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AI-Enhanced Learning in Diploma Engineering: A Paradigm Shift Toward Student-Centric and Industry-Ready Education

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Abstract

Diploma engineering education is undergoing a paradigm shift, driven by integrating AI-powered technologies. This research paper explores the transformative impact of AI-driven best educational practices on diploma engineering programs, specifically focusing on their implementation at Thiagarajar Polytechnic College. The study delves into innovative initiatives such as Student Centric Learning (SCL), Learning Management Systems (LMS), Lecture Capturing System (LCS) and industry-oriented programs that have significantly enhanced the teaching and learning process. This paper highlights the positive outcomes of these practices, including improved academic performance, higher employability rates, and the development of essential skills employers seek. Key strategies discussed include the use of Blackboard LMS for efficient content delivery and assessment, the implementation of HireMee for enhancing employability, and the integration of Moodle for interactive online learning. Additionally, the research explores the role of student facilitators in promoting peer learning and the significance of life and employability skills courses in preparing students for the workforce. By examining these innovative approaches, this paper aims to provide valuable insights for educational institutions seeking to leverage AI to improve student outcome based education and meet the demands of the modern workforce.

Keywords: *AI-Driven Education, Best Practices, Student Centric Learning, Employability.*

1. Introduction

Diploma engineering programs occupy a crucial intersection where theoretical knowledge and practical skills converge in the rapidly evolving landscape of technical education. These programs are vital for developing industry-ready professionals capable of bridging the gap between abstract concepts and real-world applications. As

we progress further into the digital age, the integration of cutting-edge technologies and innovative pedagogical approaches has become imperative to ensure the effectiveness and relevance of diploma engineering education.

At the forefront of embracing and implementing educational best practices is Thiagarajar Polytechnic College, a pioneer in this field. This study examines the transformative impact of AI-driven instructional strategies at the institution, focusing on how these practices align with the principles of Education 5.0 and the United Nations' Sustainable Development Goals (SDGs). Education 5.0 represents a paradigm shift in educational philosophy, emphasizing a more holistic, technologically advanced, and student-centric approach to learning. It builds upon previous educational models by incorporating elements such as personalized learning, AI-assisted training, and a strong emphasis on developing 21st-century skills. Simultaneously, the integration of SDGs into the curriculum demonstrates a commitment to producing graduates who possess not only technical expertise but also social responsibility and environmental awareness.

AI-driven technologies have the potential to revolutionize diploma engineering education by offering adaptive assessments, intelligent tutoring systems, personalized learning experiences, and data-driven insights for continuous improvement. This research aims to illuminate the future trajectory of technical education, with a focus on Education 5.0 principles, AI-driven practices, and SDG integration in diploma engineering programs. The findings presented herein will not only highlight innovative approaches but also provide a roadmap for other educational institutions to enhance their programs in the context of artificial intelligence and global sustainability.

2.Background

2.1 An overview of Diploma Engineering Education in India

The Diploma engineering programs in India provide technical education at a level between secondary school and a bachelor's degree. These 3-year programs are offered by polytechnic institutions and aim to produce skilled technicians and supervisors for various industries. According to a 2019 survey by the All India Council for Technical Education (AICTE), there were over 3,500 diploma-granting institutions across India with a total intake capacity of approximately 1.5 million students per year.

The survey found that mechanical, civil, and electrical engineering were the most popular diploma streams, accounting for about 60% of total enrollments. Interestingly, the study noted a growing trend in emerging fields like computer science and electronics, with these disciplines seeing a 15% year-over-year increase in admissions. Gender diversity in diploma engineering has been improving, with female enrollment rising from 21% in 2010 to 28% in 2019.Regarding employment outcomes, the survey reported that about 65% of diploma holders found relevant employment within six months of graduation, while 20% chose to pursue further education. The average starting salary for diploma engineers was reported to be around INR 15,000-20,000 per month, varying by specialization and location.

