An Analysis of Learning Analytics in Smart Education Systems and Industry 5.0 Curriculum Alignment

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Abstract
The growing adoption of smart education systems has resulted in extensive digital records of student learning activities, creating new possibilities for analysing academic progress through learning analytics. These data-driven approaches allow educational institutions to move beyond traditional evaluation methods and gain deeper insights into student performance patterns. This paper examines how learning analytics can be applied to support both the prediction of academic outcomes and the improvement of student performance in digitally enabled learning environments. The analysis is based on educational datasets containing information related to learner demographics, prior academic results, attendance behaviour, and engagement with online learning platforms. Statistical methods are used to explore relationships among learning variables, while predictive techniques based on regression and classification models are employed to estimate academic performance and detect students who may require additional academic support. Model effectiveness is assessed using standard evaluation measures to ensure dependable performance. The outcomes of the analysis demonstrate that learning analytics provides actionable insights into student academic behaviour and enables early identification of performance-related risks. These insights can assist educators in implementing timely, focused, and personalised academic interventions. The study highlights the practical value of integrating learning analytics into smart education systems to strengthen instructional planning and institutional decision-making. By promoting data-informed educational practices, learning analytics contributes to improved academic achievement and supports the ongoing digital transformation of modern education systems.

Keywords: Learning Analytics, Smart Education, Student Performance Prediction, Academic Improvement, Educational Data Analysis

Introduction

The Smart India initiative has played a pivotal role in accelerating digital transformation across various sectors, with education emerging as a key beneficiary of this shift. The growing adoption of smart education systems has led to the widespread use of digital platforms such as Learning Management Systems (LMS), online learning environments, MOOCs, and electronic learning resources. These platforms not only enhance flexibility and accessibility in education but also generate extensive learner-related

data, enabling data-driven approaches to academic management and decision-making (Meeramani et al., 2023; Soni et al., 2025).

The availability of large-scale educational data has facilitated the development of learning analytics as a systematic approach for analysing learner behaviour and performance. Learning analytics focuses on collecting and interpreting data related to students' interactions with digital platforms, including resource usage, participation in learning activities, and assessment performance. Such analyses provide meaningful insights into learner engagement patterns and academic progress, supporting educators in predicting learning outcomes and identifying students who may require academic support (Wong et al., 2025). Consequently, learning analytics enables timely interventions that contribute to improved teaching effectiveness and enhanced student learning experiences in smart education settings.

Despite its potential benefits, the successful implementation of learning analytics depends significantly on the perceptions and acceptance of its primary stakeholders—teachers and students. Educators' awareness of analytics tools, along with their ability to interpret and apply analytical insights, determines the extent to which data-driven strategies are integrated into instructional practices. At the same time, students' confidence in analytics-based systems influences their engagement and willingness to participate in digitally mediated learning processes. Prior research emphasises that positive stakeholder perceptions are critical for the effective and ethical use of learning analytics in educational environments (Valtonen et al., 2025).

Simultaneously, the transition towards Industry 5.0 has introduced new expectations for education systems, emphasising human-centred innovation, advanced digital skills, and adaptive competencies. This shift necessitates a closer alignment between academic curricula and emerging workforce requirements. Integrating learning analytics with employment trend analysis provides an opportunity to assess curriculum relevance and evaluate whether educational programmes equip learners with the skills required for future industry landscapes (Gowda, 2023). In this context, the present study investigates the role of learning analytics in enhancing and predicting academic performance within smart education systems. It examines students' engagement with digital learning platforms, explores the perceptions of students and teachers toward learning analytics, identifies challenges associated with its implementation, and evaluates the alignment of academic curricula with Industry 5.0 skill requirements.

Literature Review

Digital Learning Platforms in Smart Education Systems

The adoption of digital learning platforms has become central to smart education systems in higher education. Learning Management Systems (LMS), virtual classrooms, and e-resources support flexible learning and generate large volumes of learner interaction data. Prior research shows that consistent use of digital platforms enhances student engagement and academic continuity, particularly when integrated with structured instructional support (Kumar et al., 2020). These platforms provide the primary data source for learning analytics applications aimed at monitoring learning behaviours and outcomes.

