

# The Impact of Integrating Artificial Intelligence into Learning by Doing Concept: Economic Growth and Innovation

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**Abstract** - *To promote economic growth and innovation this paper investigates the financial outcome of incorporating artificial intelligence (AI) into experiential learning commonly referred to as learning by doing (LBD). It determines the effects of AI-driven learning approaches on skill acquisition, productivity, innovation, and cost-effectiveness across various industries by a comprehensive literature review, case studies, and theoretical framework. The results show that AI-powered tools and platforms can boost productivity to find new pathways for innovation and speed up skill development. The results proved that the hypothesis of integrating AI into LBD is positive and creating capabilities to enable workforce development, competitive advantage, and technological advancement. In addition to offering recommendations to businesses, educators, and stakeholders on applying AI to drive economic growth through experiential learning, the research also examines future trends, potential obstacles, and ethical issues. In summary, this study adds value to the expanding researches and case studies on the relationship between AI and LBD. It also helps in economic growth and provides stakeholders with information and direction on utilizing these technologies' transformative potential for long-term sustainable economic growth in the digital era.*

**Keywords** - *AI, Cost Effectiveness, Economic Growth, Learning by Doing, Skill Development.*

## I. INTRODUCTION

Artificial intelligence continues to advance beyond science fiction in this rapid technological development and the digital revolution. It has grown from a fascinating concept to a powerful tool for changing modern civilization (Apsilyam *et al.*, 2024). The integration of learning by doing and AI motivates institutions to monitor the elements of cost savings, productivity advancements, and innovation at the business levels. Several researches and studies on industrial production presented the concept of LBD. It depends on the finding that output can double while unit costs can decrease (Apetrei *et al.*, 2024). Working experience and enhancing production skills are all considered components of learning by doing in the context of a company. Utilizing, or incorporating user input and participation in the co-creation of goods and services, is another aspect of LBD process. Learning

by doing involves communicating with other businesses or outside entities including vendors, rivals, nonprofit organizations, and government agencies (Skulmowski, 2024).

The concept of LBD highlights the development of information and abilities by real-world application and experience (Simon, 1984). It emphasizes that rather than depending exclusively on theoretical knowledge or passive learning strategies, individuals and organizations may improve their capacities and productivity by actively participating in processes and operations. According to Arrow (1962), cumulative output should not be as appropriate as cumulative investment as a measure of experience because new machine introductions should encourage more innovation, whereas an environment where outputs are accumulated at a steady rate per unit of time seems less stimulating. A prominent liability in economic geography is the knowledge economy, which is illustrated, for instance, in maps of patents, employment, and vocations (Clark, 2018; Qader *et al.*, 2025). The idea of LBD is very important in economic contexts; Through practical involvement in a range of economic activities, individuals and organizations have an improved understanding of the complexities involved, enhance their processes, and spot areas for growth (Massoudi *et al.*, 2019; Zaidan *et al.*, 2024). AI has a crucial impact on corporate operations and competitiveness across various industries within the global economy. These AI tools such as machine learning (ML), data analytics, and algorithms, have a vital role in enhancing productivity and making decisions (Adigwe *et al.*, 2024). Due to the application of learning ecosystems in formal and informal approaches, LBD can inspire individuals to build a knowledge database of the economy across various subjects and contribute to a robust, inclusive, and prosperous society and economy (Skulmowski, 2024; Birdawod, 2022). AI can improve the concept of learning by doing in economic contexts. After utilizing the two concepts of massive data processing capacities and ML, the systems that integrate AI can accelerate the learning process, identify patterns, and ensure that

human analysts will maintain their role and support informed decision-making.

This study will analyze the economic effects of optimizing LBD concepts to understand how AI can promote innovation, increase productivity, and transform industries through adaption and continuous learning (Zhu, 2021). This research addresses the fusion of AI and LBD processes and procedures and how the integration is applied to develop innovation and economic growth. The study's objective is to evaluate the AI-driven learning methodologies' effects on the elements of economic growth such as cost-effectiveness, productivity, and skill development across industries. The concentration on the economic implications of AI in LBD provided this research with insights into how AI-powered tools and platforms improve skill development, streamline workflows, and demonstrate new competitiveness potential.

## II. LITERATURE REVIEW

### A. Background of AI and its Impact on Various Industries

Artificial intelligence has evolved into contemporary high-tech societies' daily lives. AI has been defined in a variety of ways, and these definitions have all progressed throughout the years (Davenport and Ronanki, 2018). Nowadays, the majority of definitions claim that AI can solve difficult cognitive challenges related to human thinking, that AI can assist as many people as possible through smartphones or healthcare, or even that AI can identify issues and develop solutions that will benefit society, individuals, and technology as a whole. Nonetheless, the goal of artificial intelligence has always been to build computers with human-like intelligence (Goralski and Tan, 2020; Al-Delawi & Ramo, 2020). How people live and work is being fundamentally altered by artificial intelligence, which is becoming an influential tool in many sectors. Healthcare, banking, manufacturing, and transportation are just a few of the industries that artificial intelligence has impacted (Hasoon and Jasim, 2013). AI has additionally opened up previously undiscovered opportunities for efficiency and innovation. Artificial Intelligence infused science fictions depict a world where autonomous labs are common, generative AI may take control of human topics and AI researchers publish study findings and earn Nobel Prizes. These concepts propose autonomous collaborators that can transcend the constraints that human capabilities now place on scientific advancement, going beyond the idea of AI as a simple tool (Messerri and Crockett, 2024). The ability of AI systems to see patterns, analyze big data, and make conclusions has created opportunities for automation and decision-making.