2.2. The Role of AI in Diploma Education

In the realm of diploma education, AI offers significant potential to enhance learning experiences, improve teaching methods, and streamline administrative tasks.

Personalized Learning: AI-powered adaptive learning platforms can tailor educational content to individual students' needs and learning styles. By analyzing student data, these platforms can identify knowledge gaps, provide targeted feedback, and recommend personalized learning paths. Intelligent Tutoring Systems: AI-driven tutoring systems can offer students one-on-one guidance, answering questions, providing explanations, and offering practice exercises. These systems can adapt to students' learning pace and provide timely support.

Automated Grading and Assessment: AI can automate the process of grading assignments, quizzes, and exams, freeing up instructors' time for more meaningful interactions with students. AI algorithms can also provide valuable insights into student performance, identifying areas where additional support may be needed.

Intelligent Content Creation: AI can assist in creating educational content, such as generating quizzes, practice problems, and even entire

courses. This can help reduce the workload of instructors and ensure a consistent quality of materials. Administrative Efficiency: AI can streamline administrative tasks, such as student enrollment, scheduling, and attendance tracking. This can improve efficiency and reduce the administrative burden on educational institutions. Virtual Labs and Simulations: AI-powered virtual labs and simulations can provide students with hands-on learning experiences without the need for physical equipment. This can be particularly beneficial for subjects that require expensive or specialized equipment.

- Improved Learning Outcomes: Personalized learning and intelligent tutoring systems can help students achieve better academic results.
- Enhanced Student Engagement: AI-powered tools can make learning more interactive and engaging, leading to increased student motivation.
- Increased Efficiency: AI can automate tasks, saving time for both students and instructors.
- Accessibility: AI can make education more accessible to students with disabilities by providing personalized support and accommodations.

2.3. Brief History and Mission of Thiagarajar Polytechnic College

Thiagarajar Polytechnic College (TPT), fondly called the root of the Sona Group of Institutions, boasts a rich history spanning over 65 years. Established in 1958 by philanthropist Sri. Karumuttu Thiagarajar Chettiar.

2.3.1. A Momentous Journey:

- Established in 1958 to address the dearth of skilled technical manpower in post-independent India.
- Inaugurated by Sri. R. Venkataraman, the then Minister for Industries, Govt. of Madras, with three diploma programs.
- Celebrated its Golden Jubilee in 2009 with former President of India, Dr. A.P.J. Abdul Kalam, as the Chief Guest.
- A pioneer in women's empowerment, TPT was the first institution in South India to admit girl students in Technical Education during International Women's Year (1976).

2.3.2. Mission:

TPT's mission is multifaceted, aiming to:

- Develop World-Class Technocrats: Offer diploma and skill development programs to equip students with strong ethical values and transform them into innovative leaders, entrepreneurs, and world-class technocrats.
- Incomparable Learning Opportunities: Provide students with cutting-edge learning experiences. This includes incorporating best practices, state-of-the-art infrastructure, and a focus on online learning to cater to the dynamic technological landscape.
- Faculty Development: Encourage faculty and staff to continuously update their knowledge and skills through ongoing learning programs.
- Global Collaboration: Strive for partnerships with other academic institutions across the globe to strengthen the educational environment.
- Industry-Academia Linkages: Collaborate with leading industries to promote research and innovation by establishing strong industry-institute interaction.
- Continuing Education: Offer continuing education courses through online and offline modes to benefit the community and promote focus on sustainable technologies for the environment.

2.3.3. Best Educational Practices:

While the specific practices may not be explicitly listed on their website, TPT's numerous awards and achievements hint at their commitment to innovative education. These likely include:

- Personalized Learning: Tailoring education to individual student needs.
- Project-Based Learning: Encouraging students to apply knowledge through real-world project work.
- Industry Exposure: Providing internships and industry visits to bridge the gap between theory and practice.
- Technology Integration: Incorporating technology tools and platforms to enhance learning.

- ❖ Focus on Communication Skills: Equipping students with strong communication and collaboration skills.

