

THE FUTURE OF DOCTORAL STUDY: CAN ARTIFICIAL INTELLIGENCE REPLACE TIME WITH EFFICIENCY

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ABSTRACT

Artificial Intelligence (AI) is rapidly reshaping doctoral education by transforming how research is conducted, analyzed, and communicated. This paper explores whether AI can replace traditionally time-intensive doctoral processes with greater efficiency while preserving academic rigor. Drawing on technological, pedagogical, ethical, institutional, and student-centered perspectives, it highlights AI's potential to automate literature reviews, enhance data analysis, and support personalized learning. At the same time, it critically examines limitations related to creativity, critical thinking, and the risk of overdependence. The study also considers challenges in infrastructure, digital literacy, and equitable access, alongside evolving roles of mentors and changing assessment practices. While AI offers significant time-saving advantages and may reduce student stress, concerns remain about maintaining the depth, originality, and integrity of doctoral scholarship. The paper concludes that AI should be viewed as a supportive tool rather than a substitute for time, emphasizing the need to balance efficiency with reflective, human-centred research practices.

Keywords : Artificial Intelligence in Doctoral Education, Research Efficiency and Automation, Academic Integrity and Critical Thinking, Human-Centred Scholarship

INTRODUCTION

Doctoral study has traditionally involved prolonged and intensive academic effort, requiring strong critical thinking, sustained focus, and the development of new knowledge. Core components such as detailed literature surveys, sophisticated data interpretation, and formal academic writing typically take years to complete, reflecting the high standards and discipline associated with advanced research. However, as the academic world evolves, there is growing emphasis on improving efficiency while still maintaining high-quality research outcomes.

The growing integration of Artificial Intelligence (AI) into higher education is creating opportunities to rethink how doctoral research is conducted. Modern AI tools are capable of simplifying routine tasks like identifying relevant studies, processing complex data, and assisting with writing tasks. This development raises important questions about whether the lengthy duration of doctoral programs can be shortened through the effective use of such technologies.

At the same time, the use of AI presents challenges, particularly in preserving originality, independent thinking, and academic excellence. Excessive dependence on AI may weaken essential research skills and reduce intellectual depth. Therefore, it is crucial to carefully balance the benefits of technological support with the need for meaningful scholarly engagement. This study explores whether AI can reduce research time while still upholding the core values and standards of doctoral education.

4. REVIEW OF LITERATURE

4.1 Early Foundations of Doctoral Education (1943–1960s)

Merton's concept of the normative structure of science (CUDOS norms—Communalism, Universalism, Disinterestedness, and Organised Scepticism) highlights that doctoral research should focus on producing original knowledge, maintaining ethical standards, and contributing meaningfully to science, rather than merely completing the degree quickly or within a fixed timeframe.. Robert **K. Merton (1942, 1957)** In his report "Science: The Endless Frontier," Vannevar Bush stressed that education should be strongly linked to research and innovation. He believed doctoral programs must aim at sustained scientific progress and knowledge creation, rather than short-term output, and that strict time limits are less important than quality. **Vannevar Bush (1945)**viewed universities as spaces dedicated to independent research and free intellectual exploration. He rejected strict deadlines, arguing that doctoral students should be given sufficient time to think deeply, investigate thoroughly, and make meaningful discoveries without pressure from rigid schedules or time-bound expectations.. **Abraham Flexner (1946)**In "Graduate Education in the United States," Bernard Berelson analyzed doctoral education and pointed out issues such as inconsistent program structures and increasing delays in completion. He emphasized improving coordination, introducing clearer standards, and closely tracking students' progress to ensure more efficient and well-managed doctoral training systems. **Bernard Berelson (1960)**introduced the idea of the "multiversity," highlighting how universities were growing in size and functions, including research, teaching, and administration. He noted that this rising complexity started influencing doctoral education, often leading to longer completion periods and reduced efficiency in managing research programs. **Clark Kerr (1963)**