Artificial intelligence has a significant effect on many different businesses, as Figure 1 illustrates. In the medical profession, AI-driven diagnostic tools and individualized treatment plans have the potential to

improve patient outcomes while lowering costs. Artificial intelligence has made a significant impact on economics, changing conventional business practices and creating new avenues for efficiency and creativity (Apsilyam *et al.*, 2024). Applying AI techniques in the banking sector is required to improve the security and profitability of clients, employees, and the bank system through implementing algorithmic trading, risk management, and fraud detection (Mhlanga, 2020). The automation feature powered by artificial intelligence impacts businesses and has developed the industrial sector by increasing quality control departments and optimizing production processes. Transportation mobiles have improved due to autonomous cars integrated with AI techniques; this upgrade made transportation safer and more effective for drivers and individuals (Tan *et al.*, 2024).

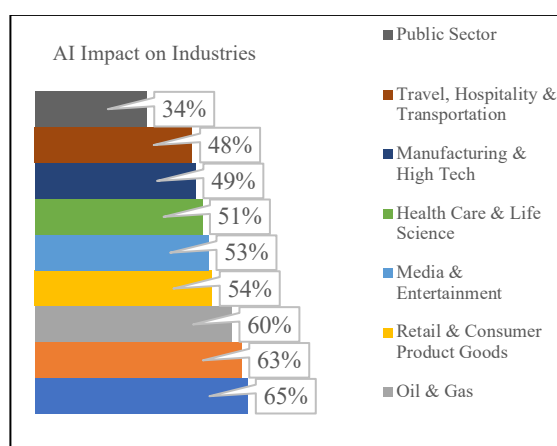


Fig. 1. AI Impact on Industries (Abasaheb and Subashini, 2023)

### B. Overview of AI Applications Researches

Figure 2 shows various types of research that have presented the application of AI and its effects on industries. Considerable studies have analyzed artificial intelligence utilization in the healthcare sector for medical image analysis, personalized treatment planning, and disease detection. For instance, Esteva *et al.* (2017) provided facts of high proficiency levels with the use of deep learning algorithms to identify skin cancer that matches dermatologists. Similarly, Ardila *et al.* (2019) demonstrated how AI can improve early diagnosis and treatment using AI system that accurately diagnose lung cancer using Computed Tomography (CT) images.

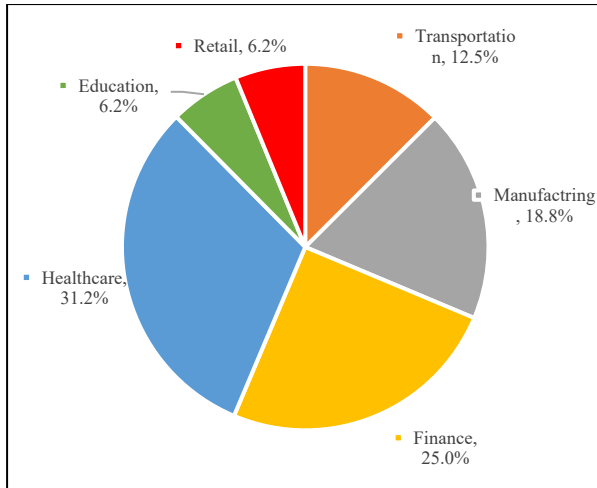


Fig. 2. AI Applications Sectors 2023 (Ibeggulam et al., 2023)

Nowadays, artificial intelligence is used extensively in the banking sector to develop and conduct several tasks such as risk management, fraud detection, investment, and trading algorithms. Researchers in many studies have analyzed how ML algorithms and AI tools are applied to identify patterns and anomalies in financial data. Ngai *et al.* (2011) conducted a comprehensive study and analysis of AI applications and their application in the financial markets, concentrating on the advantages of AI-based systems to improve market efficiency and decision-making processes and to limit the gaps and disadvantages of the traditional process (Massoudi *et al.*, 2024). In addition, the manufacturing sector has notable advancements in applying AI tools and techniques. The impact of optimizing artificial intelligence processes is analyzed in research to predict maintenance issues, conduct quality control procedures, and supply chain optimization. Lee *et al.* (2015) proposed an AI-based architecture to support decision-making process optimization and real-time monitoring in intelligent manufacturing systems (IMS).

C. Learning by Doing and Its Economic Effects

The terms of productivity, creativity, and economic growth and how learning by doing concepts impacts these terms are demonstrated in Table 1 and extensively studied in economics fields. Bessen (2015) in his study have conducted an analysis of the relationship among the concepts of creativity, LBD, labor market, diversity, and wealth generation allocating that practical experience plays a vital role in promoting economic development (ED).

The benefits of LBD in specific fields and circumstances have been examined in various research and studies (Lubis *et al.*, 2020). The analysis of LBD impacts on semiconductor manufacturing achieved by Irwin and Klenow (1994) shows that experience in production processes leads to cost savings and productivity improvements. In investigating learning-by-doing benefits applied in the aircraft manufacturing industry, Gruber (1998) emphasized that experience

plays an important role in output advancements and cutting expenses.

Table 1. Economic Effects on Applying Learning by Doing

| Economic Effect       | Description   |
|-----------------------|---|
| Productivity Gains    | Practical experience leads to improved processes, techniques, and efficiency, resulting in higher productivity.           |
| Cost Reductions       | Learning by doing enables organizations to identify and eliminate inefficiencies, reducing production costs.              |
| Innovation Enablement | Hands-on experience can uncover new opportunities for innovation and process improvements.                                |
| Competitive Advantage | Organizations with extensive learning by doing can develop unique capabilities and expertise, gaining a competitive edge. |
| Economic Growth       | Productivity gains and innovation driven by learning by doing contribute to overall economic growth and development.      |

D. AI Technologies Application into Learning Processes

The integration of artificial intelligence and learning by doing has been studied and analyzed in significant research, even though these two fields have been studied independently. Scholars have investigated how AI technologies develop and facilitate the process of learning, herewith enabling enterprises to leverage data-driven insights and adapt to dynamic market circumstances (Flaih *et al.*, 2020). Declining that AI and ED differs due to recent advancements in these fields is becoming more challenging. Consequently, studies on AI and ED have been published previously. Recent research has provided visions into the relationships between AI and ED. Moreover, the collected data indicates that the relationship between AI and the economic sectors is increasing significantly and profoundly (Qin *et al.*, 2023).

