evaluations are essential to ensure the certification remains valuable and respected nationally and internationally. Implementing this certification program is expected to cultivate a highly skilled workforce, stimulate the job market, and enhance national competitiveness in the global economy. Additionally, ongoing research is recommended to monitor advancements in AI and update the certification program accordingly, ensuring it stays aligned with the latest industry trends and technological developments.

**Keywords**— Generative artificial intelligence; professional certification; certification program; educational curriculum.

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## I. INTRODUCTION

Generative Artificial Intelligence (AI) technology is driving fundamental changes across society and industries. In healthcare, law, and entertainment fields, AI is redefining traditional workflows by enhancing efficiency and offering creative solutions [1]. The rapid advancement of this technology is increasing the demand for professionals with specialized expertise, and implementing systematic education and certification systems is essential [2].

Considering the complexity and diversity of generative AI technology, a certification system tailored to this field helps professionals deeply understand the technology's core principles and practical applications [3]. This plays a crucial role in enabling experts to solve real-world problems across various industries and develop the ability to create value through AI technology [4]. For example, in healthcare, AI can be used to improve diagnostic accuracy, while in law, it can

automate the processing of large volumes of documents, saving both time and costs [5]. AI can generate personalized content in the entertainment industry, significantly enhancing the viewer experience.

Establishing and operating a certification system maximizes the societal benefits of such technologies while minimizing potential risks posed by AI [6]. Providing professionals with systematic education on the ethical use and effective management of AI ensures responsible utilization of this technology. It grants them qualifications recognized in the market, aiding their career development [7], [8], [9]. Additionally, considering the continuous evolution of technology, the certification system must be regularly updated. This involves adjusting educational curricula and certification standards to align with new industry trends and technological advancements, ensuring that educational institutions and certification bodies meet the demands of the times. This dynamic approach ensures that education reflects actual

industry needs and continuously supports the sound development and effective use of generative AI technology [10].

In addition, the government and industry should expand policy and financial support to ensure this educational system's successful implementation and operation. Close collaboration with academia is essential to ensure that the curriculum and certification standards are developed to meet the demands of the field, thereby guaranteeing the sound development and effective utilization of this technology. Such industry-academia cooperation will ensure that education reflects the actual needs of the industry and plays a crucial role in maximizing the benefits of generative AI technology while minimizing potential risks.

This paper begins with a discussion of necessity and purpose in the introduction. The main body provides a detailed analysis of AI's current status, the specific structure and operation plans of the certification system, and the essential certifications required for the future. The conclusion summarizes the research findings and provides a final overview.

## II. MATERIALS AND METHOD

### A. Current State of AI

Generative artificial intelligence (AI) is driving significant changes across various industries, and in particular, in the healthcare sector, it is playing a key role in improving diagnostic accuracy and providing personalized treatment [11]. AI technology significantly improves efficiency in manufacturing by optimizing production processes and quality control [12]. AI also maximizes economic effects in financial services through algorithmic trading and risk management [13], [14]. In education, AI is being used to enable personalized learning and predict student performance, which is an essential factor in improving the quality of education [15]. In supply chain management, AI solves complex problems through predictive analysis and automation [16].

TABLE I  
AI APPLICATIONS ACROSS INDUSTRIES

Industry/Field	AI Applications
Healthcare	Improving diagnostic accuracy and providing personalized treatment.
Manufacturing	Optimizing production processes and enhancing quality control.
Financial Services	Maximizing economic outcomes through algorithmic trading and risk management.
Education	Enabling personalized learning and predicting student performance.
Supply Chain Management	Solving complex problems through predictive analytics and automation.
Ethical Considerations	Addressing issues like data privacy and algorithmic bias.
Marketing	Analyzing customer data and developing tailored strategies with ethical considerations.
Autonomous Vehicles	Advancing autonomous vehicle technology with a focus on safety and regulation.
Cybersecurity	Playing a crucial role in threat detection and anomaly analysis, shaping the future of cybersecurity.
Robotics	Integrating AI in autonomous robots and industrial automation, highlighting future potential.

