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AI-Supported Workflow for Online Lecture Production in Higher Education: A Case Study at the Education Technology and Adaptive Learning Institute (ETALI)

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Abstract

Digital transformation in higher education has significantly changed the way universities design curricula, develop learning resources, organize teaching, assess learning outcomes, and manage training activities. In online and distance education, online lectures are no longer supplementary teaching materials; they have become core learning resources that directly influence students' self-learning, interaction, and achievement of course learning outcomes. However, many higher education institutions still produce online lectures through fragmented processes, relying heavily on individual lecturers' digital skills and separate tools such as PowerPoint, Canva, Quizizz, Zoom, Google Forms, learning management systems, or generative artificial intelligence. This study proposes an AI-supported and quality-controlled workflow for online lecture production at the Education Technology and Adaptive Learning Institute (ETALI), Thai Nguyen University of Technology. Based on document analysis, process analysis, synthesis of instructional design models, and practical requirements of distance education, the study develops a nine-step workflow: learning material planning, input standardization, document processing, AI-generated outline/script/MCQ drafting, academic approval, learning material production, quality assurance, LMS deployment, and data-driven improvement. The proposed model integrates available digital tools such as PowerPoint, Canva, Quizizz, Moodle LMS, OCR/Mathpix, N8N, Gamma, and large language models while maintaining the human-in-the-loop principle for academic decision-making. The study contributes a practical framework for shifting from tool-based production to process-based governance of online lecture production in higher education.

Keywords: Online Lecture Production, Digital Learning Resources, Generative AI, Learning Management System, Instructional Design, Quality Assurance, Distance Education

1. Introduction

Digital transformation has become a strategic priority in higher education, especially in the context of expanding online, blended, and distance learning. This transformation does not simply refer to the digitization of existing materials or the use of online platforms. More importantly, it requires universities to redesign teaching, learning, assessment, learning resource development, and educational management based on digital technologies, data, and new governance models.

In distance education, online lectures play a particularly important role. They are not merely supporting documents for lecturers but structured learning resources that guide learners through objectives, concepts, examples, activities, assessments, and feedback. Since distance learners often study independently for a large proportion of their learning time, the quality of online lectures directly affects learner engagement, self-regulation, knowledge acquisition, and achievement of learning outcomes.

At the Education Technology and Adaptive Learning Institute (ETALI), Thai Nguyen University of Technology, the production of online lectures is closely associated with the development of digital learning resources, operation of a learning management system, and implementation of distance education programs. In practice, lecturers and staff may use various digital tools such as PowerPoint, Canva, Quizizz, Moodle, Zoom, Google Forms, or generative AI. However, the use of tools alone does not guarantee the quality of online lectures. Without a standardized workflow, learning materials may vary significantly in academic accuracy, pedagogical design, visual presentation, assessment alignment, technical compatibility, and LMS tracking.

The emergence of generative AI creates new opportunities for online lecture production. AI can support the drafting of lecture outlines, scripts, learning objectives, examples, quizzes, and revision suggestions. However, AI also introduces risks, including inaccurate content, fabricated references, inappropriate examples, copyright concerns, and misalignment with learning outcomes. Therefore, AI must be integrated into a controlled workflow in which human experts remain responsible for academic decisions.

This paper aims to propose a practical, AI-supported, and quality-controlled workflow for online lecture production in higher education. Using the Education Technology and Adaptive Learning Institute (ETALI) as a case study, the paper addresses four research questions:

1. What are the main limitations in the current online lecture production process?
2. How can digital tools and generative AI be integrated into a standardized workflow?
3. What quality assurance mechanisms are required to ensure academic reliability, pedagogical effectiveness, and technical readiness?
4. How can LMS data and learner feedback be used to improve online lectures after deployment?

2. Literature and Theoretical Background

2.1 Digital transformation and digital learning resources

Digital transformation in education refers to the application of digital technologies, data, and new organizational models to redesign teaching, learning, assessment, content development, and educational management. It should be distinguished from simple digitization. Digitization may involve converting printed materials into PDF files or storing lectures online, while digital transformation requires process redesign, platform integration, data-driven decision-making, automation, and continuous quality improvement.

Digital learning resources include all learning materials designed, stored, distributed, used, and updated in digital environments. These may include slides, videos, audio lectures, reading materials, multiple-choice questions, interactive exercises, simulations, SCORM/xAPI packages, question banks, discussion forums, feedback data, and course metadata. In distance education, digital learning resources must be structured, accessible, measurable, reusable, and regularly updated.