Learning Analytics for Improving Teaching–Learning Effectiveness

Learning analytics focuses on collecting, analysing, and interpreting educational data to improve teaching and learning processes. Studies highlight that learning analytics supports instructors in identifying learning gaps, monitoring student progress, and making evidence-based pedagogical decisions (Wong et al., 2025). From the student perspective, analytics-driven feedback improves awareness of learning performance and encourages self-regulated learning. However, the effectiveness of learning analytics is influenced by educators' analytical skills and institutional readiness for data-driven practices.

Challenges and Limitations in Learning Analytics Implementation

Despite its potential, several challenges limit the effective implementation of learning analytics. Key concerns include inadequate digital infrastructure, limited technical expertise, and ethical issues related to

data privacy and transparency (Soni et al., 2025). Many institutions rely primarily on descriptive analytics, which restricts the use of advanced predictive models for early intervention. These limitations are more evident in developing education systems, where uneven digital access affects the scalability of analytics solutions.

Curriculum Alignment with Industry 5.0 Requirements

The shift toward Industry 5.0 emphasises human-centric skills, digital competence, and analytical thinking. Learning analytics offers opportunities to evaluate curriculum relevance by linking learning outcomes with skill development indicators. Existing studies suggest that while analytics is widely used for academic performance evaluation, its application in aligning curricula with workforce demand and employment trends remains limited (Wong et al., 2025). This highlights the need for integrated analytics frameworks that connect academic learning with evolving industry expectations.

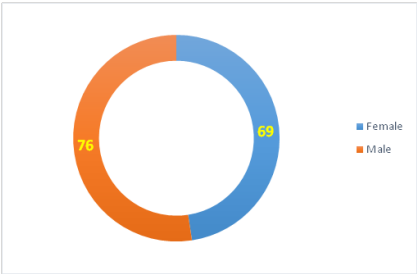
Research Gap

The reviewed literature confirms the role of learning analytics in enhancing academic performance within smart education systems. However, gaps persist in implementation readiness, ethical governance, and curriculum–industry alignment. Addressing these gaps is essential for leveraging learning analytics as a strategic tool for future-oriented education.

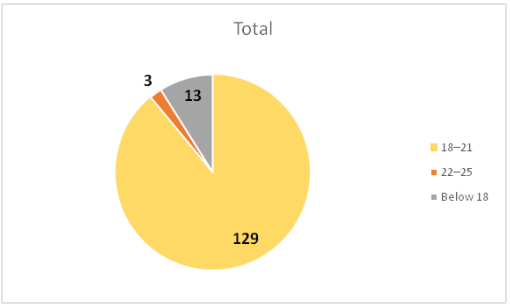
Methodology

This study adopts a descriptive and analytical research design to examine students' engagement with digital learning systems, their perceptions of learning analytics, the challenges faced in employment preparation, and the alignment of academic curricula with Industry 5.0 skill requirements. The descriptive approach helps summarise existing learning practices, while the analytical approach supports statistical evaluation of student perceptions.

The research is based on primary data collected through a structured questionnaire. The population of the study comprises students enrolled in higher education institutions across various disciplines, including Science, Engineering and Technology, Data Science, and Commerce. A total of 300 student responses were obtained using an online survey. A convenience sampling technique was employed, as respondents were selected based on accessibility and willingness to participate, making it suitable for exploratory academic research.



Gender distribution of the respondents was analysed using descriptive statistics. The results show that the sample consisted of 76 male respondents and 69 female respondents, indicating a relatively balanced gender representation with a slight predominance of males. The demographic distribution of respondents shows that the majority of participants fall within the 18–21 age group (n = 129), comprising the largest proportion of the sample. A smaller segment of respondents were below 18 years of age (n = 13), while only a minimal number were aged 22–25 (n = 3).



The data collection instrument consisted of a structured questionnaire aligned with the research objectives. The questionnaire included multiple-choice questions and Likert-scale statements covering digital learning platform usage, learning analytics feedback, employment-related challenges, and curriculum alignment with Industry 5.0 skills. All questions were mandatory, ensuring complete responses for analysis.