The development of AI is intertwined with ethical considerations, and issues such as data privacy and algorithmic bias are emerging as important issues, especially in the medical field [17]. In marketing, AI and big data are used to analyze customer data and establish customized strategies, but ethical issues that may arise in the process should be discussed together [18], [19]. The development of autonomous vehicle technology is also one of the critical applications of AI, and safety issues and legal regulations need to be discussed [20]. In cybersecurity, AI plays an essential role in threat detection and anomaly analysis, attracting attention as AI plays a key role in shaping the future of cybersecurity [21], [22]. Finally, integrating AI technology in robotics plays an important role in autonomous robots and industrial automation, suggesting the potential for future development in this field [23]. Table 1 shows the current utilization of AI and its corresponding applications.

### B. Status of AI Certifications

As artificial intelligence (AI) continues to evolve and penetrate various industries, the demand for professionals equipped with AI skills has surged. This growing demand has led to the emergence of AI-specific certification programs designed to validate individuals' expertise and practical knowledge in this field. In recent years, AI certification programs have proliferated, with many focusing on different aspects of AI, such as machine learning, data science, and AI ethics. Various institutions, including universities, online learning platforms, and industry leaders like IBM, Microsoft, and Google, offer these certifications. For instance, Microsoft's AI certification program provides a structured pathway for professionals to gain and demonstrate expertise in AI solutions. Similarly, IBM's AI Engineering Professional Certificate, available through platforms like Coursera, is designed to equip learners with hands-on experience in building AI models [24], [25], [26], [27].

However, the landscape of AI certifications is challenging. A recurring theme in the literature is the need for standardized benchmarks across different certification programs. It is argued that the need for a unified standard for AI certifications creates disparities in the quality and recognition of these credentials. This lack of standardization can lead to confusion among employers and professionals, making it difficult to assess the actual value of a certification.

Moreover, the rapid pace of AI advancement necessitates continuous updates to certification content to ensure relevance. It is emphasized that AI certification programs must be agile, regularly revising their curricula to reflect the latest developments in AI technology [28]. Without such updates, certifications risk becoming outdated, potentially diminishing their value in the job market.

Another research focus has been the impact of AI certifications on career advancement. It has been found that AI certifications are increasingly recognized as valuable assets in the job market, often leading to higher employability and salary increases for certified professionals [29]. This trend is particularly evident in finance and healthcare industries, where AI plays an increasingly central role.

However, some studies have raised concerns about the accessibility of AI certifications. It is pointed out that while AI certifications can enhance career prospects, the cost and

time commitment required to obtain these certifications may be prohibitive for some individuals, particularly those from underrepresented groups [30]. This highlights the need for more inclusive and accessible certification programs.

Another emerging trend is the emphasis on ethical AI. As AI technology becomes more integrated into decision-making processes, there is a growing recognition of the need for certifications that address AI's ethical implications. It is highlighted that incorporating AI ethics into certification programs is important to ensure that AI professionals can handle the ethical challenges associated with AI deployment [31].

Finally, the role of AI certifications in academic settings is gaining attention. There is discussion on how universities are increasingly incorporating AI certifications into their curricula to better prepare students for the job market. Integrating certification programs into formal education pathways helps bridge the gap between academic learning and industry demands.

Overall, while AI certifications are becoming an essential tool for career advancement and skill validation, there are ongoing challenges related to standardization, accessibility, and continuous updates. Addressing these challenges will ensure that AI certifications remain valuable and relevant in the rapidly evolving field of artificial intelligence.

### C. Status of Certification Acquisition

Many pursue certifications because they enhance individuals' skills and serve as an important measure of social recognition. Nowadays, university students acquire various IT certifications to increase their employment competitiveness. These certifications are significant plus factors in assessing an individual's job competence. Students also put in significant effort to obtain certifications to aid their employment prospects.

Certifications play an essential role in proving the job competence of young people, thereby enhancing their employment competitiveness. HRD Korea Webzine. The importance of utilizing certification information includes proving job abilities, setting criteria for talent selection, designing education and training programs, and formulating national workforce policies [32]. Fig. 1 presents a graph based on information provided by Q\_net regarding the current status of certifications.

