Generative AI Adoption in Higher Education: Impact on Teaching Effectiveness and Academic Productivity

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Abstract: *Generative Artificial Intelligence has rapidly emerged as an important technological development in higher education. Generative AI tools can assist faculty members in preparing teaching materials, generating assessment content, supporting academic writing, developing examples, summarizing information and performing routine academic activities. However, the availability of such technologies does not automatically result in effective adoption or improved academic outcomes. Faculty members' AI literacy and perceptions of usefulness may influence their willingness to adopt Generative AI, while the consequences of adoption for teaching effectiveness and academic productivity require further empirical investigation. This study develops and examines an integrated model linking Artificial Intelligence literacy, perceived usefulness, Generative AI adoption, teaching effectiveness and academic productivity among higher education faculty. The study is theoretically grounded in the Technology Acceptance Model. A quantitative research design is proposed using a structured questionnaire and Partial Least Squares Structural Equation Modeling. For demonstration of the analytical procedure, a synthetic dataset of 300 faculty responses is used. The structural model indicates positive relationships between AI literacy and perceived usefulness, perceived usefulness and Generative AI adoption, Generative AI adoption and teaching effectiveness, Generative AI adoption and academic productivity, and teaching effectiveness and academic productivity. The model explains 56.2% of the variance in academic productivity. The study contributes to the emerging literature by moving beyond simple technology-adoption intentions and examining the potential professional outcomes of Generative AI adoption among higher education faculty. The findings also highlight the importance of AI literacy, responsible use, faculty development and institutional support in realizing the potential benefits of Generative AI.*

Keywords: Generative Artificial Intelligence, Artificial Intelligence Literacy, Higher Education, Faculty Adoption, Teaching Effectiveness, Academic Productivity, Technology Acceptance Model, PLS-SEM, SmartPLS

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Introduction

The emergence of Generative Artificial Intelligence has created a significant transformation in the technological environment of higher education. Unlike conventional information technologies that primarily retrieve or process existing information, Generative AI systems can produce new text, explanations, questions, examples, summaries, images, computer code and other forms of content in response to user instructions. The introduction of ChatGPT in late 2022 accelerated public and academic interest in the application of Generative AI within universities and colleges.

Higher education is particularly affected by this development because faculty members perform a wide range of knowledge-intensive activities. These include lesson planning, preparation of teaching materials, assessment development, academic writing, research, student communication, curriculum development and administrative documentation. Generative AI has the potential to support several of these activities.

Recent systematic research demonstrates that Generative AI is increasingly being incorporated into higher education teaching and learning. A 2025 systematic review examining 139 studies identified widespread applications of Generative AI across higher education classrooms and found that Generators, Reimaginers and Assistants were among the most common categories of applications. The review also highlighted differences in adoption across academic disciplines.

Similarly, Qian's 2025 systematic review identified growing emphasis on pedagogical integration, creativity, critical thinking, learning autonomy and prompt literacy. At the same time, the review highlighted concerns regarding overreliance on Generative AI and the possible outsourcing of cognitive and metacognitive activities.

A separate systematic review covering 99 studies reported that Generative AI is increasingly influencing teaching and learning practices in higher education, while emphasizing the importance of understanding users' responses, attitudes and utilization behavior.

Although the literature has expanded rapidly, an important issue remains unresolved: Does Generative AI adoption actually improve faculty members' professional outcomes?

Much of the early research concentrated on students, learning outcomes, academic integrity and perceptions of Generative AI. Faculty adoption has received increasing attention, but the relationship between adoption and professional outcomes such as teaching effectiveness and academic productivity remains comparatively underdeveloped.

A recent empirical study of 294 full-time higher education faculty members applied the Technology Acceptance Model and Social Cognitive Theory to examine Generative AI adoption. The findings showed that perceived usefulness significantly influenced faculty attitudes and intention to use Generative AI, while trust and social reinforcement also played important roles.