Department	NBA Accrediation
Civil Engineering	2014,2012,2018
Mechanical Engineering	2014,2012,2018
Electrical and Electronics Engineering	2014,2012,2018
Textile Technology	2014,2012,2018
Production Engineering	2014,2012,2018

Table-1: NBA for the 5 diploma programmes

3.Methodology

Research Design: The impact of Artificial Intelligence (AI) on learning and teaching practices at Thiagarajar Polytechnic College (TPT) in Salem, India.

Types of AI Technologies: Identify the specific AI tools or platforms employed in various courses or aspects of the learning environment. (e.g., Learning Management Systems, Lecture Caputring System, Black Board,Adaptive Learning Platforms, HireMe and Virtual Labs)

Integration Strategies: Explore how these AI technologies are integrated into the curriculum and teaching methods. (e.g., Blended Learning Models, Personalized Learning Strategies, Peer to Peer, Student Facilitator, Student Centric Learning)

Impact on Learning Outcomes: Analyze the perceived or demonstrable effects of AI on student learning, including academic performance, skill development, and knowledge retention.

Challenges and Opportunities: Assess the challenges faced by faculty and students in using AI tools, alongside potential opportunities for further innovation and improvement.

4.AI-Driven Best Educational Practices at TPT

Thiagarajar Polytechnic College (TPT) has been at the forefront of integrating Artificial Intelligence (AI) into its educational practices. This has led to the implementation of several innovative initiatives that have significantly enhanced the teaching and learning experience.

4.1. Student-Centric Learning (SCL)

Student-Centric Learning (SCL) is a pedagogical approach that places students at the heart of the educational process. It shifts the focus from teacher-centered instruction to a more learner-driven and personalized experience. In the context of AI-driven education, SCL becomes even more powerful, as AI can be used to tailor educational content and experiences to individual students' needs.At TPT College, we prioritize Student-Centric Learning (SCL) in both theoretical and practical classes. Students actively discuss with their peers, collaborate on problem-solving, and often propose multiple correct solutions. This approach not only enhances learning and problem-solving skills but also fosters teamwork and critical thinking.

One notable outcome of SCL implementation has been a significant increase in our placement record. Graduates with a strong technical foundation, cultivated through SCL, are highly sought after by employers. This practice has been implemented for over a decade at TPT, demonstrating its enduring effectiveness.

4.1.1. To further enhance SCL, we have incorporated the following strategies:

- ❖ AI-Powered Adaptive Learning: Personalized learning paths tailored to individual student needs and progress.
- ❖ Interactive Simulations: Hands-on experiences that mimic real-world scenarios for practical application of knowledge.
- ❖ Peer Mentoring Programs: Upper-class students guiding and supporting younger peers.
- ❖ Collaborative Projects: Group-based assignments that encourage teamwork and diverse perspectives.

4.1.2. Key Principles of SCL:

- ❖ Active Learning: Students are actively engaged in their learning, rather than passively receiving information. This might involve problem-solving, discussions, group work, or hands-on activities.
- ❖ Personalized Learning: Education is tailored to each student's unique learning style, pace and interests. AI can play a crucial role in identifying individual needs and providing personalized content and feedback.

- ❖ Collaborative Learning: Students work together to learn from one another and develop teamwork skills. AI can facilitate collaboration by providing tools for group work and communication.
- ❖ Metacognition: Students are encouraged to reflect on their own learning and develop strategies for improving their understanding. AI can provide tools for self-assessment and metacognitive reflection.

4.1.3. How AI Enhances SCL:

- ❖ Adaptive Learning: AI-powered platforms can continuously analyze student data to identify knowledge gaps, adjust learning paths, and provide targeted feedback.
- ❖ Personalized Content: AI can generate personalized content, such as quizzes, practice problems, or explanations, based on a student's individual needs and progress.
- ❖ Intelligent Tutoring Systems: AI-driven tutors can provide one-on-one guidance, answer questions, and offer explanations in a way that is tailored to the student's learning style.
- ❖ Gamification: AI can be used to gamify learning experiences, making them more engaging and motivating for students.