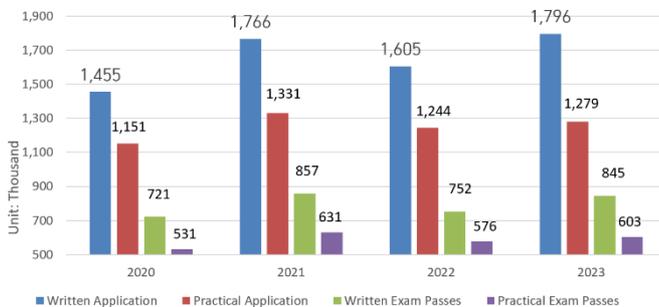


Fig. 1 Q\_net Certification Status

Despite the decline in the youth population, the gradual increase in the applicant ratio suggests that many individuals are investing substantial time in obtaining certifications. Fig. 2 relates to certifications and employment. The average

number of national certificates per employee is 5.06 for POSCO, 5.35 for POSCO affiliates, 5.29 for Hyundai Steel, and 4.73 for Hyundai Steel affiliates. The average number of national certificates for other companies, such as S-Oil, KEPCO, and Poongsan Metal, is 2.51. This study shows that field-related national certifications are used as a key evaluation criterion for hiring talent necessary for job roles and identifying candidates suitable for specific fields[4].

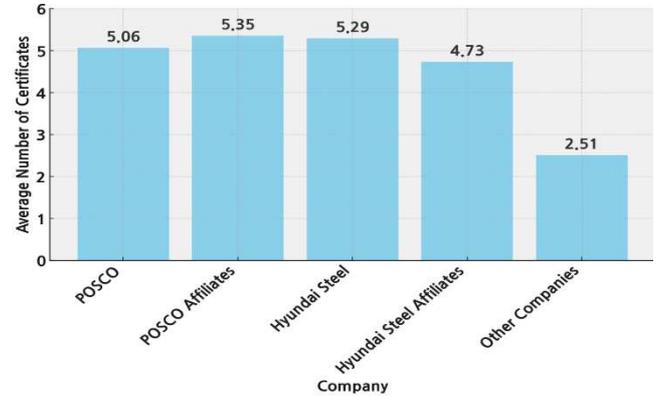


Fig. 2 Average Number of National Certificates Per Employee by Company

There has recently been growing interest in AI certifications. Various AI-related certification programs exist internationally, each focusing on specific aspects of the technology [33]. The current international certifications are listed in Table 2 [34], [35], [36], [37].

TABLE II  
INTERNATIONAL CERTIFICATIONS

Region	Certification / Program	Description
USA	Microsoft Certified: Azure AI Engineer Associate	Evaluates the ability to design, build, and operate AI solutions using Azure AI services, including machine learning, natural language processing, and computer vision.
	Google Professional Machine Learning Engineer	Certifies the ability to design, build, and operate effective machine learning models using Google Cloud Platform.
Europe	BCS AI Essentials Certificate	Focuses on understanding the fundamental principles of AI and ethical issues.
	SAS Certified AI & Machine Learning Professional	Certifies the ability to use SAS software in the fields of data science and AI.
Asia	P-Tech AI Developer Certification	Operated in collaboration with IBM, certifying AI development skills for students in several Asian countries.

## III. RESULTS AND DISCUSSION

### A. Proposed AI Certification

The structure of the certification system is fundamental, especially for generative AI. Understanding how and where generative AI will be applied is essential, and this requires a systematic learning and certification process. This process is crucial in effectively utilizing AI and maximizing its social impact.

The AI Fundamentals certification covers basic AI skills such as text generation, automatic writing, article writing, and novel writing. This certification is essential for content

creation-intensive fields such as journalism, publishing, and marketing. By mastering these essential AI functions, individuals can utilize AI effectively and build a foundation for learning more advanced AI skills.

The AI Data Management certification focuses on organizing Excel data, creating reports, and automatically generating business and research reports based on data analysis results. Data is a critical resource in modern industries, and the ability to effectively manage and analyze data can determine a company's competitiveness. This certification focuses on maximizing automation and efficiency in data management and is essential for business analysts, data scientists, and management consultants.

The AI Composition Certificate covers music composition and arrangement, music generation in various genres, background music, and sound effect production. Music and sound effects are significant in the music industry, movies, and games. The ability to create and arrange music using AI promotes innovation in the creative industries. This certificate is beneficial not only to musicians but also to game developers and filmmakers, allowing them to integrate AI composition into their work.

The AI Artist Certification covers digital art, illustration, graphic design, character and landscape creation. The importance of AI in digital art and design is rapidly increasing. This certification evaluates the ability to use AI tools to enhance creativity and efficiency in artistic work and is very useful for designers, illustrators, and game artists. This certification is especially relevant in the advertising, marketing, games, and film industries.