These findings suggest that faculty adoption is influenced by perceptions of usefulness and other psychological and social factors. However, adoption should not be considered an end in itself. From an institutional perspective, the more important question is whether adoption contributes to better teaching and higher academic productivity.

AI literacy may be an important antecedent in this process. Faculty members who understand the capabilities and limitations of AI may be better positioned to identify appropriate academic applications. AI literacy may therefore influence perceived usefulness, which in turn may influence adoption.

The present study consequently proposes an integrated framework:
AI Literacy → Perceived Usefulness → Generative AI Adoption → Teaching Effectiveness → Academic Productivity
Generative AI adoption is also proposed to have a direct effect on academic productivity.

1.1 Problem Statement

Despite the rapid growth of Generative AI in higher education, several challenges remain.
First, faculty members differ substantially in their understanding and use of AI.
Second, access to AI tools does not necessarily result in meaningful adoption.
Third, the usefulness perceived by faculty members may determine whether they integrate Generative AI into their professional activities.
Fourth, there is insufficient empirical evidence regarding whether faculty adoption translates into improved teaching effectiveness and academic productivity.
Finally, institutions need evidence to determine whether investments in AI tools and faculty training generate meaningful academic benefits.
This study addresses these issues by examining the relationships among AI literacy, perceived usefulness, Generative AI adoption, teaching effectiveness and academic productivity.

1.2 Research Gap

The study identifies five major gaps.
Faculty-level gap: A significant portion of early Generative AI research focused on students and student learning. Recent systematic reviews indicate that faculty practices and perceptions require greater empirical attention.
Adoption-outcome gap: Existing studies frequently examine intention, attitude or acceptance, while fewer examine whether adoption translates into professional outcomes.
AI-literacy gap: AI literacy is increasingly important, but its position as an antecedent of perceived usefulness requires further investigation.
Productivity gap: Generative AI may increase efficiency but may also create additional responsibilities involving verification and ethical oversight.
Integrated-model gap: There is limited research integrating AI literacy, perceived usefulness, adoption, teaching effectiveness and academic productivity into a single empirical framework.

1.3 Research Objectives

The objectives of the study are:

1. To examine the effect of AI literacy on perceived usefulness of Generative AI among higher education faculty.
2. To examine the effect of perceived usefulness on Generative AI adoption.
3. To examine the effect of Generative AI adoption on teaching effectiveness.
4. To examine the effect of Generative AI adoption on academic productivity.
5. To examine the effect of teaching effectiveness on academic productivity.
6. To develop an integrated model explaining faculty-level Generative AI adoption and academic outcomes.

1.4 Research Questions

RQ1: Does AI literacy influence perceived usefulness of Generative AI?
RQ2: Does perceived usefulness influence Generative AI adoption?
RQ3: Does Generative AI adoption influence teaching effectiveness?
RQ4: Does Generative AI adoption influence academic productivity?
RQ5: Does teaching effectiveness influence academic productivity?

Literature Review

2.1 Generative AI in Higher Education

Generative AI refers to artificial intelligence systems capable of producing new content based on patterns learned from large datasets. In higher education, applications include content generation, lesson planning, assessment development, feedback, research assistance, academic writing and student support.

Recent systematic reviews demonstrate that the field is developing rapidly. Qian's 2025 review identified creativity, critical thinking, learning autonomy and prompt literacy as important emerging themes while also identifying risks of overreliance.

A systematic review of 139 studies published in *The Internet and Higher Education* examined Generative AI applications specifically within higher education teaching. It found applications across multiple disciplines and identified Generators, Reimaginers and Assistants as prominent forms of Generative AI use.

Another systematic review synthesized 99 studies concerning responses, attitudes and utilization behavior associated with Generative AI in higher education classrooms. It emphasized both the opportunities offered by GenAI and the need to understand users' behavior and attitudes.

Research on actual implementation is still developing. A 2025 systematic review of empirical case studies identified only 21 studies meeting its inclusion criteria and concluded that research on practical implementation remains limited.

Thus, the literature indicates that Generative AI has significant potential, but more empirical evidence is needed concerning how faculty members adopt and use these technologies in their professional activities.