Recently, Zhu *et al.* (2020) explained how systems blended with AI techniques evaluate production data, allocate trends, and offer suggestions for process improvements. The scientists also presented a framework to incorporate AI and LBD concepts in manufacturing processes. Therefore, the advantages of AI for data analysis are combined with real-world knowledge from actual manufacturing experiences. Researchers in the healthcare industry have investigated the application of AI to enhance hands-on learning in medical training and clinical practice. Hashimoto *et al.* (2018) created an AI-powered system that gives surgeons real-time feedback and advice during surgical procedures, allowing them to constantly improve their abilities via practical experience.

III. METHODOLOGY: THEORETICAL FRAMEWORK

A. Economic Theories Related to Learning by Doing

The AI Economist recovers the best tax policy according to economic theory and stabilizes the difficult levels through organized curriculum learning and coadapted learning problems. The AI Economist significantly enhances the trade-off between productivity and equality over standards and ethical social welfare in geographical economies (Zheng *et al.*,

2022). Various economic theories support the concept of LBD clarifying its significance and its impact on creativity, productivity, and ED. The Learning Curve concept which is illustrated in Figure 3 is one of the core ideas. It suggests that as an individual or organization acquires proficiency in a particular activity or process their productivity and efficiency increase over time (Cook *et al.*, 2008). This phenomenon is shown by a sloping downward curve where the unit cost of manufacturing decreases as cumulative output increases.

A relevant theory known as "The Experience Curve" was introduced to expand the learning curve concept and apply it to a broader range of organizational settings and policies (Argote and Epple, 1990). The experience curve theory states that if an organization increases experience in a particular market or industry; it can apply a range of strategies, such as process optimization, scale economies, and knowledge sharing to reduce expenses and excess efficiency (Cook *et al.*, 2008; Birdawod and Massoudi, 2023). According to Teece *et al.* (1997), the Dynamic Capabilities hypothesis was presented to emphasize the importance of the adaptability of an organization to rearrange and modify its resources and capabilities for the opportunity to respond to changing market conditions; The crucial feature for acquiring these dynamic functions is experiential learning. Through direct experience, businesses may recognize opportunities, overcome obstacles, and continually improve their strategies and procedures.

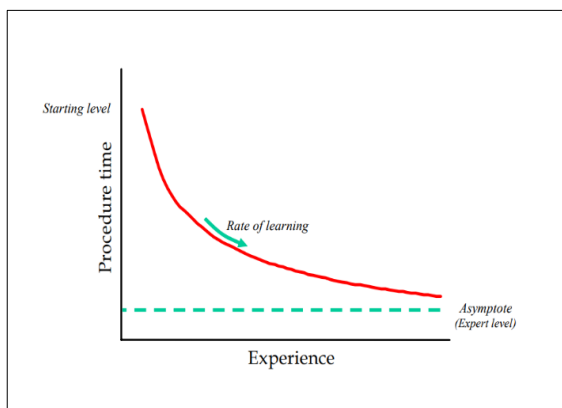


Fig. 3. Learning Curve Concept (Cook *et al.*, 2008)

#### B. How AI Can Enhance Learning Processes and Knowledge Accumulation

Artificial intelligence has crucial promise for improving organizational learning and knowledge acquisition. AI can accelerate the detection of trends, insights, and development opportunities that may be neglected or challenging to recognize through human analysis alone by utilizing sophisticated algorithms and massive data processing capabilities (Harfouche, 2023). AI gains fresh insights to supplement human knowledge and accumulates knowledge that directly influences the decisions of managers (Thabit and Jasim, 2015).

As indicated in Table 2, simulation and predictive analytics are two ways AI might improve learning processes. AI-powered systems can simulate many situations and outcomes by analyzing historical data, spotting trends, and creating predictive models. Without the requirement for expensive real-world testing, this capacity enables organizations to investigate various strategies, test hypotheses, and obtain insights (Gaines, 2013). AI can also make it easier for employees to collaborate and share information. Algorithms of ML can analyze data gathered from a variety of sources, including employee experiences, standards of practice, and documentation of procedures, to find insightful information that ought to be shared across the enterprise. Furthermore, despite the need for further complex programming, ML techniques sort the data, learn from it, acquire insights, and generate predictions based on the data they evaluate (Jasim, 2021). This information exchange can facilitate more effective knowledge transfer and improve the learning curve.