The AI Multimedia Certification covers video clip creation and editing and adding special effects, animation, and filmmaking. Video content plays a central role in modern media; multimedia production using AI can improve quality while reducing production time. This certification is an essential qualification for the broadcast, film, and digital marketing industries, equipping videographers, animators, and special effects professionals with the ability to work creatively and quickly.

The AI Coding Certification covers the basics of programming, simple game development, animation production, and project production. Coding is the foundation of all digital innovation, and when combined with AI, it becomes a vital skill for the future. This certification helps programmers and non-technical people learn to code using AI and create simple applications, games, and animations. These skills can be applied across various industries, including education, entertainment, and software development.

The AI Master Instructor Certification certifies your ability to teach generative AI applications such as writing, report writing, music creation, video editing, and project production. As AI technologies become more complex, the ability to understand and teach these technologies becomes increasingly important. This certification ensures educators, trainers, and instructors can effectively teach AI technologies. This makes those who earn the certification leaders in AI education and play a vital role in spreading AI knowledge and skills.

These certifications are essential for formally recognizing AI capabilities in various industries to improve employment opportunities and employability. Those who have obtained the certification will be recognized as AI experts in the market,

which will significantly expand employment opportunities and increase overall employment rates. In addition, as technology advances, it is crucial to continuously update the curriculum and qualification standards to keep up with the latest industry trends. This will ensure that education and certification institutions can meet the needs of the times and promote the spread and practical use of AI technology. Ultimately, the AI certification system is expected to positively impact the economy by encouraging the spread and application of AI technology in various fields. Table 3 shows the proposed certification process.

TABLE III  
TYPE OF CERTIFICATIONS

Type	Description
AI Fundamentals	Utilization in text generation, automated writing, article writing, novel, and creative document writing.
AI Data Management Certification	Organizing Excel data, report writing, and automated creation of company and research reports based on data analysis results.
AI Composer Certification	Music composition and arrangement generate music in various genres and create background music and sound effects.
AI Artist Certification	Creating digital art, illustrations, graphic design, character and landscape paintings.
AI Multimedia Certification	Creating and editing video clips, adding special effects, and producing animations and films.
AI Coding Certification	Learning programming basics, essential game development, animation creation, and project production.
AI Master Instructor	Guiding generative AI writing, report writing, music generation, video editing, and project production.

### B. Structure and Operation Plan for the Certification System

The structure and operation of the generative AI certification system are important factors that determine its success. They can be broadly divided into three main components: curriculum development, practice-oriented education, and assessment and certification. Each element plays a critical role in ensuring that individuals who have obtained the certification have the essential skills and knowledge to effectively apply generative AI technology in real life. Table 4 shows the structure and operation plan of the certification system.

TABLE IV  
STRUCTURE AND OPERATION PLAN DESCRIPTION

Structure and Operation Plan	Description
Development of Educational Curriculum	Develop an educational curriculum focused on generative AI technology. This curriculum should include various stages, from basic theory to practical application.
Practice-Oriented Education	Cultivate practical problem-solving skills through project-based learning, hands-on practice, and theoretical education.
Assessment and Certification	Evaluate students' competencies through an objective and fair assessment system and award certifications to participants who meet the standards.

First, the curriculum development must cover all aspects of generative AI technology through a well-designed curriculum. This curriculum should cover everything from basic concepts to intermediate applications and advanced technologies. It should start with providing basic theoretical knowledge,

understanding the principles of machine learning and neural networks, and moving on to more complex applications such as natural language processing, image generation, and AI-based creativity. In addition, the curriculum should be modular so learners can progress at their own pace. This should satisfy everyone, from beginners new to AI to experts. It should meet both academic knowledge and industry needs by developing content that aligns with the latest trends through collaboration with industry so that the certification has higher value in the real job market.

Second, practice-oriented education should be centered around project-based learning. Students should be able to gain practical experience by working on projects that solve real-world problems they might face in the workplace. Examples include developing AI models for text generation, creating AI-based art pieces, and developing AI tools for data analysis. These hands-on activities must reinforce theoretical knowledge and enhance technical proficiency. In addition, mentoring and collaborative learning opportunities should be provided so that students can learn under the guidance of industry experts and develop the ability to solve problems with their peers through teamwork.

Third, the assessment and certification process should be designed objectively and fairly. Students' competencies should be assessed by combining practical tests, project assessments, and theoretical tests, and the assessment criteria should be clear to ensure transparency. In addition, rather than relying on a single test, students' progress should be accurately identified through continuous assessment, and constant feedback should be provided to maximize the learning effect. Certifications should be awarded based on criteria that reflect a high level of proficiency in generative AI technology, and it is essential to recognize the learner's progress stage through various levels of certification, such as beginner, intermediate, and advanced.