Online lectures are a specific type of digital learning resource. A high-quality online lecture should not only present knowledge but also guide the learner through a meaningful learning process. It should include clear learning objectives, logical content structure, examples, visual support, interaction, formative assessment, and links to course learning outcomes. Therefore, online lecture production should be understood as a pedagogical-technological process rather than a purely technical task.

2.2 ADDIE as a foundation for online lecture production

The ADDIE model, consisting of Analysis, Design, Development, Implementation, and Evaluation, provides a systematic foundation for instructional design. In online lecture production, ADDIE helps ensure that learning materials are developed based on learning outcomes, learner characteristics, content structure, instructional strategies, technical requirements, and evaluation data.

In the analysis phase, course learning outcomes, learner needs, content priorities, and LMS requirements are identified. In the design phase, instructional outlines, storyboards, lecture scripts, learning activities, and assessment plans are developed. In the development phase, slides, videos, quizzes, and interactive resources are produced. In the implementation phase, materials are uploaded and configured on the LMS. In the evaluation phase, learner feedback, quiz results, completion rates, and LMS analytics are used to improve subsequent versions of the learning resources.

The ADDIE model is particularly relevant to distance education because it emphasizes alignment among objectives, content, learning activities, assessment, and evaluation. For institutions seeking to improve online lecture production, ADDIE provides a useful logic for transforming scattered activities into a coherent production cycle.

2.3 Generative AI and the human-in-the-loop principle

Generative AI can support online lecture production in several ways. It can summarize input documents, generate lesson outlines, draft lecture scripts, create examples, design multiple-choice questions, suggest visual elements, and recommend improvements. These functions can reduce repetitive tasks and help lecturers and instructional designers focus more on academic judgment and learner support.

However, generative AI cannot replace academic responsibility. AI-generated outputs may contain factual errors, unsupported claims, fabricated references, inappropriate examples, or assessment items that do not align with course learning outcomes. In technical subjects, even minor errors in formulas, symbols, or terminology can seriously affect learning quality.

Therefore, the human-in-the-loop principle is essential. Under this principle, AI may produce drafts, but lecturers, instructional designers, and academic reviewers must evaluate and approve content before official use. Human experts must remain responsible for academic accuracy, pedagogical appropriateness, copyright compliance, and ethical use of AI.

3. Methodology

This study adopts a practice-oriented case study approach. The case is the online lecture production process at the Education Technology and Adaptive Learning Institute (ETALI), Thai Nguyen University of Technology. The study focuses on how digital tools and AI can be integrated into a standardized workflow for producing online lectures in the context of higher education and distance learning.

The research uses four main methods:

First, document analysis was conducted to review theoretical foundations, policy orientations, digital transformation frameworks, instructional design models, distance education requirements, and research on AI-supported e-learning.

Second, process analysis was used to identify the current workflow of online lecture production. The existing process can be summarized as follows: course syllabus preparation, teaching material collection, slide design, recording/editing, question creation, and LMS upload. Although this process is suitable for an initial stage, it lacks standardized metadata, version control, digital approval workflow, progress dashboard, and learning analytics integration.

Third, synthesis and modeling were applied to design a proposed workflow that integrates instructional design, AI-supported content development, quality assurance, LMS deployment, and post-implementation improvement.

Fourth, expert-oriented evaluation logic was used to develop quality assurance criteria for academic accuracy, pedagogical design, visual presentation, interaction and assessment, technical compatibility, and LMS readiness.

The study does not aim to develop a new software platform. Instead, it proposes an integrated workflow using available tools and platforms that are feasible for institutional implementation.

4. Current Limitations in Online Lecture Production

The analysis shows that the main limitation in online lecture production is not the complete absence of digital tools, but the lack of a fully standardized and quality-controlled workflow. Lecturers and staff may use PowerPoint, Canva, Quizizz, Moodle, AI tools, or other applications, but these tools are often used separately and depend heavily on individual digital competence.

Several major limitations can be identified.

First, input materials are not always standardized. Course syllabi, learning outcomes, PDF documents, teaching materials, images, formulas, and assessment requirements may be submitted in different formats and versions. This creates difficulties for automated processing and quality control.

Second, instructional design quality is uneven. Some online lectures may have clear objectives, relevant examples, good visual design, and appropriate interaction, while others may contain overloaded slides, long videos, limited learner engagement, or weak alignment between content and assessment.