Table 2. AI Learning Enhancements

| Enhancement                          | Description  |
|--------------------------------------|--|
| Accelerated Pattern Recognition      | AI can rapidly analyze large datasets to identify patterns and insights that drive learning and improvement.                             |
| Predictive Analytics and Simulation  | AI-powered simulations enable organizations to explore scenarios, test strategies, and gain insights without real-world experimentation. |
| Knowledge Sharing and Collaboration  | AI can facilitate knowledge sharing and collaboration, accelerating the learning curve and enabling efficient knowledge transfer.        |
| Personalized Learning                | AI can tailor learning experiences to individual needs and preferences, enhancing the effectiveness of learning processes.               |
| Continuous Monitoring and Adaptation | AI systems can continuously monitor processes, identify improvement, and adapt to changing conditions, enabling continuous learning.     |

#### C. Data Collection: Quantitative Evidence

The concept of applying AI will have a significant impact on the economy according to studies and research. Consulting companies such as Accenture published several researches introducing 12 developed economies such as United States of America, United Kingdom, France, Germany, Japan, Spain, Italy, Sweden, Netherlands, Austria, Finland, and Belgium, which overall generate more than 50% of the world's economic results, forecasts that in the near future, AI double annual global economic growth rates as illustrated in Figure 4 (Branon, 2016; Szczepanski, 2019). Three methods AI will implement in driving economic growth. First, it will increase labor productivity (up to 40%) due to innovative technologies that AI acquires, enabling efficient time management in the workforce. Second, an AI virtual

platform described as "intelligent automation" is capable of solving problems and self-learning. Third, the diffusion of innovation will impact positively the economy, which will affect different sectors and create new pathways (Sahi, 2022). PricewaterhouseCoopers (PwC) presented a study estimating that global GDP will increase (up to 14 %) equivalent to the amount of \$15.7 trillion USD by the year 2030; this increase is a result of the accelerating development and applying AI in the organization processes (Szczepanski, 2019). The study anticipates the next digital revolution will rise through the support of the data collected from the Internet of Things (IoT), which is many times greater than the data gathered by the current applied IoT (Sahi, 2022). The McKinsey Global Institute expects that by the year 2030, 70% of organizations and institutions will adopt at least one AI technology. On the other hand, less than 50% of large businesses will deploy the complete set of technologies and tools that AI provides. McKinsey Institution predicts that AI will deliver an additional economic output amount of \$13 trillion USD; increasing global GDP by (1.2%) annually. This estimation will come from labor substitution by automation (Belkacemi, 2022).

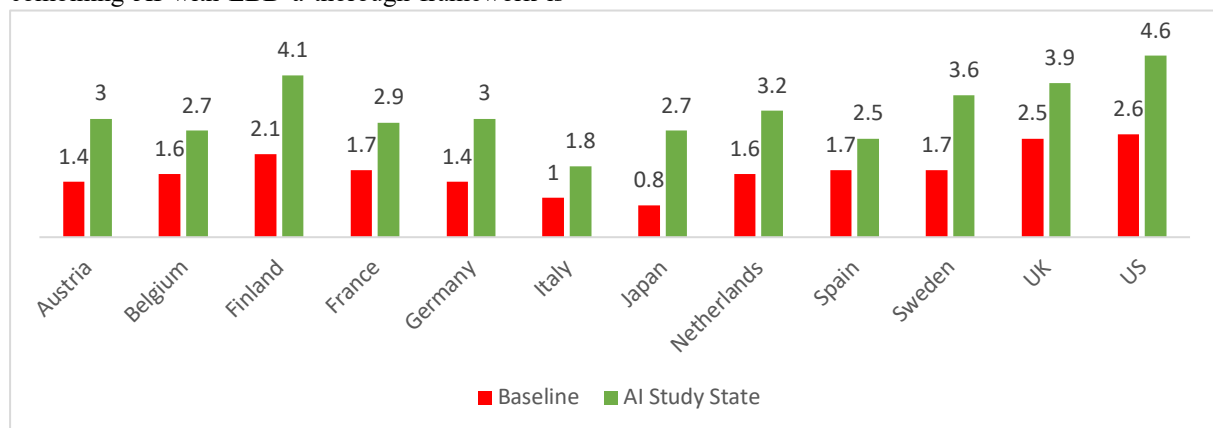
#### *D. Framework for Economic Implications of Combining AI with LBD*

Basically, the terms Perception, understanding, action, and learning are the fundamental abilities of contemporary AI. Artificial intelligence expands the logical foundation of standard information technology (IT) systems, which depend on data intake, processing, and output, to incorporate the components of comprehension and learning. The AI system utilizes feedback to learn how to comprehend the cause-and-effect connections of the operations (Massoudi et al., 2024), and to distinguish between correct and incorrect behaviors in the Learning and/or Training phase that follows, as well as across operations (Von Garrel and Jahn, 2023). To comprehend the financial effects of combining AI with LBD a thorough framework is

with any potential benefits and feedback channels, this framework must consider the relationships that exist between AI technology, learning processes, and financial results.

These are the main elements that drive the suggested framework:

1. **AI-Driven Data Analysis:** Big data comes from various resources that can be primary or secondary; collecting this data is achieved through different methods such, as customer interactions, industrial processes, and market trends. AI systems analyze this extensive amount of data to apply it within the LBD processes to identify patterns, improve opportunities, and support economic growth.
2. **Enhanced Learning Processes:** AI-generated insights are integrated into the organization's LBD methodologies. individuals can use these insights to improve current practices, test out new concepts, and never stop learning.
3. **Improvements in Production and Efficiency:** As AI data enhances learning processes, businesses stand to gain in productivity and efficiency. This may lead to decreased costs, increased output, and more efficient use of the resources at hand.
4. **Advantages of Innovation and Competitive:** Combining AI with LBD supports businesses in becoming more competitive in their specific industries through the presentation of new approaches for innovation, product development, and process optimization.
5. **Economic and Wealth Growth:** The collaboration of LBD and AI motivates institutions to monitor the factors of cost savings, productivity advancements, and innovation at the business and societal levels. These factors might stimulate overall ED and wealth creation.
6. **Feedback Loop:** The concept of applying AI within LBD can lead to learning and development iterations through the financial credits and outcomes this concept provides.



proposed (Chen, 2023). Concurrently

Fig. 4. Annual Growth Rate (Branon, 2016)