Government support and industry-academia collaboration are essential for the success of these certification systems. Governments should provide the resources needed for curriculum development and training programs through policy and financial support and establish standards to ensure the quality and reliability of certifications. In addition, if governments formally recognize certifications, they will become more valuable in the job market. Close collaboration between industry and academia is essential to ensure that training programs are aligned with market needs. This can be achieved through joint curriculum development, lectures by industry experts, internships, and co-op programs.

Finally, the certification system must continuously update to keep up with technological developments. This requires regular curriculum evaluation and the introduction of new modules or courses that reflect the latest AI research and technological advancements. Collecting feedback from students, instructors, and industry partners through a feedback loop and improving the program based on this feedback is essential. This continuous quality control plays a critical role in maintaining the credibility and value of the certification.

This well-structured and operationally oriented certification system will enable individuals to acquire the essential skills to thrive in a world driven by generative AI technologies. This will not only help individuals advance their

careers but also contribute to preparing society to responsibly leverage AI's potential.

### *C. Expected Outcomes and Potential Challenges*

Developing industry-specific talent through a certification system aims to produce AI professionals who meet the precise needs of various sectors. This focus ensures that companies acquire skilled personnel with the necessary expertise, thereby driving productivity and innovation across industries. Individuals who obtain these certifications are recognized in the job market, leading to expanded employment opportunities, which, in turn, can improve overall employment rates.

Given the rapid pace of technological change, it is crucial to update the educational curricula and certification standards continuously. This ongoing adaptation is necessary to keep the certification system aligned with the latest advancements in AI and industry demands. Adequate investment and resource allocation are essential for the effective operation of educational and certification systems. This includes funding for curriculum development, instructor training, and the establishment of robust evaluation systems. Government support is critical in providing the financial backing and policy framework for the certification system to thrive.

Lastly, it is important to regularly evaluate the effectiveness of the certification system and make immediate adjustments as needed. Continuous monitoring and evaluation helps ensure that the certification system maintains its value and that the quality of education remains consistent. By doing so, the system can adapt to evolving industry needs and technological developments, ensuring it remains a relevant and reliable measure of AI proficiency.

## IV. CONCLUSION

This paper highlights the essential role of integrating generative AI technology into the national landscape through a well-structured certification program. Such a program is crucial for keeping our educational systems and certification processes in step with the rapid pace of technological change. By encouraging close collaboration between industry and academia, we can ensure that what is taught in classrooms directly meets the job market's needs, making education more relevant and impactful.

The certification system we propose is designed to maintain high educational standards and ensure that certifications remain meaningful and valuable over time. Regular evaluations and timely updates will help keep the system robust and responsive to change. If these proposals are implemented, they have the potential to develop a workforce that is not only skilled but also adaptable, leading to a more dynamic job market and strengthening national competitiveness.

Looking ahead, it's essential to continue monitoring technological advancements and regularly updating educational programs to keep pace with industry trends. By doing so, we can ensure that our certification system remains relevant and truly prepares individuals for the challenges and opportunities of the future.