Third, assessment design is not consistently aligned with learning outcomes. Multiple-choice questions may vary in difficulty, cognitive level, distractor quality, and explanatory feedback. Without a clear question design framework, quizzes may become a technical add-on rather than an integrated part of the learning process.

Dimension	Traditional Approach	Proposed Workflow
Process structure	Fragmented	Standardized 9-step
Tool usage	Independent	Integrated
Quality control	Informal	Rubric-based
AI usage	Ad hoc	Controlled (human-in-loop)
Data usage	Limited	LMS-driven
Scalability	Low	High

Fourth, quality assurance is not yet fully standardized. Review activities may exist, but without a scoring rubric, evidence-based checklist, version tracking, and clear responsibility assignment, it is difficult to determine whether a lecture is ready for official LMS deployment.

Fifth, LMS data have not been fully used for improvement. LMS logs, completion rates, quiz results, learner feedback, and interaction data can provide valuable insights, but they need to be systematically collected, visualized, and linked back to the revision process.

These limitations suggest that online lecture production requires a workflow that combines tools, people, quality criteria, data, and governance mechanisms.

5. Proposed Nine-Step Workflow for Online Lecture Production

This study proposes a nine-step workflow for AI-supported online lecture production. The workflow is designed to transform fragmented tool usage into a controlled production system.

ADDIE Phase	Workflow Steps
Analysis	Step 1–2
Design	Step 3–4
Development	Step 5–6
Implementation	Step 7–8
Evaluation	Step 9

Step 1: Learning material planning

The first step is to identify the list of courses, production priorities, responsible lecturers, required outputs, timelines, reviewers, and expected LMS deployment dates. Planning should be based on training schedules, learner demand, reuse potential across programs, and the current status of existing materials.

Step 2: Input standardization

Input materials must be checked before production begins. Required inputs include course syllabus, learning outcomes, teaching materials, PDF files, required number of multiple-choice questions, lecturer information, and deadlines. Files must be readable, properly named, versioned, and stored in a shared repository.

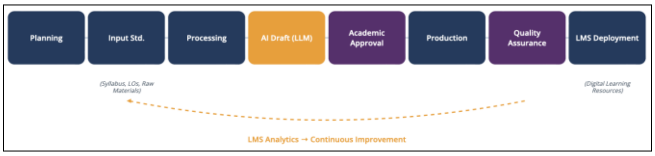

Fig 1: AI-supported and quality-controlled workflow for online lecture production

Step 3: Document processing

OCR tools and formula recognition tools may be used to extract text, tables, images, and formulas from documents. This step produces a clean data package that can be used for AI-supported drafting. For technical subjects, formulas, diagrams, and symbols must be manually checked to avoid recognition errors.

Step 4: AI-generated outline, script, and MCQ drafting

Generative AI can be used to draft lesson outlines, learning objectives, lecture scripts, examples, interaction suggestions, and multiple-choice questions. Prompts must specify course scope, learning outcomes, input materials, required cognitive levels, and restrictions against adding unsupported information.

Step 5: Academic approval

Lecturers review AI-generated drafts for academic accuracy, terminology, alignment with the syllabus, appropriateness for distance learners, correctness of MCQ answers, and quality of explanations. Only approved content can move to the production stage.

Step 6: Learning material production
Instructional designers and technical staff create slides, scripts, MCQ banks, supporting documents, and videos if required. Slides should follow institutional templates, avoid excessive text, include visual support, and contain short review questions or learning activities. Videos should be divided into short segments and include clear introductions, explanations, and summaries.

Step 7: Quality assurance
Learning materials are reviewed using a quality assurance rubric. The proposed rubric includes five dimensions: academic content, pedagogical design, visual design, interaction and assessment, and technical/LMS readiness. Materials that do not meet the required threshold must be revised before publication.

Step 8: LMS deployment
Approved materials are uploaded to the LMS. The LMS administrator configures learning resources, quizzes, completion conditions, grading settings, access permissions, and tracking functions. Testing should be conducted from the learner's perspective to ensure accessibility and functionality.

Step 9: Evaluation and improvement
After implementation, data from the LMS and learner surveys are collected. Key indicators include access rates, completion rates, time on task, quiz performance, learner satisfaction, technical issues, and content-related feedback. These data are used to update the next version of the learning materials.