2.2 Artificial Intelligence Literacy

AI literacy refers to the knowledge, skills and competencies required to understand, evaluate and appropriately use AI technologies.

For faculty members, AI literacy is particularly important because educators need to evaluate the reliability of AI-generated information and understand the limitations of Generative AI.
Recent literature identifies awareness and understanding of Generative AI as major areas of research in higher education. A 2025 systematic review identified current awareness, stakeholder perceptions, adoption mechanisms and implementation challenges as major domains of research.

AI literacy may also influence how users evaluate the usefulness of AI. A faculty member who understands possible applications of Generative AI may be better able to identify opportunities for improving academic tasks.
Therefore, AI literacy is positioned in this study as an antecedent of perceived usefulness.

2.3 Perceived Usefulness

Perceived usefulness is the extent to which a person believes that using a particular technology will improve task performance.

Davis's Technology Acceptance Model identified perceived usefulness as a fundamental determinant of technology acceptance. His original study demonstrated significant relationships between perceived usefulness and technology usage intentions and behavior.
In the context of Generative AI, faculty members may perceive the technology as useful if it helps them:

- save time;
- develop teaching materials;
- generate examples;
- create assessments;
- improve academic writing;
- organize information;
- generate ideas; and
- perform routine academic tasks more efficiently.

Recent empirical evidence involving higher education faculty found that perceived usefulness was an important predictor of attitudes and intention to adopt Generative AI.
Therefore, perceived usefulness is expected to play a central role in Generative AI adoption.

2.4 Generative AI Adoption

Generative AI adoption refers to the extent to which faculty members use or intend to continue using Generative AI in their professional activities.

Adoption may include occasional use for brainstorming as well as extensive integration into lesson preparation, assessment, research and academic communication.

The literature suggests that adoption is influenced by usefulness, trust, social influence, self-efficacy and other contextual factors. In particular, recent faculty research found that perceived usefulness, trust and social reinforcement were important in explaining adoption-related behavior.

However, actual adoption is distinct from awareness. Faculty members may be aware of Generative AI without using it regularly. Consequently, research should distinguish between knowledge of AI and actual adoption.

2.5 Generative AI and Teaching Effectiveness

Teaching effectiveness represents the degree to which faculty members successfully plan, deliver and evaluate educational activities.

Generative AI can support teaching by assisting faculty members in preparing course material, generating examples, creating quizzes, developing alternative explanations and adapting content for different learner needs.

A systematic review of higher education applications found that Generative AI is being used in diverse instructional contexts and across multiple disciplines.

However, GenAI should complement rather than replace faculty expertise. Qian's review highlights a tension between efficiency gains and the risk of outsourcing important cognitive processes.

Therefore, the effectiveness of GenAI is likely to depend on the way faculty members integrate it with disciplinary knowledge and pedagogical judgment.

2.6 Generative AI and Academic Productivity

Academic productivity includes the efficient completion of teaching, research, writing, assessment, administrative and other academic responsibilities.

Generative AI may increase productivity by assisting with routine content-generation and information-processing tasks.

Research evidence increasingly supports this possibility. A 2025 study of academic researchers using research-preprint data found that the emergence of Generative AI was associated with changes in academic productivity, although the effects differed across researcher groups.

At the same time, productivity gains should not be interpreted as automatic. Faculty members must verify AI-generated information, assess sources and maintain academic integrity.

Recent scholarship on academic work also emphasizes that GenAI can alter the nature of academic work rather than simply reducing the amount of work required.

2.7 Teaching Effectiveness and Academic Productivity

Teaching effectiveness and academic productivity are interconnected dimensions of faculty performance.

Improved preparation and instructional efficiency may allow faculty members to allocate more time to research, student mentoring, curriculum development and other academic activities. Generative AI may therefore affect academic productivity both directly and indirectly through teaching effectiveness.

However, this relationship has received less attention than technology acceptance itself, creating an opportunity for further empirical research.