## REFERENCES

- [1] D. Jang and J. Kim, "Two-way Interactive Algorithms Based on Speech and Motion Recognition with Generative AI Technology," *J. of The Korea Institute of Electronic Commun. Sciences*, vol. 19, no. 2, pp. 397–402, 2024.
- [2] Y.-J. Ko, "An Analysis of Artificial Intelligence Education Research Trends Based on Topic Modeling," *Journal of the Korea Society of Computer and Information*, vol. 29, no. 2, pp. 197–209, Feb. 2024.
- [3] Y. Oh, "Generative AI Jeonse Fraud Prevention System," *J. of The Korea Institute of Electronic Commun. Sciences*, vol. 19, no. 1, pp. 173–180, 2024.
- [4] M. Yoo, "Effect of Certificates of Major on Employment: Case of Steel Industry," *J. of Practical Engineering Education*, vol. 12, no. 1, pp. 203–212, 2020.
- [5] N. Khan, S. Khan, B. C. Tan, and C. H. Loon, "Driving Digital Competency Model Towards IR 4.0 In Malaysia," *Journal of Physics: Conference Series*, vol. 1793, no. 1, p. 012049, Feb. 2021, doi:10.1088/1742-6596/1793/1/012049.
- [6] J. Lee, M. Hong, and J. Cho, "Development of a Content Framework of Artificial Intelligence Integrated Education Considering Ethical Factors," *International Journal on Advanced Science, Engineering and Information Technology*, vol. 14, no. 1, pp. 205–213, Feb. 2024, doi: 10.18517/ijaseit.14.1.19558.
- [7] P. Kousa and H. Niemi, "Artificial Intelligence Ethics from the Perspective of Educational Technology Companies and Schools," *AI in Learning: Designing the Future*, pp. 283–296, Nov. 2022, doi:10.1007/978-3-031-09687-7\_17.
- [8] H. Moon, H. Go, Y. Lee, and S.-W. Kim, "Investigating Factors in Artificial Intelligence Literacy for Korean Elementary School Students," *International Journal on Advanced Science, Engineering and Information Technology*, vol. 14, no. 4, pp. 1226–1232, Aug. 2024, doi: 10.18517/ijaseit.14.4.16998.
- [9] W. Ho and D. Lee, "Enhancing Engineering Education in the Roblox Metaverse: Utilizing chatGPT for Game Development for Electrical Machine Course," *International Journal on Advanced Science, Engineering and Information Technology*, vol. 13, no. 3, pp. 1052–1058, Jun. 2023, doi: 10.18517/ijaseit.13.3.18458.
- [10] S.-W. Kim, "Development of a TPACK Educational Program to Enhance Pre-service Teachers' Teaching Expertise in Artificial Intelligence Convergence Education," *International Journal on Advanced Science, Engineering and Information Technology*, vol. 14, no. 1, pp. 1–9, Feb. 2024, doi: 10.18517/ijaseit.14.1.19552.
- [11] Z. Hakim, T. Ierasts, I. Hakim, A. D'Penha, K. Smith, and M. Caesar, "Connecting Data to Insight: A Pan-Canadian Study on AI in Healthcare," *Healthcare Quarterly*, vol. 23, no. 1, pp. 13–19, Apr. 2020, doi: 10.12927/hcq.2020.26144.
- [12] R. Jha, P. K. Patra, and A. K. Srivastava, "AI-guided optimization of manufacturing protocols for AHSS coils," *Materials and Manufacturing Processes*, vol. 38, no. 2, pp. 151–158, Aug. 2022, doi:10.1080/104226914.2022.2105871.
- [13] X. Chen, C. Chen, and Y. Cheng, "Toward the AI-enabled Digital Financial Services Innovation: The Role of Positive Emotional Interactions with Users," *Proceedings of the Korean Intelligent Information Systems Society Conference*, vol. 2022, no. 6, pp. 469–528, 2022.
- [14] R. Manrai and K. P. Gupta, "Investor's perceptions on artificial intelligence (AI) technology adoption in investment services in India," *Journal of Financial Services Marketing*, vol. 28, no. 1, pp. 1–14, Jan. 2022, doi: 10.1057/s41264-021-00134-9.
- [15] J. Kim, H. Lee, and Y. H. Cho, "Learning design to support student-AI collaboration: perspectives of leading teachers for AI in education," *Education and Information Technologies*, vol. 27, no. 5, pp. 6069–6104, Jan. 2022, doi: 10.1007/s10639-021-10831-6.
- [16] S. Earley, "The Future of Supply Chain Management is AI and Data," *Supply Chain Management Review*, vol. 25, no. 2, pp. 24–31, 2021.
- [17] I. Horváth, "AI in interpreting: Ethical considerations," *Across Languages and Cultures*, vol. 23, no. 1, pp. 1–13, May 2022, doi:10.1556/084.2022.00108.