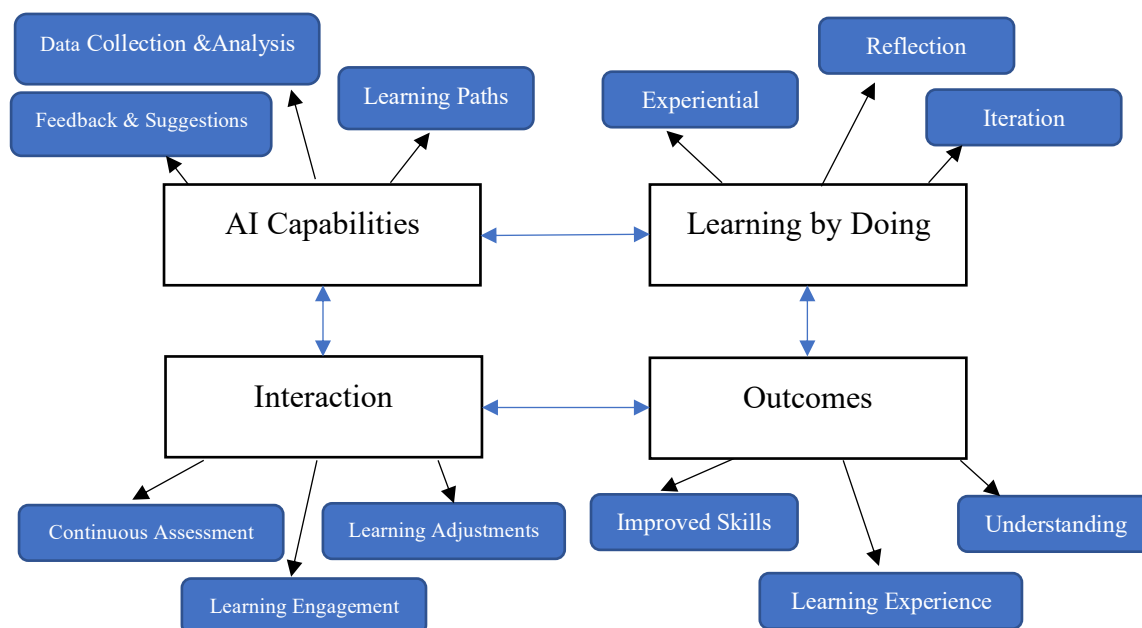


Fig. 5. Conceptual Model: AI and LBD

Figure 5 depicts the conceptual framework of incorporating artificial intelligence and learning by doing techniques, the objective of applying the framework is to create a customized and dynamic learning environment in the institutions. Firstly, the process initiates with the AI capabilities component that gather performance data, apply data analysis techniques, and explore patterns and possible areas for improvement. Activating another process that informs the requirement for an individual condition customized feedback and provides in-depth suggestions for enhancing performance in real-time. The other capability is developing the learning pathways that depend on the learner's progress and consistently offer relevant challenges to the existing skill level. Secondly, supporting the abilities of AI within the LBD method, this process concentrates on experiential learning via the functions of learner activities and real-world problem-solving. In the promotion of reflection, critical thinking, and self-evaluation, learners have the opportunity to acquire a deeper understanding of the learning processes. Furthermore, another process in this phase emphasizes iteration and strongly encourages the learners to adapt and tailor their projects in response to feedback; this process is implemented to foster skill development and continuous improvement.

Thirdly, the interaction phase, the most critical feature that distinguishes the relationship between AI and LBD is continuous assessment. AI is activated and begins to track performance during progress and activities and provides continuous assessment and feedback. Learning practices are modified continuously in real-world activities, enabling tasks to remain engaged and challenged. Learners' interest and investment in the educational

process is retained by AI through the use of gamification elements and incentive abilities that raise engagement in the learning process, several implications of this integrative approach are found. Lastly, Through the outcome phase, learners acquire experience in confidence, and practical skills improvement over time. Iteration and reflection factors collaborate to enable learners to learn how to comprehend topics more deeply and apply the information they have learned in various conditions. The most vital feature in the conceptual framework is that each learner has a highly customized learning path that depends on their unique requirements and abilities, which maximizes their progress in implementing projects efficiently within the deadline.

#### IV. ANALYSIS AND DISCUSSION

##### A. Analyzing AI Function to Facilitate LBD

Businesses from a variety of industries are using AI technology to improve experiential learning and knowledge acquisition, and this integration of AI into LBD processes has gained momentum. Case studies such as these demonstrate how AI is enabling experiential learning.

1. Manufacturing: AI-Powered predictive maintenance depends substantially on artificial intelligence. It analyzes big datasets produced by machinery in industries by utilizing deep learning, ML, and data analytics. Beyond what human operators can see, AI systems can identify defects, patterns, and trends (Abbas, 2024). AI-driven predictive maintenance solutions are applied by manufacturers such as General Electric and Siemens. These systems forecast potential malfunctions and maintenance requirements by analyzing real-time data from

- sensors and equipment. Technicians may improve their troubleshooting abilities, obtain a greater knowledge of the equipment behavior and its maintenance, and learn from real world scenarios by integrating AI insights with training repair operations (Çinar, 2020).
2. Healthcare: AI-Assisted surgical residencies training is a particular field in the healthcare industry where AI has enormous potential to supplement training. AI is being utilized to improve hands-on learning and surgical training. Applications for AI-enhanced computer vision include illness identification, patient health monitoring, medical image analysis, surgical support, accelerating drug development, and developing customized treatment plans. For instance, Osso VR has created a surgical training platform driven by AI that gives surgeons real-time feedback and direction during simulated surgeries (Eswaran, 2024). The surgeon's actions, methods, and decision-making are examined by the AI system, which then provides individualized knowledge and recommendations for development. With this method, surgeons can accelerate their skill development by learning from actual events in a free risk setting (Guerrero *et al.*, 2023).
  3. Retail: AI-Driven customer experience optimization is becoming increasingly vital in e-commerce to improve customer experience and foster long-term profitability. AI has stimulated the interest of investors who analyze the long-term potential of the metaverse and decentralized play to earn economies (Rojas, 2022). Retailers like Amazon and Walmart have employed AI to enhance customer experiences and gather data from in-person encounters. To find areas for development, AI systems examine client data, purchase trends, and feedback (East and Smith, 2024). Subsequently, this data is employed to improve the entire shopping experience, target marketing efforts, and make more precise product suggestions. Furthermore, it may offer retail managers an analytical framework to support them in creating justifications for their strategic decisions and best practices for the integration and application of AI (Cao, 2021).