4.1.4. Benefits of SCL in AI-Driven Education:

- ❖ Improved Student Outcomes: SCL can lead to better academic performance, increased student engagement, and higher levels of motivation.
- ❖ Enhanced Critical Thinking Skills: Active learning and problem-solving activities promote critical thinking and problem-solving skills.
- ❖ Personalized Learning Experiences: AI-powered SCL ensures that students receive the support and resources they need to succeed.

4.2. Learning Management Systems (LMS)

4.2.1. Blackboard

TPT is pioneering the implementation of an innovative Learning Management system in India, utilizing Blackboard (LMS). This cutting-edge platform empowers instructors to upload a variety of course materials, such as textual documents, multimedia, and audio-visual aids, allowing students to progress at their own pace. Additionally, this tool streamlines the process of submitting and grading assignments, providing students with an opportunity to expand their knowledge and skills to meet global standards.

4.2.2. HireMee

A placement opportunity at Thiagarajar Polytechic College speaks about the quality education provided to the students. Aptly, to improve the employability eligibility of the students, HIREMEE – Employability Eligibility Test is conducted for the students. It helps the students to elevate their skills to grab lucrative jobs in the placement. Also it helps to scale levels of essential skills that every recruiter seeks in a prospective employee. HireMee also helps in conducting online examinations.

4.2.3. Moodle

Modular Object-Oriented Dynamic Learning Environment (MOODLE), an e-Learning platform has been introduced in our institution which helps teachers to create online courses with a focus on interaction and collaborative construction of content for active participants in community forums. MOODLE has been introduced for first year Mathematics subject and mock Objective Tests by Training and Placement cell.

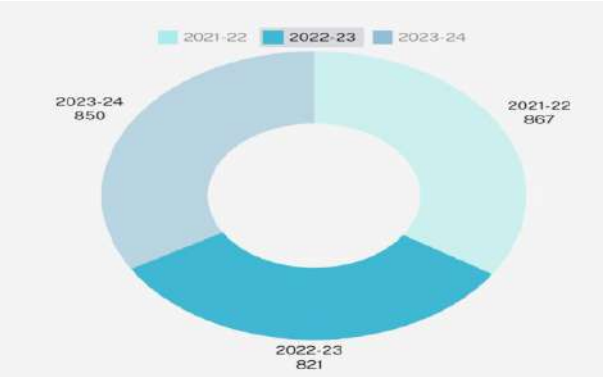

Figure-1:Placement Statistics

4.3. Lecture Capturing System (LCS)

Lecture Capturing System for college that makes it easy for anyone to record, live stream, and share video. TPT wants to enhance the learning process and improve student achievement. Using LCS flexible video platform

that can record lectures, flip classrooms, capture student assignments, and engage faculty, students, communities, alumni, and others. With LCS , every video in an institution's library is automatically searchable, shareable, secure, and accessible anytime and anywhere, on any device – all you need to do is click record.

4.4. Industry-Oriented Programs

The institution offers a variety of industry-oriented programs through its various divisions and partnerships. The Centre for Civil Testing and Consultancy, along with the Center for Structural and Environmental Design Division, provides expertise in civil engineering and construction. The Textile Testing and Consultancy Centre focuses on textile-related testing and consultancy services. The Industry Institute Partnership Cell (IIPC) facilitates collaborations between the institution and industries, fostering practical learning opportunities for students. The Indian Society for Technical Education (ISTE) and the Institution of Engineers (India) - IE(I) provide platforms for professional development and networking.