- [18] P. K. Koppalle, M. Gangwar, A. Kaplan, D. Ramachandran, W. Reinartz, and A. Rindfleisch, "Examining artificial intelligence (AI) technologies in marketing via a global lens: Current trends and future research opportunities," *International Journal of Research in Marketing*, vol. 39, no. 2, pp. 522–540, Jun. 2022, doi:10.1016/j.ijresmar.2021.11.002.
- [19] M. M. Mariani, R. Perez - Vega, and J. Wirtz, "AI in marketing, consumer research and psychology: A systematic literature review and research agenda," *Psychology & Marketing*, vol. 39, no. 4, pp. 755 – 776, Dec. 2021, doi: 10.1002/mar.21619.
- [20] X. Li and F.-Y. Wang, "Scenarios Engineering: Enabling Trustworthy and Effective AI for Autonomous Vehicles," *IEEE Transactions on Intelligent Vehicles*, vol. 8, no. 5, pp. 3205–3210, May 2023, doi:10.1109/tiv.2023.3269421.
- [21] A. Yaseen, "AI-Driven Threat Detection and Response: A Paradigm Shift in Cybersecurity," *Int. J. Inf. Cybersecurity*, vol. 7, no. 12, pp. 25–43, 2023.
- [22] J. Yoon, "A Study on IT-Related Certifications Preferred by DOI: Students," *J. of the Korea Knowledge Information Technol. Society*, vol. 17, no. 3, pp. 405–414, 2022.
- [23] J. Baek, J. Kim, and J. Han, "Current Status and Suggestions for Robot Technology Certifications for Robot Education," *J. of Information Education*, vol. 15, no. 1, pp. 51–58, 2011.
- [24] A. Borboni, K. V. V. Reddy, I. Elamvazuthi, M. S. AL-Quraishi, E. Natarajan, and S. S. Azhar Ali, "The Expanding Role of Artificial Intelligence in Collaborative Robots for Industrial Applications: A Systematic Review of Recent Works," *Machines*, vol. 11, no. 1, p. 111, Jan. 2023, doi: 10.3390/machines11010111.
- [25] S. Kim and Y. Jeon, "Development of a Python Library to Generate Synthetic Datasets for Artificial Intelligence Education," *International Journal on Advanced Science, Engineering and Information Technology*, vol. 14, no. 3, pp. 936–945, Jun. 2024, doi: 10.18517/ijaseit.14.3.18158.
- [26] Microsoft, "Microsoft Certified: Azure AI Engineer Associate," 2021. [Online]. Available: <https://docs.microsoft.com/en-us/learn/certifications/azure-ai-engineer/>
- [27] IBM, "AI Engineering Professional Certificate," Coursera, 2022. [Online]. Available: <https://www.coursera.org/professional-certificates/ai-engineer/>
- [28] M. Joshi, "Adaptive Learning through Artificial Intelligence," *SSRN Electronic Journal*, 2023, doi: 10.2139/ssrn.4514887.
- [29] F. Stephany and O. Teutloff, "What is the price of a skill? The value of complementarity," *Research Policy*, vol. 53, no. 1, p. 104898, Jan. 2024, doi: 10.1016/j.respol.2023.104898.
- [30] P. Cihon, M. J. Kleinaltenkamp, J. Schuett, and S. D. Baum, "AI Certification: Advancing Ethical Practice by Reducing Information Asymmetries," *IEEE Transactions on Technology and Society*, vol. 2, no. 4, pp. 200–209, Dec. 2021, doi: 10.1109/tts.2021.3077595.
- [31] A. Jobin, M. Ienca, and E. Vayena, "The global landscape of AI ethics guidelines," *Nature Machine Intelligence*, vol. 1, no. 9, pp. 389–399, Sep. 2019, doi: 10.1038/s42256-019-0088-2.
- [32] Korea Vocational Competency Development Institute, "Professional Certification Information," 2024. [Online]. Available: <https://www.q-net.or.kr/man004.do?id=manSubMain>
- [33] Microsoft, "Microsoft Certified: Azure AI Engineer Associate," Microsoft Learn, 2024. [Online]. Available: <https://learn.microsoft.com/en-us/credentials/certifications/azure-ai-engineer/>
- [34] Google, "Google Professional Machine Learning Engineer," Google Cloud Certification, 2024. [Online]. Available: <https://cloud.google.com/certification/machine-learning-engineer>
- [35] BCS, "BCS AI Essentials Certificate," BCS - The Chartered Institute for IT, 2024. [Online]. Available: <https://www.bcs.org/qualifications/exams/all-exams/ai-essentials-certificate/>
- [36] SAS, "SAS Certified AI & Machine Learning Professional," SAS, 2024. [Online]. Available: [https://www.sas.com/en\\_us/certification/credentials/advanced-analytics/ai-ml-professional.html](https://www.sas.com/en_us/certification/credentials/advanced-analytics/ai-ml-professional.html)
- [37] IBM, "P-Tech AI Developer Certification," IBM SkillsBuild, 2024. [Online]. Available: <https://www.ibm.com/skills/programs/ptech/>