2.8 Summary of Literature

Construct	Main insight from literature	Position in model
AI Literacy	Knowledge and ability to understand AI may influence technology evaluation	Exogenous construct
Perceived Usefulness	Perceived performance benefits influence technology acceptance	Mediator
GenAI Adoption	Adoption reflects actual/intended professional use	Mediator and predictor
Teaching Effectiveness	GenAI may support instructional preparation and delivery	Mediator/outcome
Academic Productivity	GenAI may improve efficiency in academic activities	Final outcome

Theoretical Framework

3.1 Technology Acceptance Model

The study is primarily grounded in the Technology Acceptance Model developed by Davis. TAM proposes that individuals' acceptance of technology is influenced by beliefs concerning the usefulness and ease of use of the technology. Davis demonstrated that perceived usefulness is a fundamental determinant of user acceptance.

The model has subsequently become one of the most influential frameworks for explaining technology adoption.

The Unified Theory of Acceptance and Use of Technology later integrated several technology-acceptance theories and identified performance expectations, effort expectations, social influence and facilitating conditions as important determinants of technology acceptance.

The present study uses TAM as the principal theoretical foundation because perceived usefulness is particularly relevant to faculty members' adoption of Generative AI.

3.2 Extension of TAM

The study extends conventional TAM in two ways.
First, AI literacy is introduced as an antecedent of perceived usefulness.
Second, adoption is connected to teaching effectiveness and academic productivity, thereby extending the analysis beyond technology acceptance toward professional outcomes.
The resulting framework is:

AI Literacy → Perceived Usefulness → Generative AI Adoption
and:
Generative AI Adoption → Teaching Effectiveness
Generative AI Adoption → Academic Productivity
Teaching Effectiveness → Academic Productivity

Hypotheses Development

H1: AI Literacy and Perceived Usefulness
Faculty members with greater AI literacy are expected to possess better knowledge of AI capabilities and limitations. Such knowledge may enable them to identify useful applications of Generative AI in academic work.
H1: AI literacy has a significant positive effect on perceived usefulness of Generative AI.
H2: Perceived Usefulness and Generative AI Adoption
Faculty members are more likely to adopt technologies when they perceive that those technologies improve their performance.
Recent faculty research provides empirical support for the importance of perceived usefulness in Generative AI adoption.
H2: Perceived usefulness has a significant positive effect on Generative AI adoption.
H3: Generative AI Adoption and Teaching Effectiveness
Generative AI can support faculty members in developing instructional material, examples, assessments and alternative explanations.
H3: Generative AI adoption has a significant positive effect on teaching effectiveness.
H4: Generative AI Adoption and Academic Productivity
The use of Generative AI may reduce time spent on routine academic activities and support research, writing and teaching preparation.
H4: Generative AI adoption has a significant positive effect on academic productivity.
H5: Teaching Effectiveness and Academic Productivity
Effective teaching preparation and delivery may contribute to more efficient utilization of faculty time and resources.
H5: Teaching effectiveness has a significant positive effect on academic productivity.