6. Technology Workflow and Tool Integration

The proposed technology workflow is semi-automated and controlled. N8N may serve as the workflow orchestration layer. A shared repository such as Google Drive or an internal storage system can store input and output files. OCR and formula recognition tools can support text and formula extraction. Large language models can generate outlines, scripts, and MCQ drafts. Canva, Gamma, or PowerPoint can support slide production. Moodle LMS can host and deliver the final learning materials. Dashboards can track progress, quality status, and LMS usage data.
The workflow can be described as follows:
Course submission form → file storage → workflow trigger → PDF/text extraction → formula and image processing → AI draft generation → lecturer approval → revision if needed → slide and MCQ production → quality assurance → LMS upload → dashboard update.
The most important feature of this workflow is the presence of mandatory approval points. AI-generated content cannot move directly to official learning materials without lecturer review. Similarly, learning materials cannot be uploaded to the LMS before quality assurance is completed.

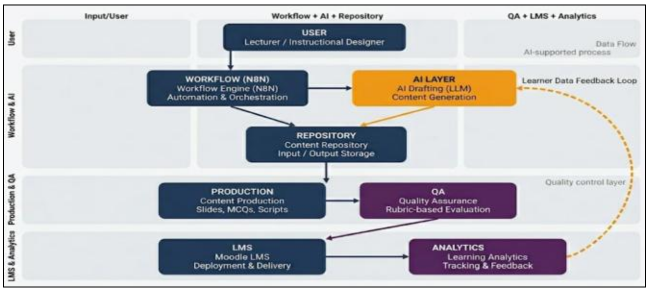

Fig 2: System architecture and data flow of the AI-supported workflow

This model is suitable for higher education institutions because it does not require the development of a completely new platform. Instead, it integrates available and affordable tools into a governed process. It is flexible, scalable, and appropriate for institutions that need to improve productivity while maintaining academic responsibility.

7. Quality Assurance Framework

A quality assurance framework is necessary to ensure that online lectures are not only visually attractive but also academically correct, pedagogically effective, technically stable, and suitable for distance learners. The proposed framework uses a 100-point rubric.

Dimension	Main criteria	Maximum score
Academic content	Accuracy, alignment with syllabus and learning outcomes, no AI-generated misinformation	40
Pedagogical design	Logical structure, segmentation, examples, learning activities, suitability for self-study	20
Visual design	Clear slides, appropriate images, institutional template, no text overload	15
Interaction and assessment	MCQs, tasks, feedback, cognitive-level classification, self-learning support	15
Technical and LMS readiness	File format, accessibility, quiz function, tracking, LMS compatibility	10
Total		**100**

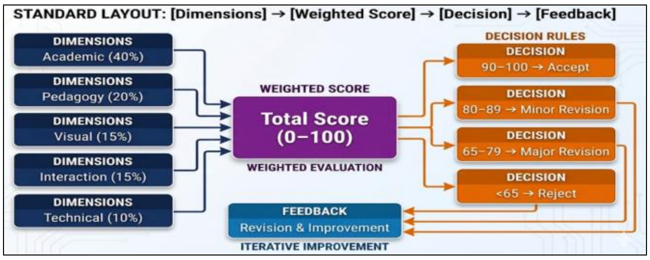

Fig 3: Multi-dimensional quality assurance framework for online lecture production

The recommended classification is as follows:

Score range	Classification	Decision
90–100	Excellent	Ready for use
80–89	Acceptable	Ready after minor revisions
65–79	Needs improvement	Revision required before LMS publication
Below 65	Unsatisfactory	Major revision or redevelopment required

This quality assurance framework helps avoid vague review comments such as "good," "acceptable," or "needs improvement." Instead, reviewers can identify specific problems in academic content, pedagogy, visual design, interaction, or technical implementation.

8. Expected Outcomes and Evaluation Indicators

The effectiveness of an online lecture production workflow should not be evaluated only by subjective perception. It should be measured through indicators related to production efficiency, quality assurance, LMS deployment, learner experience, and institutional management.
The following indicators are proposed:

Indicator	Suggested target	Data source
Average production time per online lecture	Reduced by 30–40% after workflow stabilization	Workflow dashboard
Percentage of materials approved after first review	At least 70%	Quality assurance records
Percentage of courses with complete slides and MCQs	At least 90%	Production plan and repository
Percentage of materials uploaded to LMS on schedule	At least 95%	LMS and progress dashboard
Lecturer satisfaction	At least 80% positive responses	Lecturer survey
Learner satisfaction	At least 80% positive responses	Learner survey
Number of MCQs per course	According to institutional requirement	LMS question bank
Percentage of materials revised based on feedback	At least 80%	LMS reports and revision records

These indicators enable institutions to monitor not only whether learning materials are produced, but also whether they are produced efficiently, reviewed properly, deployed on time, and improved based on evidence.