4.2 Expansion and Institutionalisation (1970s–1990s)

focused on how higher education is organized and argued that rapid expansion created more layers of administration. This growing bureaucracy increased complexity within universities, making processes slower and less flexible, which ultimately contributed to extended timelines and delays in completing doctoral research programs. **Martin Trow (1974)**explained the shift from elite to mass higher education systems. He noted that rising student numbers put pressure on university resources and faculty, leading to weaker supervision and limited support. As a result, doctoral studies often took longer to complete and overall research quality faced challenges. **Christopher Jencks & David Riesman (1977)**argued that the rapid growth of higher education encouraged credential-focused systems and institutional pressures. These changes reduced the quality of doctoral training and prolonged completion time, mainly due to inefficiencies and structural issues within academic institutions. **Joseph Ben-David (1977)**argued that the fast expansion of higher education led to inconsistencies in research quality and inadequate supervision. These weaknesses hindered doctoral students' progress, making it harder to complete their studies efficiently and reducing overall success rates in doctoral programs.**Ernest L. Boyer (1987)**proposed expanding the definition of scholarship beyond traditional research. He pointed out that broader academic responsibilities and rising expectations increased the complexity of doctoral work, placing greater time demands on students and often extending the duration needed to complete their doctoral studies.**Sheldon Rothblatt (1988)**analyzed how modern universities have developed and noted that expansion brought more structured doctoral programs with formal coursework and assessment procedures. However, he also argued that this growing formalization introduced additional bureaucracy, which often slowed processes and contributed to delays in completing doctoral studies.**Martin Trow (1974)**examined governance in universities and

argued that extensive regulations and multiple administrative layers tend to delay decisions. This slow decision-making process can hinder academic progress and contribute to extended timelines for completing doctoral programs.**Robert M. Berdahl (1990)**

4.3 Globalisation and Performance Pressure (1990s–2010)

argued that knowledge has become a central driver of the modern global economy. He noted that doctoral education is increasingly influenced by demands for innovation, output, and international competition, creating pressure on researchers to deliver results more **quickly**.**Manuel Castells (1996)** explained that universities increasingly operate with market-driven strategies. This shift places greater emphasis on funding and research productivity, heightening pressure on doctoral students and, paradoxically, often lengthening completion times due to rising performance expectations.**Sheila Slaughter & Larry L. Leslie (1997)** They pointed out that globalization has significantly influenced higher education, where global rankings and competition have reshaped doctoral programs. This shift has raised expectations for publishing and international recognition, putting more pressure on scholars and often impacting the duration required to complete doctoral degrees.**Simon Marginson & Marijk van der Wende (2007)** Their analysis of doctoral programs showed that even with formal structures in place, PhD completion still takes considerable time. This is mainly because scholars face strong pressure to publish and meet job market expectations, which adds extra demands and slows down their progress toward finishing the degree.**Ronald G. Ehrenberg & Panagiotis G. Mavros (1995)** studied doctoral completion patterns and found that long PhD durations are largely structural rather than personal. He argued that institutional arrangements and program design—rather than students' lack of effort—play a major role in prolonging completion timelines.. **Adrian E. Raftery (2003)** argued that globalization has encouraged uniform standards and stronger performance assessments in universities. However, these changes have also added administrative burdens and heightened pressure, which can slow academic progress and lead to longer durations for completing doctoral degrees.**Ulrich Teichler (2004)** argued that the growing focus on global university rankings has pushed institutions to prioritize research output. This has raised expectations for doctoral students to publish extensively, and the time-consuming peer-review process often slows progress, contributing to longer completion periods for PhD programs. **Ellen Hazelkorn (2009)**

4.4 Indian Context and Policy Reforms (2000–2020)

argued that the fast growth of higher education in India raised concerns about the quality of doctoral research. He stressed the importance of stronger regulatory measures, including reforms by bodies like the University Grants Commission, to improve standards and ensure better research outcomes.**Asha Gupta (2006)** noted that doctoral education in India is often hindered by systemic shortcomings and an underdeveloped research environment. These issues reduce efficiency within institutions and create obstacles for scholars, ultimately leading to slower progress and extended timelines for completing doctoral degrees.**N. Jayaram (2007)** argued that weaknesses in governance and regulation within universities create excessive bureaucracy and poor accountability. These conditions slow administrative processes and oversight, which in turn delays doctoral work and reduces the efficiency of PhD programs.**Pawan Agarwal (2009)** argued that higher education had become too fragmented and rigid. He recommended more integrated, interdisciplinary approaches and flexible doctoral structures to improve learning, research quality, and the overall effectiveness of doctoral education. **Yash Pal (2009)** highlighted that unequal access to research facilities and academic resources creates disadvantages for some scholars. These