#### B. Analysis of AI-Driven Tools and Platforms to Support Experiential Learning

Numerous AI-driven tools and platforms have evolved to improve experiential learning as the use of AI in LBD processes continues to rise (Salinas *et al.*, 2024). Here are a few instances:

- According to Radianti *et al.* (2020), By practicing in the immersive environments provided by simulation and virtual reality (VR) platforms, students can improve their skills in a controlled and safe setting. These platforms create realistic scenarios, provide instant feedback, and adapt the

learning process based on the learner's progress using AI algorithms. Two instances are Meta Quest 3 and Apple Vision Pro.

- One of the AI-powered platforms in the learning process is intelligent tutoring systems (ITS), which provide learners with customized learning opportunities for needs adaptation, benefits, and drawbacks. Through the utilization of ML algorithms, ITS will evaluate performance, identify knowledge gaps, and provide personalized feedback and instructional materials. Knewton's adaptive learning platform and Carnegie Learning's cognitive tutor are two common examples of ITS.
- To provide an accurate result from the learning process, the integration of AI to achieve learning analytics is the solution. Artificial intelligence analyzes data collected from various sources efficiently, such as learning management systems (LMS), conversations and interviews, and surveys. AI evaluates the results to strengthen learning trends and advancements and increase learning reliance opportunities. The advantage of the mentioned system technologies, they play a significant role in assisting instructors and organizations to present their teaching strategies and intervention efforts. Blackboard Analytics, Moodle, and Coursera's Course Data Analytics are instances of these systems.

#### C. Analysis of AI-Learning by Doing Economic Benefits and Challenges

The drawbacks of incorporating AI into LBD processes should be considered by stakeholders, managers, decision-makers, and businesses, although despite the financial benefits these systems provide. When organizations and institutions include AI in their learning processes, there are potential cost and efficiency profits. Table 3 illustrates how enterprises reduce possible expenses associated with using methods of traditional practical training. On the other hand, developing the scale learning experience via applying AI-powered virtual environments, ITS, and simulations.

Table 3. Cost Efficiency Benefits of AI in Learning

| Benefit                          | Description   | Potential Impact  |
|----------------------------------|---|---|
| Reduced Training Costs           | AI simulations and virtual environments reduce costs associated with physical training facilities.                            | Cost savings can increase up to 50% compared to traditional training methods. |
| Optimized Resource Utilization   | AI-driven learning analytics enable efficient allocation of training resources based on learner data and performance metrics. | Highly improved resource utilization.   |
| Increased Operational Efficiency | Rapid skill acquisition and process optimization insights from AI lead to reduced errors and waste.                           | Enhanced productivity gains in manufacturing operations.                      |

The following is the possible advantages and challenges when applying integrated systems:

Economic Benefits:

1. **Productivity and Efficiency:** The learning procedures of AI-driven improve the productivity and efficiency of businesses. The outcome is saving time and money on training and development due to the velocity of gaining employee knowledge and skill acquisition.
2. **Cost Savings:** Obtaining a cost-effective practical teaching method is implemented by utilizing AI-powered simulations and virtual platforms. AI-driven predictive maintenance capability and process optimization decrease the learning costs and delays.
3. **Competitive Advantage:** The integration of AI into an organization's training procedures provides a highly trained and flexible staff, that can help businesses increase quality and productivity and maintain a competitive position in the market.
4. **Talent Attraction and Retention:** Job satisfaction provide talent retention and attraction as an advantage of optimizing AI-driven learning systems in the organization. Investing in cutting-edge learning resources and providing opportunities for ongoing skill development can help employers attract applicants.

Challenges:

1. **Data availability and quality:** Knowledge database provides AI systems access to big data and generates accurate decisions and recommendations. The process of maintaining the availability and quality of data is a challenging function, especially when organizations don't have the digital and technology foundation and lack data collection experience.
2. **Integration and Scalability:** It is a challenging and resource-intensive process to incorporate AI technology into the existing learning infrastructures and protocols. Organizations and institutions will face challenges when implementing the function of scaling AI-driven learning solutions across divisions, regions, or user groups.
3. **Trust and Acceptance:** Developing trust in AI-driven learning systems is demanding. Individuals are concerned regarding the integrity, transparency, and potential biases that occur when delivering recommendations or feedback generated by artificial intelligence.
4. **Expenses and Resources:** Investments in technology infrastructure and specialized knowledge to implement and develop AI-driven learning solutions in a business require investors, banks, and reliable resources. Challenges are possible for institutions in obtaining the resources and adjusting costs.

