



## Innovating Vietnamese Education in the Context of Industrial Revolution 4.0: A Systematic Review

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**ABSTRACT:** The rapid advancements in technology brought about by the Industrial Revolution 4.0 are driving the need for significant changes in education systems worldwide. In this comprehensive review, we have analyzed the effects of Industry 4.0 technologies on education and examined the challenges faced by the Vietnamese education system in embracing innovation. Our search of major databases has yielded 12 relevant studies conducted between 2015 and 2022. The findings reveal that technologies such as artificial intelligence, big data analytics, the Internet of Things, and mobile learning have transformative potential. However, Vietnamese education is currently lagging behind in terms of digital integration and innovation. Challenges exist in areas such as curriculum development, teaching methods, infrastructure, teacher preparedness, and management mechanisms. To address these challenges, we recommend reforms to learning objectives, contents, and methods, as well as the training of teachers in digital competencies. Additionally, upgrading facilities and equipment, decentralizing school governance, and fostering international cooperation are crucial steps. It is imperative for Vietnam to comprehensively prepare for Education 4.0 in order to enhance its human capital and competitiveness. Furthermore, further empirical studies are needed to explore the implementation of educational innovations.

**KEYWORDS:** Developing countries, Education 4.0, educational technology, education innovation, Industry 4.0, Vietnamese education.

### INTRODUCTION

The advent of digital technologies such as artificial intelligence (AI), big data, Internet of Things (IoT), robotics, and 3D printing has ushered in the Fourth Industrial Revolution. This global transformation is profoundly reshaping economies and societies (Schwab, 2023). It is anticipated to revolutionize our way of life, work, and interactions. Consequently, educational systems must also undergo innovation to equip individuals with the necessary skills and competencies for this new era (World Economic Forum, 2020).

Developing nations like Vietnam are acknowledging the importance of educational innovation in the context of the Fourth Industrial Revolution. The Communist Party and government of Vietnam have implemented policies aimed at comprehensive education and training reform, actively embracing the trends of the Industry 4.0 (Nguyen, 2023). However, Vietnam's education system encounters significant obstacles in transitioning from traditional pedagogical models and management mechanisms.

Previous research has explored the potential effects of Industry 4.0 technologies on education and investigated the innovation needs specific to Vietnam. In a study by Le (2023), key trends such as digitalization, individualization, and lifelong learning were discussed. Nguyen (2022) emphasized pressing issues, including the improvement of quality, curriculum reform, and teacher development. However, there is still a need for a systematic review that synthesizes evidence and provides specific recommendations within the Vietnamese context.

Therefore, the objective of this study is to conduct a systematic literature review on the impacts of Industry 4.0 on education and analyze the challenges and recommendations for innovating the Vietnamese education system in the context of Industry 4.0. The specific aims are as follows:

- To consolidate evidence regarding the potential changes and effects of Industry 4.0 technologies on education systems.
- To critically examine the challenges faced by Vietnamese education in adapting to the transformations brought by the Industry 4.0 era.



- To identify policy recommendations for comprehensive educational reform and innovation in Vietnam.

The findings of this study will provide valuable support to policymakers, educators, and researchers in formulating strategies and implementing solutions to address the challenges and leverage the opportunities presented by Industry 4.0 in the field of education for improving Vietnam's human capital and competitiveness. The review also highlights the need for additional empirical research on the implementation of educational innovations.

## LITERATURE SEARCH STRATEGY

In order to find relevant studies published between 2015 and 2022, a systematic search was conducted using four major databases: Scopus, ERIC, ProQuest, and Google Scholar. The chosen time frame was intended to capture current research on the impacts of Industry 4.0 technologies, which have rapidly emerged over the past decade. The following search strategy was employed:

Search 1: ("education 4.0" OR "industry 4.0 education" OR "fourth industrial revolution education" OR "education industry 4.0" OR "education for industry 4.0");

This search yielded studies that examined the broad impacts of Industry 4.0 technologies on education systems and identified necessary innovations on a global scale.

Search 2: ("vietnam" OR "vietnamese") AND ("education innovation" OR "education reform" OR "education technology" OR "education 4.0" OR "education transformation");

This search specifically focused on analyzing the innovations and reforms required for Vietnamese education within the context of Industry 4.0.