Different measurement scales were used based on the nature of variables. Demographic details were measured using a nominal scale, while perception-related responses were measured using ordinal scales. Curriculum alignment with Industry 5.0 skills was assessed using a 4-point Likert scale, where 1 represented "Not aligned" and 4 represented "Well aligned." Data were coded and analysed using Microsoft Excel. Descriptive statistical techniques, including frequency and percentage analysis, were applied to identify key challenges faced by students in preparing for future employment. To assess curriculum alignment, a one-sample t-test was conducted to determine whether students' perceptions significantly differed from a neutral benchmark value ($\mu = 3$). The level of significance was fixed at 5% ($\alpha = 0.05$).

Ethical considerations were strictly followed during the study. Participation was voluntary, respondents were informed about the academic purpose of the research, and confidentiality of the data was maintained throughout the analysis.

Data Analysis

Objective 1: Digital Learning Platform Usage

To assess students' usage of digital learning platforms (such as LMS, online classes, e-resources) in smart education systems.

Table 4.1 Digital Platform Usage by Students

Digital Platform Used	Count
Learning Management Systems (LMS)	38
Live online classes	60
Recorded lectures	66
E-books / Digital notes	86

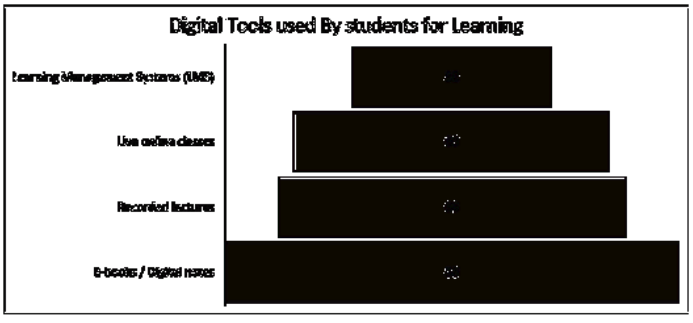


Figure 4.1 Digital platform usage by students.

Objective 2: Perceptions of Learning Analytics

To understand students' and teachers' perceptions of learning analytics for improving teaching–learning effectiveness.

Null Hypothesis (H_{02}): Learning analytics does not have a significant impact on improving the teaching–learning process as perceived by students and faculty members.

Alternative Hypothesis (H_{12}): Learning analytics has a significant impact on improving the teaching–learning process as perceived by students and faculty members.

Table 4.2 Learning Analytics Feedback and Student Activities

Feedback Type	Study Planning	Time Management	Exam & Assignment Prep	Participation in Classes
Assignment Progress Track	30	26	36	18
Performance Reports	54	43	42	21
Attendance Tracking	35	35	31	15
Personalised Learning Tips	38	22	34	17

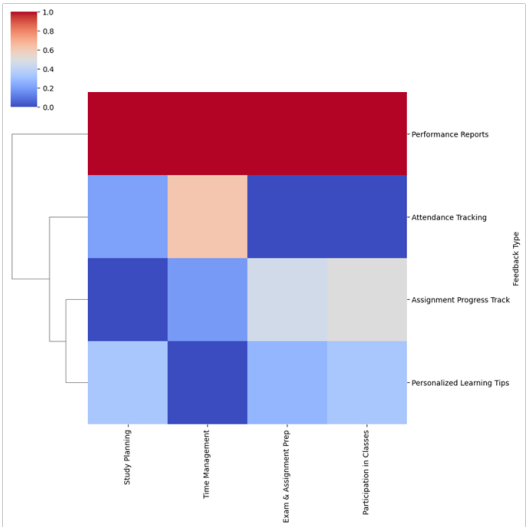


Figure 4.2 Learning Analytics Feedback And Student Activities Chart.

Students find Performance Reports to be the most useful learning analytics feature. It helps them clearly understand how they are performing in studies, plan better, manage time, prepare for exams, and stay involved in classes. Assignment Progress Tracking is mainly helpful for exam and assignment preparation—students feel that knowing their assignment status helps them stay focused and complete work on time. Personalised Learning Tips help students in planning studies and exam preparation, but students do not see them as very useful for managing time. Attendance Tracking is seen more as a monitoring tool—students feel it helps maintain discipline, but it does not directly improve learning or participation much.

Objective 3: Challenges in Employment Preparation

To identify the major challenges faced by students in preparing for future employment.