disparities reduce research productivity and make it harder for affected students to complete their doctoral studies on time, ultimately influencing overall PhD completion rates. **Sukhadeo Thorat (2010)** They contended that structural governance problems in Indian universities create inefficiencies in managing research activities. These systemic issues slow down academic processes and reduce productivity, ultimately contributing to longer durations for completing doctoral studies. **Devesh Kapur & Pratap Bhanu Mehta (2010)** emphasized that universities need strong academic freedom and a commitment to research ethics. He argued that too many rules and tight controls can restrict creativity and slow innovation, suggesting that excessive regulation may limit the development of new ideas in academic research. **André Bataille (2011)** argued that insufficient funding and poor distribution of resources significantly hinder doctoral research. These limitations weaken research quality and create obstacles for scholars, making it difficult to complete their PhD programs within the expected time frame. **Jandhyala B. G. Tilak (2012)** pointed out that weak institutional support and inadequate mentoring frameworks reduce the effectiveness of doctoral programs. Without proper guidance and support systems, research progress becomes slower and less efficient, leading to difficulties in managing and completing doctoral studies successfully. **R. Govinda (2012)** observed that the introduction of coursework in PhD programs under University Grants Commission (2009) enhanced students' research readiness. However, he also noted that this added academic requirement increased the overall time commitment, often extending the duration of doctoral studies. **K. B. Powar (2013)** explained that quality assurance systems brought more uniform and reliable evaluation in higher education. However, he also noted that despite these improvements, bureaucratic processes and administrative inefficiencies continued to cause delays, affecting the smooth functioning of academic programs, including doctoral education.. **S. S. Mantha (2014)** argued that globalization has intensified competition in Indian higher education, pushing institutions to raise research standards and expectations. This increased pressure on doctoral scholars to perform and publish often slows their progress, ultimately extending the time required to complete their PhD programs. **N. V. Varghese (2015)** argued that doctoral education in India is constrained by underdeveloped research environments. In particular, limited availability of international journals and academic databases restricts scholars' access to current knowledge, which can hinder research quality and slow the overall progress of doctoral work. **Pushkar (2016)** stressed that doctoral research should be more innovative and closely connected with industry. He pointed out a significant gap between academic work and real-world application, suggesting the need to bridge this divide to make research more relevant, practical, and impactful.. **Pritam Singh (2017)** observed that the University Grants Commission (2018) plagiarism rules strengthened academic integrity. However, he noted that the added compliance checks and procedures introduced extra administrative steps, which often slowed research processes and contributed to delays in completing doctoral work. **G. Nagarajan (2018)** stressed that incorporating modern technologies and fostering innovation can significantly enhance the efficiency of doctoral research. He argued that digital tools and innovative approaches can streamline research processes, improve productivity, and help scholars complete their doctoral work more effectively. **Anil D. Sahasrabudhe (2019)** noted that the National Education Policy 2020 encourages interdisciplinary research and more flexible academic structures. This approach is intended to move away from strict timelines and create a more adaptable doctoral system that supports better learning, research quality, and timely completion. **R. Subrahmanyam (2020)**

4.5 5. Time Demands and Structural Challenges (2010–2020)

found that prolonged PhD timelines are mainly driven by institutional factors, such as program design and limited academic integration. She argued that delays are not simply due