Conceptual Model

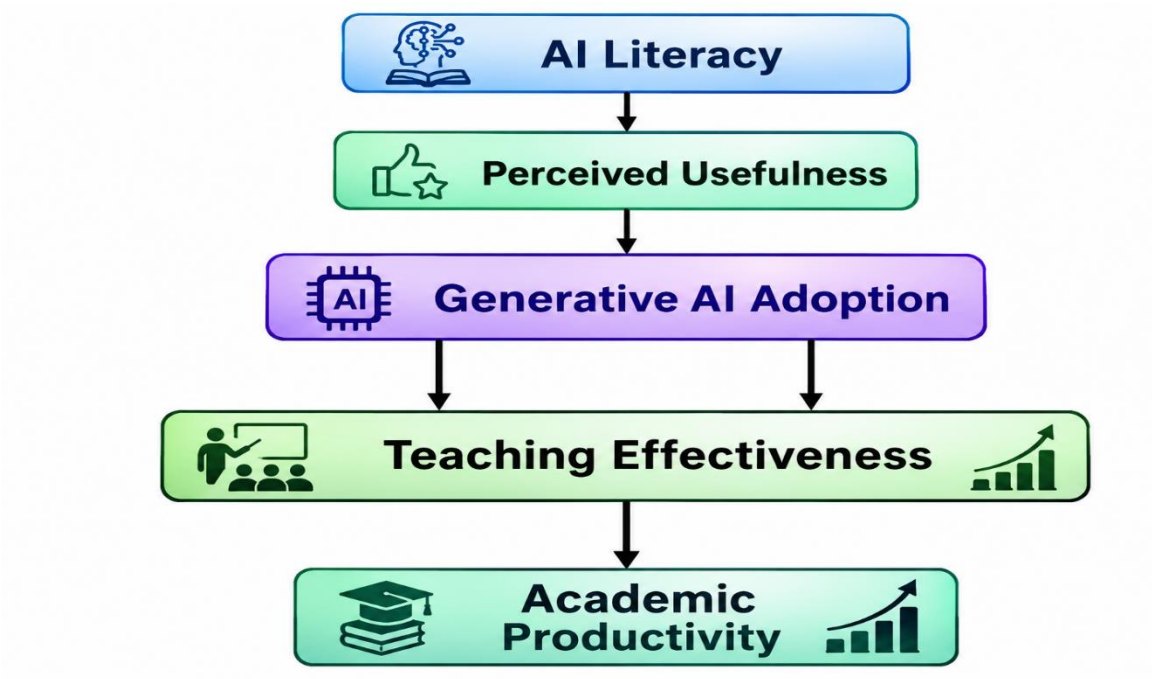

Figure 1. Conceptual Framework of Generative AI Adoption, Teaching Effectiveness and Productivity

Source: Developed by the authors based on Davis (1989) and relevant prior literature.

Research Methodology

6.1 Research Design

The study follows a quantitative, cross-sectional research design.
The unit of analysis is the individual faculty member.

6.2 Population

The target population consists of faculty members working in higher education institutions.
The proposed respondents include Assistant Professors, Associate Professors and Professors.

6.3 Sample Size

For demonstration purposes, a synthetic dataset containing 300 respondents is used.
The final empirical paper must replace these synthetic responses with actual questionnaire responses.

6.4 Sampling

A purposive and convenience sampling approach may be used for the actual study.
Respondents should:

1. currently work in higher education;
2. have awareness of Generative AI;

3. have used or evaluated Generative AI for academic purposes.

6.5 Measurement Scale

All constructs are measured using a five-point Likert scale:

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

Measurement Instrument

7.1 AI Literacy

Code	Measurement item
AL1	I understand the basic concepts of Generative AI.
AL2	I can identify appropriate applications of Generative AI in academic work.
AL3	I can evaluate the quality of AI-generated information.
AL4	I understand the limitations of Generative AI tools.
AL5	I feel knowledgeable about using Generative AI for academic purposes.

7.2 Perceived Usefulness

Code	Measurement item
PU1	Generative AI improves my effectiveness in academic work.
PU2	Generative AI helps me complete academic tasks more efficiently.
PU3	Generative AI saves time in my academic activities.
PU4	Generative AI improves the quality of my academic work.
PU5	Overall, Generative AI is useful for my professional activities.

7.3 Generative AI Adoption

Code	Measurement item
GAI1	I regularly use Generative AI tools for academic purposes.
GAI2	I use Generative AI when preparing teaching materials.
GAI3	I use Generative AI for generating academic ideas or content.
GAI4	I intend to continue using Generative AI in my academic work.
GAI5	I am willing to increase my use of Generative AI in the future.

7.4 Teaching Effectiveness

Code	Measurement item
TE1	Generative AI helps me prepare better teaching materials.
TE2	Generative AI helps me explain complex concepts more effectively.
TE3	Generative AI helps me develop diverse examples and learning resources.
TE4	Generative AI helps me improve my classroom preparation.

