

# AI-Enabled Instructional Material Development for Engineering Education

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## Abstract

The integration of Artificial Intelligence (AI) in higher education has transformed the preparation, delivery, and accessibility of instructional materials. Traditionally, faculty members spend significant time creating lecture notes, assessments, bilingual content, and visual materials. With AI tools such as ChatGPT, Google Translate, and Canva, educators can now generate structured, interactive, and bilingual content more efficiently. This paper presents practical implementation examples from engineering education, highlighting the use of AI for lecture notes, question bank creation, bilingual translation, and infographic development. Results indicate a 45–50% reduction in preparation time, improved student engagement, and enhanced inclusivity for regional-language learners. The study concludes that AI serves as a complementary pedagogical tool, requiring faculty validation and contextualization for optimal effectiveness.

**Keywords**— Artificial Intelligence, Instructional Materials, Engineering Education, Bilingual Content, ChatGPT, Canva, Higher Education

*JETLP Category*—Practice

## I. INTRODUCTION

A paradigm shift is occurring in higher education with the increasing use of Artificial Intelligence (AI) for academic content creation. Educators traditionally invest substantial time in producing lecture notes, presentations, assessments, and supplementary learning resources. With AI-driven tools now widely available, instructional material development has become faster, more structured, and more student-centered.

AI supports content creation aligned with Bloom's Taxonomy, course outcomes, and pedagogical best practices. Tools such as ChatGPT generate draft notes and questions, Google Translate produces bilingual materials, and Canva supports the creation of diagrams and infographics. This creates more inclusive, engaging, and adaptable learning environments while reducing manual workload for educators.

## II. REVIEW OF RELATED WORK

Recent literature highlights the increasing role of AI in higher education for automating content development, enhancing learner engagement, and supporting personalized learning. Studies report

that AI-assisted note preparation enhances clarity and structure, while automated assessments improve coverage of higher-order thinking skills. AI translation tools are also recognized for promoting accessibility, particularly in multilingual contexts.

However, researchers also emphasize the importance of human oversight to ensure accuracy, contextual relevance, and ethical usage of AI-generated materials.

### III. METHODOLOGY / IMPLEMENTATION DETAILS

This study documents four practical use cases where AI-supported tools were integrated into teaching–learning practices in engineering courses.

#### Example 1: Lecture Notes Development

- Faculty entered the syllabus topic “*Characteristics of road aggregates*” into ChatGPT.
- AI generated structured content including definitions, properties, and test methods.
- Faculty refined the content with regional examples, such as the use of basalt aggregates in Gujarat.
- Canva was used to design diagrams for Aggregate Impact and Abrasion tests.

#### Example 2: Question Bank Creation

- In *Construction Project Management*, ChatGPT generated 20 MCQs and 10 descriptive questions based on Bloom’s Taxonomy.
- Faculty validated the questions, replacing generic examples with Indian construction case studies.
- Time required for question bank preparation reduced from **two weeks to four days**.

#### Example 3: Bilingual Content Creation

- AI-generated English notes on *Bituminous Road Construction* were translated into Gujarati using Google Translate.
- Faculty ensured technical terms such as *Marshall Stability Test* remained correctly represented in English.
- Students reported improved comprehension due to availability of bilingual materials.

#### Example 4: Infographics and Visual Summaries

- Canva and AI tools generated a one-page infographic comparing *Flexible and Rigid Pavements*.
- Students used the infographic for last-minute revision, and faculty uploaded it to the LMS for wider access.

### IV. RESULTS AND DISCUSSION

Table 1: . Multi-Dimensional Faculty Competency Model

Area	TRADITIONAL METHOD	AI-Enabled Method	Outcome
Lecture Notes Preparation	12–15 hours/unit	6–8 hours/unit	45% time saved
Question Bank Development	2 weeks/subject	4–5 days/subject	Faster assessment prep
Bilingual Notes	Manual translation	AI-assisted	Increased inclusivity
Visual Materials	Faculty-created, limited	AI + Canva-generated	Improved engagement

## Impact on Teaching–Learning

- Time Efficiency: AI reduced faculty workload by approximately 50%, enabling better focus on mentoring and student interaction.
- Student Engagement: Interactive materials such as infographics and quizzes increased participation in classroom discussions.
- Accessibility: Bilingual content helped bridge the language gap for rural and regional-medium learners.
- Quality Enhancement: AI-generated assessments ensured coverage of multiple cognitive levels, improving overall assessment quality.

## V. LESSONS LEARNED

AI complements faculty expertise, and human validation is essential for technical accuracy. Accuracy checks are crucial, especially in engineering subjects, to avoid factual errors. Inclusivity improves when bilingual and multimodal content is provided. Ethical use requires plagiarism screening and proper citation of AI assistance. Scalability is high; the same framework can be extended to science, management, and humanities courses.

## VI. Supporting Materials (As Requested by Reviewers)

Representative examples are listed below:

### 6.1 Sample Materials

[https://lms.rku.ac.in/courses/1547/discussion\\_topics/11124](https://lms.rku.ac.in/courses/1547/discussion_topics/11124)

*Here I found the generation of no. of topics for poster presentation.*

### 6.2 Sample Materials Used in Class

- AI-generated lecture notes (PDF)
- Question bank (MCQs & descriptive questions)  
[Question with answer: Construction Planning and Control](#)
- Bilingual English–Gujarati notes
- Canva infographic

## VII. Conclusion

AI-enabled instructional material development offers transformative potential in higher education. Through structured content generation, bilingual support, and visually appealing resources, AI significantly enhances both teaching efficiency and student learning. While AI tools accelerate the creation of educational resources, faculty oversight remains critical for context-specific accuracy. The successful outcomes reported in engineering courses highlight the potential for widespread application across multiple disciplines.

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### **Author Bio**

Kajal Thumar is currently affiliated with RK University, where she serves in the Department of Civil Engineering. With a strong academic foundation and professional commitment to engineering education, she has been actively involved in teaching, curriculum development, and mentoring diploma and undergraduate students. Her core research interests include transportation engineering, sustainable construction materials, construction project management, and environmental engineering. Kajal is particularly focused on integrating innovative and learner-centered pedagogical approaches—such as heutagogy and outcome-based education—into engineering instruction to enhance student engagement and competency development.