*D. Analyzing AI Impact on Skills, Productivity, and Innovation of LBD*

According to the integration of artificial intelligence into learning-by-doing, applying artificial intelligence's abilities within data analysis, pattern recognition, and personalized feedback functions allows employees to shorten their learning curves and gain expertise faster through acquiring real-world experiences. Following is a list of AI Impact on Skills, Productivity, and Innovation:

1. **Skill Acquisition:** During the learning events, enabling staff to identify improvement areas, and improve their skills, AI-driven environments provide personalized regulations and instructions, and real-time feedback. For instance, artificial intelligence simulations support employees in the sector of manufacturing enabling them to learn and develop proficiency in complex processes, reducing error and defect rates and improving overall business quality.
2. **Productivity:** The enhanced system of learning-by-doing using artificial intelligence abilities, increases skill acquisition quickly and results in a significant growth in employee productivity. AI-enhanced LBD systems can assess performance data, identify bottlenecks, and prepare recommendations for adaptations that improve outcomes and efficiency.
3. **Innovation:** Advancements in innovation are derived from the process of experiential learning enhanced by AI techniques. Through data analysis gathered from real-world cases and pattern recognition features, AI-driven systems offer innovative concepts to develop the organization and solutions for existing issues. This procedure promotes innovation in various topics, such as service delivery, product development, and operational processes, giving businesses a competitive advantage.

*E. Discussion on Potential Disruptions and Opportunities for Businesses*

The enhanced system of LBD associated with artificial intelligence is capable of challenging long-standing business strategies and models and introducing new opportunities across different industries. Organizations and institutions must adapt their infrastructure, development techniques, policies, regulations, and workflow to maintain competition among organizations in the market. The following are several points to consider:

- **Traditional Training Disruption:** Organizations and institutions using traditional training models depending on physical facilities, human instructors, and in-person lessons might face disruption after the rise of AI-driven virtual environments and ITS. The manufacturing, healthcare, and aviation sectors for instance, need

to review their training methods and decide to invest in AI-driven solutions to remain competitive and cost-effective.

- Emergence of New Business Models: Merging AI with LBD may lead to new streams and business models. VR training environments, learning analytics tools, simulation platforms, and other AI-driven learning solutions may become important participants in the industry. Businesses may look into presenting entirely new services or products in light of the discoveries and advancements made possible by AI-enhanced experiential learning.
- Transformation of the Workforce: As AI-driven learning by doing techniques increases the skill requirements and job roles within the workforce may alter dramatically. Employees will be required to develop further long-term learning of AI and data analysis skills. Businesses might need to invest in reskilling and upskilling initiatives to ensure that employees retain adaptability and ability to use AI-powered learning materials effectively.
- Competitive Advantage: Organizations that apply AI for continuous learning accumulate a significant advantage. These organizations could exceed competitors in representations of product quality and adaption to market demands through the improvement of innovation, acceleration of skill acquisition, and optimization of procedures.

Businesses and industries need to adopt a culture of continuous learning, foster cooperation between AI experts and industry specialists, and develop strategies for successful workforce transformation and transition management to leverage the potential of AI-driven learning by doing processes.

*F. Discussion on the Impact of AI and LBD Integration on Economic Growth*

There are significant implications for economic growth at the organizational and social levels when artificial intelligence is included in learning by doing processes. According to Table 4, economies may open up new channels for competitiveness, growth, and innovation by utilizing the complementary advantages between AI and learning through experience.

Table 4. Economic Effects of AI Learning

| Implications                    | Description  |
|---------------------------------|--|
| Workforce Development           | AI-driven LBD techniques are significant because they support the development of a highly skilled and adaptable workforce, which is essential for fostering innovation and economic advancement. The need for employee upskilling and training is growing as new technologies and industries emerge. |
| Productivity & Efficiency Gains | The productivity and efficiency improvements achieved by AI-enhanced LBD approaches could support ED. By optimizing resource utilization, reducing waste, and streamlining procedures, organizations can increase productivity and profitability that support economic growth and wealth outcomes.   |

|                           |   |
|---------------------------|---|
| Technological Advancement | Using AI-driven learning processes in organizations produces breakthroughs and insights to extend technology and ED. In addition, institutions and organizations may design innovative products, services, and business models.                         |
| Competitive Advantage     | Through the inclusion of AI into LBD processes, economy specialists can acquire a transnational competitive advantage. Organizations will be more reasonable in responding to market challenges and maintaining financial stability in times of crisis. |

V. CONCLUSION, LIMITATIONS, AND FUTURE DIRECTIONS AND CHALLENGES

In conclusion, the present article has investigated the significant impact of Artificial Intelligence in illustrating the economic implications of experiential learning, another name for learning by doing. The overall conclusions have important implications on incorporating AI into experiential learning procedures. Firstly, the impact on future research it will overcome limitations and gaps, encourage multidisciplinary collaboration, and promote advancements in AI-driven methods to learning. Secondly, practice implication can acquire a competitive edge by adopting AI-driven learning by doing. Lastly, the effect on organization policies provides frameworks and rules that address algorithmic bias, data privacy, and transparency in the development of ethical and responsible AI. Although this study provided significant insights into the economic consequences of incorporating AI into LBD, more investigation is necessary in several future areas of study:

1. Longitudinal Studies: The most effective way to assess the long-term impacts of AI-driven learning strategies on productivity, economic growth, and skill development is through longitudinal studies. These studies strengthen the performance and outcomes of institutions or industries that have previously used these technologies.
2. Cross-cultural and Cross-Sector Comparisons: Researching the acceptability and effectiveness of AI-driven learning in real-world settings across business sectors and cultural contexts may produce instructive data. Comparative studies may emphasize opportunities, challenges, and best practices identified in other domains or fields.
3. Development of Ethical AI Frameworks: As the use of AI in learning processes advances, robust governance models and ethical frameworks will be needed to ensure the ethical and trustworthy development of AI. Prospective investigations in this domain may address issues such as, algorithmic bias, accountability, transparency, and data privacy.
4. Integration of Emerging Technologies: Analyzing the possible combinations of AI-

driven learning by doing methods with enhanced mixed reality (MR), augmented reality (AR), and VR systems could open up new concepts for immersive and hands-on learning.

