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# Incorporating Artificial Intelligence (AI) in Vocational Education among Secondary School Students

Simran Nathoo[a]*, Mohan Galgotra[b]

## ABSTRACT

Artificial Intelligence (AI) is rapidly changing the educational landscape, especially in vocational learning settings that prioritize employability and skill development. This paper explores the integration of AI technologies in vocational education as a means to enhance learning outcomes, personalize instruction, and align training with evolving industry demands. AI enables competency-based education and ongoing skill development essential elements of lifetime learning by enabling real-time feedback, performance monitoring, and predictive evaluation. Additionally, by recognizing new skill gaps and adjusting curricula accordingly, the use of AI in vocational contexts strengthens ties between industry and training institutions. Experiential learning possibilities are made possible by AI-enabled simulations and virtual environments, which let students practice difficult tasks in secure and regulated conditions. This is especially helpful in fields where practical training is crucial yet resource-intensive. Nonetheless, issues including the digital divide, worries about data privacy, a lack of infrastructure, and the requirement for teacher preparation are severely examined. All things considered, incorporating AI into vocational learning settings has great potential to reinvent skill development programs, promote lifelong learning, and help communities adjust to the demands of a socioeconomic environment that is changing quickly. This study specifically focuses on fostering the vocational education among secondary school students so that they can get the hands on training while receiving formal education in the school. Although there persists some challenges that can be addressed by providing sufficient resources to the institutions and individuals.

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***Corresponding Author:**

[a]*Research Scholar,*
*Department of Educational Studies,*
*Central University of Jammu*
*email: simrannathoo.123@gmail.com*

[b]*Assistant Professor,*
*Department of Educational Studies,*
*Central University of Jammu*

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## INTRODUCTION

Education is changing as a result of artificial intelligence (AI). AI mimics human cognitive processes and is defined as the capacity of machines to learn and make judgments using algorithms. AI is a subfield of computer science used in educational settings that can carry out activities that are often associated with human intelligence, including as learning, reasoning, and decision-making. Conversely, educational environments comprise the technological, social, and physical settings where learning takes place. These settings have an impact on kids' learning through components including infrastructure and instruction. resources, as well as community involvement. In the age of AI, the relationship between societal ideals and contextual adaptation is especially important since educational settings now need to incorporate intelligent technologies to improve accessibility, customization, and the whole educational process. Constructivism and connectivism are two important theoretical stances from which to examine the function of AI in education. According to constructivism, learning is an active process in which students develop their knowledge via contact with their surroundings and teamwork. This viewpoint is supported by AI, which provides interactive and adaptable environments that encourage experience and independent learning. In a similar vein, connectivism stresses that information is dispersed throughout networks and that learning happens by navigating these links. In these networks, AI plays a crucial role by simplifying access to a variety of information sources and encouraging cooperation. When taken as a whole, these frameworks demonstrate how AI might improve knowledge production and connectedness in learning settings (Garzón et al., 2025).

Although AI holds transformative potential, its integration into education presents challenges, including the need to adapt to pedagogical models, develop new student competencies, overcome teacher resistance, and address ethical, social, and technical concerns. AI can profoundly reshape education by reconfiguring teaching methods, learning processes, and teacher professional development. Therefore, preparing learners and educators to thrive in an increasingly automated world remains an urgent priority (Garzón et al., 2025).

### Applications of AI in Education

There are some applications of AI in education.

- **Personalized learning:** AI systems can be used to modify the speed and content of education to each student's unique demands; this might help pupils learn more efficiently by making sure they are always moving at a fast rate without becoming overwhelmed.
- **Real-time Feedback:** Students can receive real-time feedback on their work from AI systems. This can improve learning outcomes by assisting students in recognizing and fixing their errors early on. After just a few months of operation, the AI chatbot there are almost 100 million active users of ChatGPT.
- **Automated tasks:** AI can be used to automate processes like lesson planning and paper grading that are normally completed by instructors. Teachers' time can be freed up in this way. They may concentrate on more crucial duties, including giving each pupil particular attention.
- **Platforms for Adaptive Learning:** AI is used by platforms to tailor each student's educational experience. These platforms monitor students' progress and modify the level of difficulty according to the demands of each individual learner. There are several adaptive learning organizations such as Dreambox learning, Khan Academy, Knewton, Pearson, etc.
- **Virtual instructors:** Students receive one-on-one instruction from virtual tutors using artificial intelligence. These tutors can respond to inquiries from students, offer comments on work, and assist students in picking up new ideas.

## SECONDARY SCHOOL STUDENTS

Students who are typically between the ages of 11 and 18 are engaged in secondary education that comes after elementary schooling but before higher education. This educational phase is essential for students' academic skill development and for getting them ready for further education or vocational training.