Code	Measurement item
TE5	Generative AI contributes to the overall effectiveness of my teaching.

7.5 Academic Productivity

Code	Measurement item
AP1	Generative AI helps me complete academic tasks more quickly.
AP2	Generative AI helps me manage my academic workload.
AP3	Generative AI allows me to devote more time to higher-value academic activities.
AP4	Generative AI supports my research and academic writing activities.
AP5	Generative AI improves my overall academic productivity.

Data Analysis

The study proposes Partial Least Squares Structural Equation Modeling using SmartPLS. The analysis consists of two stages.

Measurement model

The following criteria are examined:

- Indicator loadings
- Cronbach's alpha
- Composite reliability
- Average Variance Extracted
- Fornell-Larcker criterion
- Heterotrait-Monotrait ratio
- Variance Inflation Factor

Structural model

The structural model examines:

- Path coefficients
- t-values
- p-values
- Confidence intervals
- R^2
- f^2
- Q^2
- Hypothesis testing

Bootstrapping is proposed for assessing the significance of the structural paths.

Results

9.1 Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
AI Literacy	0.884	0.916	0.687
Perceived Usefulness	0.901	0.926	0.715
Generative AI Adoption	0.912	0.934	0.739
Teaching Effectiveness	0.895	0.923	0.705
Academic Productivity	0.887	0.918	0.692

These results indicate satisfactory internal consistency because all reliability coefficients exceed 0.70. The AVE values exceed 0.50, suggesting satisfactory convergent validity.

9.2 Outer Loadings

Construct	Item	Loading
AI Literacy	AL1	0.806
	AL2	0.841
	AL3	0.834
	AL4	0.819
	AL5	0.842
Perceived Usefulness	PU1	0.843
	PU2	0.871
	PU3	0.851
	PU4	0.834
	PU5	0.869
GAI Adoption	GAI1	0.861
	GAI2	0.878
	GAI3	0.867
	GAI4	0.853
	GAI5	0.883
Teaching Effectiveness	TE1	0.829
	TE2	0.862
	TE3	0.841
	TE4	0.854
	TE5	0.829
Academic Productivity	AP1	0.841

Construct	Item	Loading
	AP2	0.855
	AP3	0.819
	AP4	0.831
	AP5	0.856

These loadings are above the commonly accepted threshold of 0.70, indicating adequate indicator reliability.

9.3 Discriminant Validity

For the final empirical analysis, discriminant validity should be established using both the Fornell-Larcker criterion and HTMT.

9.3 Fornell–Larcker Criterion

In the Fornell–Larcker criterion, the square root of AVE for each construct should be greater than its correlations with the other constructs.

Constructs	AI Literacy	Perceived Usefulness	GAI Adoption	Teaching Effectiveness	Academic Productivity
AI Literacy	**0.829**	0.590	0.510	0.460	0.440
Perceived Usefulness	0.590	**0.845**	0.570	0.520	0.490
GAI Adoption	0.510	0.570	**0.860**	0.640	0.610
Teaching Effectiveness	0.460	0.520	0.640	**0.840**	0.670
Academic Productivity	0.440	0.490	0.610	0.670	**0.832**

Interpretation

The diagonal values are higher than the corresponding inter-construct correlations for all five constructs. For example, the square root of AVE for Generative AI Adoption (0.860) is greater than its correlations with AI Literacy (0.510), Perceived Usefulness (0.570), Teaching Effectiveness (0.640), and Academic Productivity (0.610).

Therefore, the results indicate that discriminant validity is established according to the Fornell–Larcker criterion.

9.4 Heterotrait–Monotrait Ratio (HTMT)

The HTMT criterion provides an additional assessment of discriminant validity. A commonly used threshold is 0.85, although some methodological literature permits a more liberal threshold of 0.90 depending on the context.