4.4.1. Continuing Education Centre

The Canada India Institutional Co-operation Project was launched in Thiagarajar Polytechnic College in the year 1993. This project has been mandated by an MOU between the Government of Canada and India.The project was executed by the association of Canadian Community Colleges (ACCC) and overall direction was provided by the Ministry of Human Resource Development Agency , Canada.The Southern operational plan of CIICP is a partnership between selected Canadian and Indian institutions to work together and strengthen the capability of Indian Polytechnics.This project is well under way in three southern states of Kerala, Karnataka and Tamil Nadu. Initially four polytechnic colleges have been selected from each of these states for the implementation of the project and Thiagarajar Polytechnic College, Salem is one among them.The project is managed by the State Project Coordination Unit established under the Directorate of Technical Education, Chennai.

4.4.2. HireMee's Employability Enhancement Program

4.4.2.1 Challenges

HireMee's Employability Enhancement Program addresses the challenges faced by students in securing employment. Students often lack awareness of available opportunities, while employers seek candidates with a diverse and specific skill set. Despite numerous job vacancies, many students find themselves unprepared for the workforce.

4.4.2.2. Employability Enhancement Program Advantages

HireMee's Employability Enhancement Program offers strategically designed learning tracks to equip students with the skills sought by employers. The program provides insights into specific skills valued by various industries, enabling students to tailor their learning to meet market demands. Additionally, students receive timely notifications about relevant job vacancies, ensuring they are well-prepared and informed about career opportunities.

4.4.2.3. HireMee's Employability Enhancement Program

- Features

- Diagnostic Assessment - Scientific tests and the use of a complex algorithm to uncover a student's true potential, further, Identifying the areas needing improvement.
- Learning Tracks -Every opportunity seeks a particular set of skills acquiring which, in turn, calls for a specific learning pathway. We find the right path for you that will take you to your coveted destination.
- Jobinars - Give exposure through sessions conducted by Industry experts.
- Recruitment Calendar - A series of dates giving you a glimpse of various job events conducted by HireMee.
- Programming Practice - Get access to a series of coding sessions which also comes with solutions. You can also brush up on your skills by reading our tutorials and knowing about interview questions asked at companies.
- Digital Profile - A clickable online profile with remarkable features like Aptitude test

scores, IT skill sets acquired, and the learning path adopted.

4.5. Student Facilitators

Student Facilitators for peer learning is an innovative best educational practice that is implemented in our institution since the academic year 2016-17. Students Facilitators are selected with properly framed guidelines in all the disciplines and appointment orders are issued to them. The student facilitators handle classes on the respective courses to their peers in consultation with their respective HoD and faculty in-charges. This helps the students to learn well and promotes peer learning. In order to motivate the students to act as the facilitators, remuneration of Rs.250/- per hour to a maximum of Rs.2500/- per semester is being paid to them. This best practice has instilled confidence among the student facilitators and encourages the other students to take part as student facilitators.This remuneration is really very useful to meet out the expenses for Project Works, paper presentation and the like.

Figure-2: Student Facilitators

4.5.1. Tech Talk

TECH talk is implemented for all the programmes in the Theory class room sessions. During the TECH talk session, all the students are given chance to present technical presentations for about 5 minutes. The students are allowed to deliver their speech in attendance order (one student per day on daily basis). Slow learners and the students who have stage fear are given chances again to improve their communication and technical skills. This practice has removed their stage fear and enhanced communicative ability. Also, marks are awarded for this practice.

4.6. Life and Employability Skills Courses

The Life and Employability Skills courses have been designed and conducted by the external experts from industries / institutions who handle the different areas to enable the students to fetch the best placements. These classes are conducted for 30 hrs with allocation to different areas as follows.

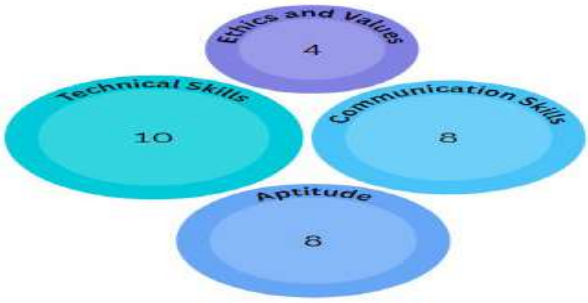

Figure-3: Life and Employability Skills Courses based on Hours

4.7. Speaker's Forum

Speaker's Forum is one of the Best Innovative Educational Practices which provides a platform to the students to share their thoughts and ideas and thereby improve their Communication, Presentation Skills and enhances their Confidence.Through the Speakers' Forum, the students are presenting a talk daily evening on the topic of their interest which helps to enhance the power of delivering their content in a clear and precise manner.