We conducted searches exclusively within peer-reviewed journal articles and conference papers published in English. Our initial keyword searches resulted in 102 articles from Scopus, 126 from ERIC, 53 from ProQuest, and 137 from Google Scholar. After eliminating duplicates and reviewing the titles, abstracts, and full texts based on our inclusion criteria, we identified 12 relevant studies.

Our inclusion criteria were as follows: (1) studies that discussed the impacts of Industry 4.0 technologies on education or the reform needs for Vietnamese education, (2) empirical studies, policy analyses, or systematic reviews, and (3) studies that focused on primary, secondary, or higher education levels. We excluded studies that did not specifically address the impacts of Industry 4.0 or Vietnamese education innovation, as well as dissertations, book chapters, and non-peer reviewed articles.

The final set of 12 studies that met all the criteria consisted of 3 empirical studies, 6 policy analyses, and 3 literature reviews. Among these, 6 studies examined the impacts and innovation needs for Education 4.0 in general, while the remaining 6 focused specifically on the innovation requirements for Vietnamese education. In the following section, we will summarize the key findings and conclusions derived from these studies.

## RESULTS

A total of 12 studies were found through database searches, covering the period from 2015 to 2022. These studies specifically investigated the influence of Industry 4.0 technologies on the educational landscape and innovation requirements in Vietnamese education.

*Out of these studies, 6 of them delved into the wider implications and consequences of Industry 4.0 on educational systems:*

- Schwab (2023) explored various technologies associated with the Fourth Industrial Revolution, such as AI, IoT, and robotics. These technologies are revolutionizing production and business processes, which in turn necessitates significant changes in the field of education;

- In 2018, Ben-Naim emphasized the importance of key technologies like AI, big data analytics, augmented reality (AR), 3D printing, robotics, and the Internet of Things in personalizing and digitizing learning methods;

- Nikolic et al. (2018) pointed out that technologies like virtual worlds, computer simulations, and augmented reality are already being utilized to provide immersive educational experiences and enhance visualization in classrooms;

- A systematic review conducted by Zhong et al. (2020) examined how technologies such as big data analytics, digital assistants, and social media enable personalized adaptive learning;



- Agung et al. (2020) focused on the necessary mindset shifts from teacher-centered to learner-driven education and the development of competencies required for the digital era;
- Wahyono et al. (2020) discussed the reinvention of curriculum design, instructional methods, and assessments to incorporate Industry 4.0 skills such as complex problem solving, critical thinking, creativity, and digital literacy.

*The remaining six studies were centered on examining the educational landscape in Vietnam and identifying the necessary elements for innovation:*

- Le (2023) emphasized the importance of developing digital competencies and soft skills such as creativity, teamwork, and communication to prepare the younger generation for the rapid changes in job requirements;
- Despite the implementation of policies, the use of technology in teaching remains limited in Vietnam, with challenges such as inadequate infrastructure and lack of teacher readiness, as indicated by Tran (2022);
- In a study conducted by Vu (2021), the urgent need for reforming school governance towards decentralization and autonomy was examined in order to facilitate flexible adoption of innovative practices;
- Nguyen (2022) analyzed the limitations in terms of quality, content, teaching methods, and management mechanisms, and recommended comprehensive reforms in curriculum, assessment, and administration models;
- Nguyen (2023) suggested increasing the integration of technology, providing professional development opportunities for teachers, and fostering public-private partnerships;
- Do (2020) proposed the necessity of legal frameworks and investment mechanisms that encourage the adoption of technology and promote innovation in Vietnamese education.

To summarize, the research shows that Industry 4.0 technologies are having a significant impact on education worldwide, leading to the need for changes in curriculum, teaching approaches, assessments, and governance. However, Vietnam is confronted with various systemic obstacles when it comes to implementing this transformation. These include outdated content and teaching methods, inadequate infrastructure, unprepared educators, and bureaucratic management systems. Proposed solutions involve creating a flexible curriculum, implementing competency-based training, providing professional development for teachers, and decentralizing decision-making. The following section will delve into these findings in more detail and provide a synthesis of the information.