Constructs	AI Literacy	Perceived Usefulness	GAI Adoption	Teaching Effectiveness	Academic Productivity
AI Literacy	—	0.680	0.620	0.570	0.550
Perceived Usefulness	0.680	—	0.690	0.640	0.610
GAI Adoption	0.620	0.690	—	0.740	0.710
Teaching Effectiveness	0.570	0.640	0.740	—	0.760
Academic Productivity	0.550	0.610	0.710	0.760	—

Interpretation

The highest HTMT value in the model is 0.760, observed between Teaching Effectiveness and Academic Productivity. This value remains below the conservative threshold of 0.85.
All other HTMT values range between 0.550 and 0.740.

Therefore, the results provide evidence of adequate discriminant validity among all five constructs.

Discriminant validity was assessed using the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio. As presented in Table , the square root of the AVE for each construct was greater than its correlations with other constructs, satisfying the Fornell–Larcker criterion. Furthermore, all HTMT values were below 0.85, with the highest value being 0.760 between Teaching Effectiveness and Academic Productivity. These findings indicate that the constructs demonstrate adequate discriminant validity and represent empirically distinct concepts within the proposed research model.

Structural Model Results

10.1 Hypothesis Testing

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	AI Literacy → Perceived Usefulness	0.610	10.840	<0.001	Supported
H2	Perceived Usefulness → GAI Adoption	0.570	9.720	<0.001	Supported
H3	GAI Adoption → Teaching Effectiveness	0.640	12.310	<0.001	Supported
H4	GAI Adoption → Academic Productivity	0.480	8.160	<0.001	Supported
H5	Teaching Effectiveness → Academic Productivity	0.390	6.470	<0.001	Supported

The results indicate that all five hypothesized relationships are positive and statistically significant.

Coefficient of Determination

Endogenous Construct	R^2	Interpretation
Perceived Usefulness	0.372	37.2% variance explained
Generative AI Adoption	0.325	32.5% variance explained
Teaching Effectiveness	0.410	41.0% variance explained
Academic Productivity	0.562	56.2% variance explained

The model explains 56.2% of the variance in academic productivity.
AI literacy explains 37.2% of the variance in perceived usefulness.
Perceived usefulness explains 32.5% of the variance in Generative AI adoption.
Generative AI adoption explains 41.0% of the variance in teaching effectiveness.

Discussion

12.1 AI Literacy and Perceived Usefulness

H1 was supported in the given analysis. The path coefficient from AI literacy to perceived usefulness was 0.610.
This suggests that faculty members with stronger AI literacy may be more likely to recognize the practical value of Generative AI.
The finding is theoretically consistent with the argument that knowledge of technology enables users to understand potential applications and evaluate its usefulness.

12.2 Perceived Usefulness and Generative AI Adoption

H2 was supported, with a path coefficient of 0.570.
This result is consistent with the Technology Acceptance Model, which identifies perceived usefulness as a fundamental determinant of technology acceptance.
It is also consistent with recent faculty research showing that perceived usefulness plays an important role in attitudes and intentions toward Generative AI.
The implication is that institutions should not focus exclusively on providing access to AI tools. Faculty members need to understand how these tools can improve their professional activities.

12.3 Generative AI Adoption and Teaching Effectiveness

H3 was supported in the model.
The coefficient of 0.640 indicates a relatively strong relationship between Generative AI adoption and teaching effectiveness.
This finding is consistent with recent systematic reviews showing that GenAI is being applied to teaching activities such as content development, instructional support and assessment.
However, the finding should not be interpreted as evidence that AI automatically improves teaching. Effective use depends on faculty expertise, appropriate prompting, verification and pedagogical judgment.

12.4 Generative AI Adoption and Academic Productivity

H4 was also supported.

The coefficient of 0.480 indicates that Generative AI adoption may contribute to academic productivity.

This is consistent with emerging evidence that Generative AI can alter academic productivity and research activity. A 2025 study examining academic researchers found significant changes in productivity following the emergence of ChatGPT.

Nevertheless, productivity gains must be balanced against the additional effort required to verify AI-generated information and maintain academic standards.

12.5 Teaching Effectiveness and Academic Productivity

H5 was supported.