Table 4.3 Challenges Faced by Students in Employment Preparation

Challenges	Frequency	Percentage (%)
Lack of practical experience	100	30.30
Weak communication or soft skills	86	26.06
Weak technical skills	70	21.21
Low awareness of ethics and sustainability	39	11.82
Limited interdisciplinary knowledge	35	10.61
Total	**330**	**100**

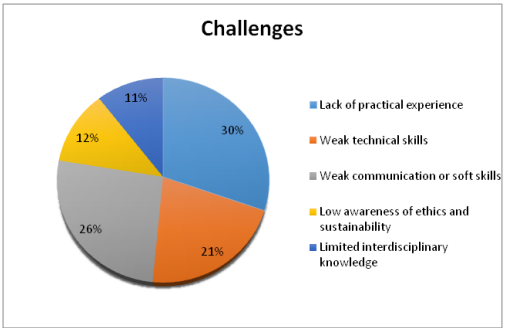


Figure 4.3 Challenges Faced By Students In Employment Preparation.

The results indicate that lack of practical experience is the most significant challenge faced by students, reported by 30.30% of respondents, highlighting a major gap between theoretical learning and real-world application. The second most frequently reported challenge is weak communication or soft skills (26.06%), followed by weak technical skills (21.21%). Challenges related to low awareness of ethics and sustainability (11.82%) and limited interdisciplinary knowledge (10.61%) were reported by a smaller proportion of students but remain important areas requiring attention. The findings emphasise the need for curriculum enhancement through practical training, skill-development programmes, industry exposure, and interdisciplinary learning opportunities to better prepare students for future job requirements.

Objective 4: Curriculum Alignment with Industry 5.0 Skills

To assess students' perception of curriculum alignment with Industry 5.0 skills.

Null Hypothesis (H_{04}): Students' perception of curriculum alignment with Industry 5.0 skills does not differ significantly from the moderate level.

Alternative Hypothesis (H_{14}): Students' perception of curriculum alignment with Industry 5.0 skills differs significantly from the moderate level.

Table 4.4 One-Sample t-Test Results for Curriculum Alignment

Variable	Mean	Std Dev	n	t_cal	df	p-value / Decision
Curriculum alignment	3.179	0.733	145	2.947	144	0.00375 / Reject H_0

The p-value (0.00375) is less than the significance level of 0.05, indicating that the null hypothesis is rejected. This shows that students' perception of curriculum alignment is significantly different from the neutral moderate level. The mean score of 3.179 indicates that students perceive the curriculum as moderately to well aligned with Industry 5.0 skills. This suggests that while the curriculum covers emerging technologies, digital literacy, and interdisciplinary skills, there remains room for improvement to fully meet students' expectations and industry requirements.

Conclusion

This study examined the role of learning analytics in smart education systems with a focus on students' use of digital learning platforms, perceptions of analytics-based feedback, challenges in employment preparation, and curriculum alignment with Industry 5.0 skills. The findings highlight the growing importance of data-driven approaches in enhancing teaching–learning effectiveness and supporting academic decision-making in digitally enabled education environments.

The results show that students actively use digital learning platforms such as LMS, online classes, recorded lectures, and e-resources, confirming the central role of digital technologies in contemporary education. Learning analytics-based feedback, particularly performance reports and assignment progress tracking, was perceived as helpful in improving study planning, exam preparation, and overall academic engagement. These findings indicate that learning analytics contributes positively to students' awareness of their learning progress and supports self-regulated learning.

The analysis of employment-related challenges reveals that students face significant gaps in practical experience, communication skills, and technical readiness. These challenges suggest a mismatch between academic learning and real-world job expectations, emphasising the need for curriculum designs that incorporate experiential learning, industry exposure, and skill-oriented training.

Further, the one-sample t-test results indicate that students perceive the current curriculum as moderately to well aligned with Industry 5.0 skill requirements. Although emerging technologies and digital competencies are included in academic programmes, the findings suggest that further curriculum enhancement is required to fully address evolving industry demands, particularly in human-centred skills, ethics, sustainability, and interdisciplinary knowledge.

Overall, the study demonstrates that learning analytics serves as a valuable tool in smart education systems by supporting academic monitoring, improving learning effectiveness, and informing curriculum development. The findings underscore the importance of integrating learning analytics with curriculum planning and industry needs to better prepare students for future employment. Institutions can strengthen educational outcomes by adopting data-informed strategies, enhancing practical learning opportunities, and aligning academic programmes with Industry 5.0 skill expectations.

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