9. Discussion

The proposed model demonstrates that technology integration in online lecture production should be understood as a governance issue rather than a purely technical issue. Tools such as PowerPoint, Canva, Quizizz, Moodle, OCR, workflow automation, and generative AI can increase productivity, but they cannot guarantee quality by themselves. Quality emerges from the interaction between clear learning outcomes, standardized inputs, instructional design, academic review, technical testing, LMS deployment, and data-driven improvement.

Risk	Example	Mitigation
Hallucination	Fake references	Lecturer validation
Misalignment	Wrong MCQ level	Bloom taxonomy check
Technical error	OCR formula error	Manual verification
Ethical issue	Copyright violation	Source tracking

The study also confirms the value of the human-in-the-loop approach. Generative AI is useful for producing first drafts, but academic responsibility must remain with lecturers and reviewers. This is particularly important in higher education, where errors in terminology, formulas, references, or assessment questions can directly affect learning outcomes.
The proposed workflow provides several expected benefits. It can reduce production time, improve consistency across courses, support reuse of learning materials, strengthen LMS-based management, improve quality assurance evidence, and create a foundation for scalable distance education. It also supports institutional digital transformation by shifting from individual tool usage to process-based and data-informed management.
However, successful implementation requires several conditions. Institutions need a multidisciplinary production team, including lecturers, instructional designers, media technicians, AI/workflow administrators, LMS administrators, and academic reviewers. Internal regulations are also required for AI use, copyright, data security, file naming, version control, and product acceptance. In addition, staff training should be organized at basic, intermediate, and advanced levels.
Potential risks include inaccurate AI-generated content, OCR errors in formulas, copyright violations, data leakage, rising API costs, delayed academic approval, LMS incompatibility, and resistance to change. These risks can be controlled through checklists, approval points, access permissions, version logs, usage monitoring, training, and leadership commitment.

10. Conclusion

This paper proposed an AI-supported and quality-controlled workflow for online lecture production in higher education. The study argues that online lecture production should not be reduced to slide design, video recording, or LMS uploading. It is a complex pedagogical-technological process that requires systematic planning, standardized inputs, instructional design, AI-assisted drafting, academic approval, quality assurance, LMS deployment, and continuous improvement based on data.
The proposed nine-step workflow provides a practical model for institutions seeking to improve the quality and efficiency of digital learning resource production. Its key contribution is the shift from fragmented tool usage to governed process management. By integrating available tools such as PowerPoint, Canva, Quizizz, Moodle, OCR/formula recognition tools, workflow automation platforms, and large language models under the human-in-the-loop principle, the model balances productivity, academic quality, and institutional accountability.
Future research should pilot the proposed workflow with selected courses and collect before-and-after data on production time, quality scores, LMS engagement, lecturer satisfaction, and learner satisfaction. Further studies may

also develop digital dashboards for monitoring online lecture production and explore more advanced applications of learning analytics and AI assistants in distance education.

11. References

1. Branch RM. Instructional Design: The ADDIE Approach. Springer, 2009.
2. Clark RC, Mayer RE. e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning (4th ed.). Wiley, 2016.
3. European Commission. Digital Education Action Plan 2021-2027, 2021.
4. Hodell C. ISD From the Ground Up: A No-Nonsense Approach to Instructional Design (4th ed.). ATD Press, 2016.
5. OECD. OECD Digital Education Outlook 2023: Towards an Effective Digital Education Ecosystem. OECD Publishing, 2023.
6. Siemens G. Connectivism: A learning theory for the digital age. International Journal of Instructional Technology and Distance Learning. 2005; 2(1).
7. Tang KY, Chang CY, Hwang GJ. Trends in artificial intelligence-supported e-learning: A systematic review and co-citation network analysis. Interactive Learning Environments, 2021.
8. UNESCO. Guidance for Generative AI in Education and Research, 2023.
9. UNESCO. Six Pillars for the Digital Transformation of Education, 2024.
10. Vietnam Ministry of Education and Training. Circular No. 28/2023/TT-BGDĐT on distance education at undergraduate level, 2023.
11. Prime Minister of Vietnam. Decision No. 131/QĐ-TTg on strengthening ICT application and digital transformation in education and training for 2022-2025, with orientation to 2030, 2022.