5. **Economic Modeling and Impact Assessment:** By measuring the potential benefits and drawbacks of AI-driven LBD, policymakers and industry stakeholders can acquire valuable understandings from the development of economic models and impact assessments. These models may be ideal for resource allocation strategies and decision-making processes.

Many researchers, practitioners, decision-makers, and policymakers can benefit from AI-driven learning by doing methodologies to drive economic growth, production and service innovation, and competitiveness in the rapidly evolving digital age. By pursuing these future research directions, they can contribute to the ongoing advancement of AI-driven learning to eliminate the gaps and limitations and corporate in economic growth.

#### *A. Addressing Potential Limitations and Gaps in Research*

Embedding artificial intelligence into learning-by-doing processes has a significant positive impact on economic growth; however, there are specific limitations and research gaps in using AI-driven systems in the learning process:

- **Data Quality and Availability:** AI systems depend on the volume and standard of available data for the analysis and training phases. AI-driven learning solutions are inapplicable in some industries or regions due to the lack of data or data quality issues. Therefore, additional studies, reviews, and decisions are needed to address data problems and examine alternative approaches such as transfer learning or artificial data generation.
- **Ethical and Privacy Concerns:** Issues about bias algorithms, data privacy, and AI systems influencing or modifying learning outcomes are the ethical and privacy problems that will face organizations and institutions when applying artificial intelligence in the learning process. Trustworthy AI-driven learning systems require the development of robust governance models, privacy-protecting techniques, and ethical frameworks.
- **Human and AI Collaboration:** Through the improvement of embedding AI into LBD; human instructors, trainers, and experts maintain playing a critical role in learning processes and education. Building robust AI-driven learning systems and encouraging productive human-AI collaboration will require additional research and analysis.
- **Integration Challenges:** Putting AI-driven learning solutions into practice at scale can be difficult and resource-intensive when integrating with pre-existing infrastructure, systems, and practices.

Studies are required for solving compatibility issues, scaling limitations, and developing change management strategies for successful adoption and implementation.

- **Cross-Cultural Considerations:** AI-driven LBD approaches may be successful or accepted differently depending on the cultural and environment. More research is necessary to understand how cultural norms, educational frameworks, and socioeconomic conditions influence the uptake and application of new technology.

#### *B. Challenges and Ethical Considerations in Using AI into LBD*

It is critical to consider the ethical implications of using AI technologies to ensure that the technologies are applied successfully and ethically (Tawfeeq *et al.*, 2023). There are several issues and ethical dilemmas that need attention:

- **Data Privacy and Security:** Using AI-driven learning systems raises several concerns about the essential elements of AI-driven learning systems such as learning datasets, data analysis, and data collection, and how these systems have the possibility to breach data and share it. Therefore, establishing robust data governance frameworks and ensuring compliance with relevant regulations like the General Data Protection Regulation (GDPR) is a crucial procedure for organizations to protect learner's data and maintain trust.
- **Algorithmic Bias:** Biases in the training data sets could be strengthened by using AI systems, leading to inaccurate or biased learning results. Therefore, ensuring fairness and addressing algorithmic bias in AI-driven learning systems is critical to minimize negative impacts and promote opportunities for all learners.
- **Transparency:** AI systems are not easy to understand by individuals with little knowledge of digital and computer literacy and lack transparency, which makes it hard to comprehend the reasoning behind their recommendations or conclusions. For instance, AI systems using deep learning algorithms must deliver transparency and the ability to explain and promote the continuous development of effective human confidence.
- **Human-AI Collaboration:** The rise of several concerns is presented about replacing AI with human instructors or trainers. A successful acceptance and deployment of AI-driven learning systems requires building excellent collaboration among human and AI systems and establishing confidence in these systems to protect the individual from being replaced.
- **Ethical AI Development:** Ethical frameworks and standards must involve the development and implementation of AI-driven learning systems to secure the beneficial use of artificial intelligence technologies. Privacy protection responsibilities

and avoidance of unintended consequences are the core of AI research efforts.

### C. Recommendations to Leverage AI for Economic Growth

To successfully implement AI to promote economic growth through LBD, corporations, instructors, and legislators must work together. The following suggestions are provided:

#### 1. Policymakers:

- Develop frameworks and policies that address concerns like data privacy, algorithmic bias, and transparency to protect ethical behavior using of AI-driven learning systems.
- Fund research and development projects that focuses on AI-driven learning approaches, encouraging cooperation among government, business, and academic institutions.
- Develop laws and other incentives to promote the use of AI-driven learning systems across a range of industries, especially those with significant economic influence.

#### 2. Educators:

- Integrate AI literacy and skills into educational curriculum, enabling students the skills and knowledge they need to effectively apply AI-driven learning tools and approaches.
- Collaborate with industry partners and AI specialists to create cutting-edge AI-driven learning initiatives and chances for students to engage in practical learning.
- Adopt individualized learning paths and AI-driven adaptive learning systems to improve the efficiency and accessibility of education.

#### 3. Entrepreneurs:

- Improve and upgrade the workforce and secure constant learning and adaptation in the context of swiftly evolving market needs.
- Encourage staff to participate in AI-driven simulations, virtual environments, and chances for practical training to promote an atmosphere that values LBD.
- Collaborate with academic institutions and AI technology suppliers to create industry specific AI-driven learning software that is suited to their requirements and difficulties.
- Guarantee the ethical application of AI in learning processes. Establishing strong data governance and ethical frameworks that address issues with algorithmic bias, data privacy, and transparency.

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