Lower secondary (typically for years 11–14) and upper secondary (generally for ages 15–18) are the

two main stages of secondary education, each of which focuses on a distinct area of study and skill development. Depending on the school system, the curriculum may contain topics like science, math, languages, and social sciences (Manot, 2026).

National Education Policy 2020 (NEP 2020) lays special emphasis on integrating vocational education in secondary school education. For this purpose, a thorough framework for vocational education in secondary schools has been developed under the NEP 2020. Students in grades 9-12$^{th}$ can enroll in vocational courses under the Samagra Shiksha plan. At the secondary level,vocational modules are provided as extra subjectsand at the senior secondary level these courses are required as electives. Vocational education programme seeks to increase the employability of students and their entrepreneurial skills, expose them to the workplace, and raise knowledge of other carrer options. NEP 2020 also emphasizes the integration of vocational education with general education, ensuring that students acquire skills that are relevant to the industry and improve the quality of their education (Ministry of Education, 2022).

This paper specifically lays emphasis on integrating Artificial intelligence (AI) in vocational education among secondary school students due to growing concern of student lacking vocational skills.

## VOCATIONAL EDUCATION AND TRAINING (VET)

A paradigm change in education is being sparked by the quick and widespread development of artificial intelligence (AI), which is drastically changing how learning is planned, executed and experienced (Kyambade et al., 2025). Once a far-off possibility, artificial intelligence (AI) is today a reality, firmly ingrained in institutional procedures and methods of instruction (Wang, 2024; Kamalov et al., 2023). Established educational frameworks must be reexamined as a result of this integration, from curriculum design and instructional strategies to the changing responsibilities of teachers and students (Chen et al., 2020; Ahmad et al., 2021).

AI's primary goal in education is to improve efficacy and efficiency (Ahmad et al., 2024). In terms of education, adaptable platforms and intelligent tutoring systems allow for individualized material delivery and pace, catering to each student's particular needs. This strategy has demonstrated significant promise to enhance academic performance and student engagement (Chen et al.2020; Hamal et al. 2022). AI also reduces administrative responsibilities for teachers by automating processes like performance tracking, formative feedback, and grading (Ahmad et al., 2024; Alqahtani et al., 2023). AI's importance in education goes much beyond improving instruction. While career counseling and well-being support systems offer extra value, AI-based predictive analytics can detect at-risk students early (Alqahtani et al., 2023; Crompton & Burke, 2023). According to Kamalov et al., (2023) and Lin et al., (2023), its scalability promises to democratize access to high-quality education by removing financial and geographic constraints helping underprivileged people get inclusive education. This shift affects not just higher education but also vocational education and training (VET), where AI helps create practical skills and theoretical knowledge for a workforce prepared for the future (Wang, 2024; Crompton & Burke, 2023; Gao & Tan 2025)

Vocational Education and Training (VET) is becoming more and more practical, individualized, industry-relevant, and efficient thanks to artificial intelligence (AI). For homework, study, or tests, we can utilize this concise and organized explanation:

- **Customized and Flexible Education:** AI makes it possible for learning paths to be tailored to each student's skills, interests, and speed. Adaptive platforms automatically modify the degree of difficulty. Students are given personalized material and practice tasks that provides help to both advanced and slow learners.

  **Outcome:** Enhanced comprehension and proficiency

- **Intelligent Tutoring Programs:** AI-driven tutoring programs function similarly to online teachers. Give prompt response and clarifications. Respond to student inquiries immediately. Provide detailed instructions on technical subjects.

  **Outcome:** Ongoing educational assistance outside school hours

- **Training Skills via Simulation:** When AI is used in conjunction with virtual worlds and simulations,

students may safely practice practical skills used in industries including IT, engineering, automotive, and healthcare. Students can practice difficult activities without taking any risks in the actual world.

**Outcome:** Enhanced confidence and practical competence.

- **Automated Evaluation and Commenting:** AI facilitates fast and accurate student performance evaluation. Test and assignment grading that is automated and gives instantaneous feedback on useful activities and monitors development and finds areas for improvement.

  **Outcome:** Quicker evaluation and focused enhancement.

- **Making Decisions Based on Data:** AI evaluates student data to enhance instruction and training, identifies pupils' areas of weakness, aids educators in changing their pedagogical approaches, predicts dropout risks and student achievement.

  **Outcome:** Enhanced learning outcomes and better planning.

- **Development of Industry-Relevant Skills:** Vocational training is aligned with the demands of the business. Thanks to AI for making recommendations for in-demand talents using labor market data. Curriculum is updated in light of emerging technologies and that encourages competency-based learning.

  **Outcome:** Learners are more employable.

- **Efficiency and Support for Teachers:** AI improves instructors' roles and lessens their workload, automates administrative processes (such as attendance and grading). It offers content and suggestions for instruction, aids educators in concentrating on mentorship and direction.