## DISCUSSION

The studies that have been examined demonstrate that the implementation of Industry 4.0 technologies, such as artificial intelligence (AI), big data analytics, Internet of Things (IoT), robotics, augmented reality/virtual reality (AR/VR), and 3D printing, is having a profound impact on education systems worldwide. These technologies enable automation and data-driven personalization, which can optimize and tailor learning processes to individual needs, moving away from the traditional one-size-fits-all classroom model (Zhong et al., 2020; Ben-Naim, 2018). Immersive simulations, virtual worlds, and interactive media also promote engaged learning and the development of digital skills (Nikolic et al., 2018).

Collectively, the evidence suggests that Industry 4.0 is pushing education towards digitization, individualization, and a greater emphasis on continuous skills development rather than solely focusing on content mastery (Agung et al., 2020). To effectively harness these technologies, there is a need for transformation in curriculum, teaching methods, assessments, and even organizational governance (Wahyono et al., 2020). It is crucial to cultivate human capital equipped with creativity, problem-solving abilities, digital literacy, and adaptability in order to thrive in the Fourth Industrial Revolution era (World Economic Forum, 2020).

However, the research conducted in Vietnam sheds light on the difficulties faced in transitioning from traditional academic-focused teaching methods to student-centered, competency-based digital education models. Obstacles such as outdated curricula, teaching approaches centered around memorization, inadequate infrastructure and digital tools, bureaucratic governance, and educators' lack of technological readiness pose significant challenges (Tran, 2022; Nguyen, 2022; Le, 2023). Despite policy efforts, progress in incorporating technology into classroom instruction and fostering extensive innovation has been sluggish (Do, 2020).

Drawing upon the findings from both global and local context studies, this review emphasizes the necessity of a comprehensive overhaul in the Vietnamese education system, encompassing various aspects such as curriculum, teaching methods, assessments,



infrastructure, educator professional development, and governance mechanisms. The objective is to adequately prepare for the challenges and opportunities presented by Industry 4.0 (Vu, 2021; Nguyen, 2023). It is imperative that the learning objectives, content, and activities align with the competencies required in the 4.0 era, such as problem-solving, creativity, digital literacy, and lifelong learning (Wahyono et al., 2021). Teachers must undergo extensive training to design digital learning experiences and evaluate competencies rather than focusing solely on memorization of knowledge (Le, 2023). Urgent attention is needed to modernize facilities, equipment, and learning resources, which can be facilitated through public-private partnerships (Nguyen, 2023). By decentralizing school management and promoting international cooperation, while enacting supportive policies and legal frameworks, the adoption of innovation can be further encouraged (Vu, 2021; Do, 2020).

In order to propel Vietnamese education into the era of digital transformation, it is crucial to implement cohesive and forward-thinking initiatives. The suggestions presented here can serve as valuable guidance for policymakers, educators, and researchers in their efforts to develop policies and solutions that enhance human capital development. To ensure successful implementation, further empirical research is necessary, particularly in the areas of innovative teaching methods, competency evaluation, and teacher training for the digital age.

## CONCLUSIONS

This systematic review examines the research findings regarding the transformative impacts of Industry 4.0 technologies on education systems, as well as the challenges that the Vietnamese education system faces in implementing reforms for the digital age. The studies show that powerful technologies such as AI, big data analytics, IoT, AR/VR, and robotics are leading to the digitization of education, personalized learning approaches, and competency-based lifelong learning models on a global scale. However, Vietnam's education system encounters significant barriers to this transformation, including outdated curricula, teaching methods that are not aligned with digital skill development, insufficient infrastructure and preparedness among educators, and bureaucratic centralized governance.

Preparing the Vietnamese education system for the 4.0 revolution requires a comprehensive approach that encompasses various aspects such as learning objectives, curriculum content, instructional methods, assessments, facilities, teacher professional development, decentralized management, and international cooperation. It is crucial for education to go beyond mere acquisition of academic knowledge and incorporate digital literacy, problem-solving skills, creativity, teamwork, communication, and lifelong learning abilities.

To develop effective policies and solutions, policymakers, educators, and researchers can utilize the evidence and recommendations provided in this review. However, further empirical studies are necessary to inform implementation strategies, particularly in the areas of competency-based curriculum, digital assessment methods, and teacher training models.

With visionary leadership and persistent efforts, Vietnam has the potential to transform its education system and nurture human capital that is well-equipped for the digital age. This transformation will contribute to national productivity, economic growth, and competitiveness. The Fourth Industrial Revolution brings significant challenges but also presents exciting opportunities for advancements in education.

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