- **Institution's speakers' forum club:** An overview of the Speaker Forum and its impact on our students' communication skills, stage fear, and preparation for placement and interviews. The Speaker Forum is a vital platform within our institution aimed at enhancing students' overall development and readiness for the professional world. Students were able to come out of their comfort zone and actively participate in every day's activities and were able to speak boldly without any stage fear that gradually made them to face their interviews, group discussions, seminars, etc without any anxiety.
- **Communication Skills Enhancement**: The Speaker Forum plays a pivotal role in enhancing students' communication skills. By regularly participating in discussions and presentations, students learn to

articulate their thoughts effectively, improving their verbal and non-verbal communication abilities. They also gain confidence in expressing ideas in front of an audience, which is crucial for their personal and professional growth.

- **Overcoming Stage Fear:** One of the primary objectives of the Speaker Forum is to help students overcome stage fear. Through various speaking opportunities, such as delivering speeches, presenting projects, and participating in debates, students gradually build confidence in public speaking. This not only helps them in academic settings but also prepares them for future endeavors where public speaking skills are essential.
- **Preparation for Placement and Interview Process:** The Speaker Forum plays a significant role in preparing students for the placement and interview process. By participating in mock interviews, panel discussions, and industry talks, students get a glimpse of real-world scenarios and expectations. They learn to articulate their achievements, aspirations, and skills effectively, which is crucial for making a positive impression during interviews.
- **Impact Assessment:** Regular feedback sessions and surveys are conducted to gauge the effectiveness of the Speaker Forum in achieving its objectives. Students' progress in communication skills and stage fear reduction is tracked over time through assessments and observations. Placement records and feedback from recruiters are also analyzed to assess the impact of the Speaker Forum on students' readiness for the professional world.
- **Future Recommendations:** Introduce more interactive sessions and workshops focused on specific aspects of communication skills, such as public speaking, effective writing, and interpersonal communication.Collaborate with industry experts to provide insights into the latest trends and expectations in the job market, helping students better prepare for interviews and placements. Continue to encourage active participation and engagement from students to maximize the benefits of the Speaker Forum.

Figure-4: Speaker's Forum

5. Conclusion

Thiagarajar Polytechnic College's strategic adoption of AI-driven educational practices marks a significant advancement in diploma engineering education. The institution's comprehensive approach has yielded remarkable outcomes across multiple dimensions. The successful integration of Student Centric Learning (SCL) has fundamentally transformed the teaching-learning paradigm. Advanced Learning Management Systems (Blackboard, Moodle) and Lecture Capturing System (LCS) have created a robust digital learning infrastructure. The innovative Student Facilitator program has fostered peer learning and leadership development. Students have benefited from enhanced employability through HireMee's Employability Enhancement Program, improved communication and presentation skills via the Speaker's Forum, and the development of life skills and professional competencies through specialized courses. Tech Talk sessions have increased confidence and technical proficiency. Strong industry-academia partnerships through various centers and consultancy services have provided practical exposure through industry-oriented programs, leading to enhanced placement opportunities. Measurable outcomes include improved academic performance metrics, higher employability rates, increased student engagement and participation, and enhanced industry readiness among graduates. These implementations serve as a model for other technical institutions, demonstrating how AI-

driven practices can be effectively integrated into traditional engineering education. TPT's success story underscores the importance of continuous innovation in educational methodologies, a balanced integration of technology and traditional teaching methods, a focus on holistic student development, and strong industry alignment.

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