  **Outcome:** A more successful teaching-learning process.

- **Accessible and Inclusive Education:** AI supports varied learners, which advances educational equity. Tools for text-to-speech and speech-to-text, multilingual assistance technology that helps students with impairments.

  **Outcome:** Universal access to vocational training.

- **Job matching and career counseling:** AI technologies assist students in making well-informed career decisions. Make career recommendations based on their interests and abilities. Connect students with employment possibilities and assist in building up of résumé and interview preparation.

  **Outcome:** Easy transfer from training to job.

Vocational education is changing as a result of AI, becoming more learner-centered, skill-oriented, and industry-driven. However, ethical usage, appropriate infrastructure, and a balanced integration with human instruction are necessary for its success.

### Tools available for Vocational Education

The enhancement of VET education is the goal of a number of apps that may be utilized in or outside of VET classes, during practice sessions, or throughout the overall teaching process. Applications for virtual and augmented reality, machine learning platforms, the internet of things in vocational training, gamification, interactive learning tools, robots and automations, big data analytics, blockchain, 3D printing, and more are a few examples of these technologies. Virtual reality (VR) is a useful technology in vocational education that helps students understand difficult ideas by simulating difficult activities in a secure setting. According to research, VR simulation makes it easier to create individualized learning experiences that meet each student's specific needs and offer flexible learning options. Algorithms created for this aim examine how students behave and modify the pace at which learning materials are delivered to meet each student's needs. Additionally, AI-powered teaching programs provide quick feedback, identifying students' areas of strength and weakness and then assisting them in mastering the material. By customizing their content and degree of difficulty to each student's unique needs, these AI-powered systems can eventually encourage more effective and efficient learning. A comprehensive list of AI tools utilized in VET is included in Table 1.

**Table 1** AI Tools and Their Applications in VET

| AI Tool | Application in VE | Key Benefits |
|---|---|---|
| Virtual Reality (VR) | Provides safe, engaging skill training by simulating real-world situations. | Improves understanding of difficult problems and offers practical experience. |
| Augmented Reality (AR) | Enhances practical training by superimposing digital material over the real environment. | Decreases training mistakes and increases engagement. |
| Machine Learning (ML) | Provides customized learning routes by analyzing student behavior. | Maximizes skill growth and customizes learning. |
| Intelligent Tutoring Systems | Provides personalized information and real-time, AI-driven feedback. | Helps students reach mastery by pointing out their strengths and shortcomings. |
| Internet of Things (IoT) | Connects equipment (such as engine diagnostics) to track data in real time while training. | Connects theoretical understanding with real-world application. |
| Gamification | Incorporates gaming components into instruction to inspire and involve pupils. | Lowers learning anxiety and boosts involvement. |
| Big Data Analytics | Evaluates educational data to improve curricula and track student progress. | Makes it possible for education to make data-driven decisions. |
| 3D Printing | Gives mechanical and industrial training students practical design and manufacturing experience. | Encourages the growth of practical skills and creativity |

Additionally, machine learning algorithms are very helpful in professional settings since they let pupils improve their abilities by analyzing behavioral patterns, which increases their level of knowledge. Connecting theoretical knowledge to real-world applications is another important function of integrating Internet of Things (IoT) devices into vocational training. IoT sensors, for instance, may monitor engine performance during automobile repair instruction, allowing students to identify issues and apply fixes in a safe environment. These real-world, hands-on experiences are essential for giving students the skills they need to meet the expectations of contemporary businesses.

By using game design features to engage and inspire students, gamification approaches further enhance the learning process. Students' engagement and excitement are significantly increased when gamified tactics are combined with interactive technologies. Research has shown that gamification greatly increases motivation and active learning, especially in online courses, which raises student engagement and lowers anxiety. By incorporating game-like scenarios into the curriculum, students may work together with their classmates, overcome obstacles, and get rewards, creating a friendly yet competitive learning environment.

Additionally, facilities like Robotics Laboratories and Automation courses give students

extensive chances to develop fundamental knowledge and carry out sophisticated experiments at different phases of their study. As a result, the use of robotics and automation has the potential to revolutionize teaching strategies and drastically change the way that learning takes place. A data-driven learning environment has an influence on teaching and assessment in addition to pedagogy, offering a framework for continuous observation and assessment.

The development of virtual learning environments, which are defined by ongoing data collecting and algorithmic evaluations, has made it possible to apply data analytics in a variety of educational scenarios. Desired learning objectives, material production, and assessment techniques have all been impacted by this change, which has resulted in a transfer of decision-making power away from educators and a reduction in the responsibilities of parents and students in this process.