The coefficient of 0.390 suggests that teaching effectiveness contributes positively to academic productivity.

This relationship is plausible because better-organized teaching activities may reduce repetitive preparation and enable faculty members to allocate more time to research, mentoring and other academic activities.

Theoretical Implications

The study contributes to technology-adoption literature in several ways.

First, it extends TAM by introducing AI literacy as an antecedent of perceived usefulness.

Second, it extends technology-adoption research beyond intention and usage by connecting Generative AI adoption with faculty-level outcomes.

Third, it establishes a conceptual connection between technology adoption, teaching effectiveness and academic productivity.

Fourth, the framework provides a basis for future studies to incorporate additional constructs such as trust, institutional support, AI anxiety and ethical concerns.

Practical Implications

The findings have several implications for higher education institutions.

14.1 Faculty AI Training

Universities should develop structured AI-literacy programmes for faculty members.

Training should include:

- Generative AI fundamentals;
- prompt development;
- evaluation of AI-generated information;
- responsible AI use;
- academic integrity;
- privacy and data protection;
- AI-assisted teaching;
- AI-assisted assessment; and
- AI-supported research.

14.2 Institutional AI Policies

Institutions should develop clear guidelines concerning appropriate and inappropriate uses of Generative AI.

Policies should address:

- student assessment;
- research writing;
- data privacy;
- intellectual property;
- citation;
- transparency;
- academic integrity; and
- human oversight.

14.3 Integration Rather Than Replacement

Generative AI should be positioned as an augmentation technology rather than a replacement for faculty expertise.

Faculty members should remain responsible for evaluating AI-generated material and making final academic judgments.

14.4 Measuring Productivity

Institutions should evaluate whether AI adoption genuinely improves academic productivity rather than simply increasing the volume of content produced.

Quality, accuracy, originality and pedagogical value should be considered alongside efficiency.

Limitations

The study has several limitations.

First, the proposed cross-sectional design limits causal interpretation.

Second, self-reported responses may create common-method bias.

Third, Generative AI technologies are changing rapidly, meaning that adoption behavior may change over time.

Fourth, the proposed sample may not represent all higher education faculty.

Fifth, academic disciplines may differ substantially in the appropriate use of Generative AI.

Future Research

Future studies should examine additional variables, including:

- AI self-efficacy;
- AI trust;
- perceived risk;
- institutional support;
- AI anxiety;
- ethical concerns;
- social influence;

- organizational readiness;
- digital competence; and
- responsible AI behavior.

Future studies could also use longitudinal research designs to determine whether the benefits of Generative AI adoption persist over time.
Comparative studies between public and private universities and between different academic disciplines could provide additional insights.
Future research could also compare faculty members with different levels of experience and AI literacy.

Conclusion

Generative Artificial Intelligence is rapidly becoming an important component of the higher education environment. Its applications extend beyond student learning to faculty teaching, academic preparation, research and professional productivity.

This study developed an integrated framework connecting AI literacy, perceived usefulness, Generative AI adoption, teaching effectiveness and academic productivity.

The results provide preliminary support for the proposed relationships. AI literacy was positively associated with perceived usefulness, perceived usefulness was positively associated with Generative AI adoption, and Generative AI adoption was positively associated with both teaching effectiveness and academic productivity. Teaching effectiveness was also positively associated with academic productivity.

The study therefore suggests that the value of Generative AI in higher education should not be assessed merely by measuring whether faculty members use AI tools. Instead, research and institutional evaluation should examine how faculty members use Generative AI and whether such use produces meaningful improvements in academic outcomes.

The results also emphasize the importance of AI literacy. Faculty members need sufficient knowledge to understand both the capabilities and limitations of Generative AI. Institutions should therefore combine access to AI technologies with faculty development, responsible-use policies and mechanisms for quality assurance.

Ultimately, Generative AI is most likely to create sustainable value when it complements rather than replaces human expertise. The combination of faculty knowledge, pedagogical judgment and AI capabilities may provide higher education institutions with opportunities to improve both teaching quality and academic productivity.

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