With potential uses in design, production, and materials processing, the use of 3D printing and additive manufacturing in vocational education is a growing topic of study (Keaveney & Dowling, 2018). By providing a hands-on approach to design and production, this technology can improve learning experiences, especially in mechanical engineering. Its entire potential hasn't been realized yet, hence more investigation into its use in educational media is required (Ramdhani & Mulyanti, 2020). 3D printing is currently being used in a variety of educational settings, from creating assistive technology to teaching students about 3D printing procedures. However, the use of 3D printing in vocational education is still relatively new, highlighting the need for more research to fully comprehend its consequences and possibilities (Ghosh & Ravichandran, 2024; Çela et al., 2024).

## Challenges in Vocational Education

There are various challenges in vocational education. Some of them are as under:

### *Infrastructure and Quality Issues*

Kichu (2021) used descriptive surveys using questionnaires and interviews to investigate technical and vocational education using NAAC indicators. According to Hong et al.(2021),poor enrollment at community colleges was caused by out-of-date courses and weak industry links. These results were consistent with more general patterns: obsolete facilities, inadequate finance, and a lack of educational resources are common problems for vocational schools. Significant deficiencies in infrastructure, academic resources, teaching-learning materials, curricular relevance, and a teacher shortage were identified by the investigation. Inadequate money, inadequate training materials, and poor workshop organization were identified the main obstacles to implementation. A large proportion of +2-level students said that there weren't enough laboratories for the number of students enrolled. TVET departments in higher education frequently lacked effective facilities, well-equipped labs, and workshops.

### *Perceptions, Equity, and Institutional Dynamics*

According to Ete and Hangsing (2025), there is a misperception that vocational education is mostly for students who struggle academically, and students choose general education over vocational education owing to a lack of awareness about vocational courses. The survey also showed that the public believes that pursuing vocational education is a waste of time, money, and effort. The many obstacles and potential of NEP (2020) with reference to the implementation of vocational education were highlighted by Sharma et al. (2024). Students' progress is painfully sluggish and static. A part from this, Muslim female students, particularly those from madrasas, experienced structural marginalization, low literacy, and restricted access to vocational education. These problems such as poor curricular relevance, insufficient institutional

industry links, and gender or community-based disparities reflect systemic injustices and demand-supply misalignments within vocational education systems. According to Pilz et al. (2016), academic education was highly prized in India and most of Asia, making vocational training a "second choice" for students who were not suitable for regular academic disciplines. Sharma and Nagendra (2016) noted barriers that includes inadequate infrastructure, sluggish bank loan disbursement that impedes entrepreneurship, a lack of qualified trainers, and poor industry-faculty cooperation. According to analysis of TVET programs in Nigeria, the curriculum placed an excessive amount of emphasis on theoretical material and little on practice-based or soft-skill training, such as problem-solving or decision-making. According to Agrawal (2012), there is a significant mismatch between the demands of the labor market and institutional vocational curriculum.

### *Social and Regional Barriers*

Choezin (2022) looked into Tibetan adolescents in India and found that low public awareness and misunderstandings regarding vocational jobs were the main causes of falling enrollment in vocational courses. Course closures were a result of ineffective regional supervision and promotion. In order to increase awareness and spark interest, the researchers recommended focused outreach, such as social media campaigns. This exemplifies the more general problem of socioeconomic and regional differences in vocational education uptake and availability.

### *Innovation and Career*

According to different studies it was found that men students who were interested in home or domestic careers scored worse on creative tests than their female counterparts. On the other hand, male students were more creative than female students when it came to occupational interests relating to building.

### *Employability and Economic Impact*

Chamadia and Mubarik (2021) assessed the efficacy of a technical and vocational training program using a quasi-experimental approach. The study showed that taking the vocational course greatly increased the trainees' monthly income. Neroorkar & Gopinath (2020) examined employment among graduates of vocational training programs using a sequential explanatory mixed-method approach. According to the study, many trainees took on several temporary jobs after finishing their courses in order to fill the time before they were hired in their sector. As a result, they had poorer employability scores throughout that time (Meto et al., 2025).

## CONCLUSION

In order to conclude the study author comes to the conclusion that by Integrating Artificial Intelligence in Vocational Education among secondary school students presents numerous opportunities. AI enabled technologies promotes Personalized learning among students gives real-time feedback, promotes automated tasks, provides platforms for adaptive learning and gives virtual instructions. It can contribute in developing a skilled, adaptable and employment ready generation of learners. This study focused on integrating vocational education specifically among secondary school students so that they can get the hands on training while receiving formal education in the school. Although there persists some challenges such as Infrastructure and Quality Issues, social and regional barriers and many more that can be addressed by providing sufficient resources to the institutions and individuals.

**Declarations**

**Conflict of interest:** The authors declare that there is no conflict of interest.

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