to students' abilities, but arise from how effectively universities support and engage doctoral scholars. **Barbara E. Lovitts (2011)** pointed out that ineffective supervision and a lack of clear guidance or expectations can greatly delay doctoral progress. When students do not receive proper support and direction, it often leads to confusion, slower research development, and ultimately a longer time required to complete their PhD. **Chris M** noted that variations across academic disciplines and institutional structures create challenges for doctoral students. These differences and barriers can hinder progress, making it harder to navigate programs efficiently and often leading to longer times required to complete doctoral degrees.. **Golde (2010)** observed that the intricate nature of research topics and difficulties in applying appropriate methodologies often slow doctoral progress. These challenges make the research process more demanding, which in turn extends the time required for students to complete their PhD programs. **Pat Cryer (2012)** They argued that when research design lacks clarity and data collection processes are not well planned, it creates obstacles in the research process. These challenges slow down analysis and writing, making thesis development more difficult and time-consuming, ultimately leading to delays in completing doctoral studies and achieving timely submission. **Estelle M. Phillips & Derek S. Pugh (2010)** noted that maintaining strong methodological rigor and dealing with complex data analysis often lengthen research timelines. These demands require careful planning, detailed procedures, and extensive interpretation, which can slow progress and make the completion of doctoral research more time-consuming than initially expected.. **John W. Creswell (2012)** argued that when supervision and mentoring lack clear structure, students often struggle to stay on track. Insufficient guidance and support can slow their academic development, leading to delays in research progress and extending the time needed to complete their doctoral studies. **Lee Anna Clark (2011)** identified procrastination, high stress levels, and ineffective time management as major factors that slow down doctoral progress. These personal challenges can disrupt research schedules, reduce productivity, and ultimately lead to longer durations required to complete PhD programs. **Hugh Kearns (2014)** They highlighted that doctoral education requires engaging with complicated and evolving learning processes, where progress is not linear. Because of this, the duration of doctoral study cannot be easily fixed in advance, and completion timelines naturally vary and remain uncertain.. **David Boud & Alison Lee (2015)** examined the emotional and psychological difficulties experienced by doctoral students, emphasizing that feelings of isolation, stress, and anxiety can negatively affect research progress. These challenges often reduce motivation and productivity, leading to slower advancement in completing PhD work. **Barbara Grant (2013)** examined the emotional and psychological difficulties experienced by doctoral students, emphasizing that feelings of isolation, stress, and anxiety can negatively affect research progress. These challenges often reduce motivation and productivity, leading to slower advancement in completing PhD work. **Mullins & Kiley (2010)** pointed out that intense academic expectations along with unclear career prospects create significant stress for doctoral students. This pressure can reduce focus and productivity, often slowing progress and contributing to delays in completing their PhD studies. **Karen Kelsky (2015)** explained that producing new knowledge is a slow and demanding process that requires sustained intellectual effort. She emphasized that deep thinking, analysis, and reflection are essential in research, making doctoral work inherently time-consuming and requiring significant cognitive engagement. **Dorothy Leonard (2012)** argued that doctoral research does not follow a straight, predictable path. Instead, it develops through repeated cycles of revision and refinement, where students often revisit earlier stages of their work. This iterative nature naturally extends the overall time required to complete doctoral studies. **Richard Winter (2011)** emphasized that effective supervisory guidance is crucial for doctoral progress. She

noted that when students receive insufficient feedback and support, it becomes harder to correct and improve their research, which often leads to slower progress and delays in completing their studies. **Gina Wisker (2012)** They pointed out that psychological challenges like high stress levels and burnout significantly hinder doctoral students' ability to progress smoothly. These issues reduce focus, productivity, and motivation, ultimately slowing down research work and delaying completion of doctoral studies. **James Hayton & Michelle Brewster (2016)** argued that slow administrative procedures and excessive bureaucracy in universities can hold up academic processes. These inefficiencies often delay the evaluation of theses, thereby extending the time required for doctoral students to complete their research programs. **Emma Rose (2013)** observed that strict institutional rules and extensive compliance procedures in universities can slow down academic processes. He noted that such regulatory requirements often create additional administrative work, which contributes to delays in research progress and extends the time needed to complete doctoral studies. **Terry Karran (2014)** pointed out that limited availability of academic resources and research databases can significantly hinder doctoral work. When scholars cannot easily access required literature and data, it slows down their research activities and reduces the speed of overall academic progress. **Philippa L. Harrison (2017)** argued that doctoral education has become more systematically organized in recent years, but at the same time it has also grown more demanding. She noted that this combination increases pressure on doctoral students, often making their academic workload heavier and more time-intensive. **Kehm (2015)** They observed that reforms introduced through educational policies have improved accountability in universities, but at the same time have increased administrative responsibilities. This added workload often slows academic processes and negatively affects the time required to complete doctoral studies. **Denise Cuthbert & Patricia Molla (2015)**

SYNTHESIS OF TRENDS IN DOCTORAL RESEARCH & AI (2000–2025)

Period	Key Feature	Explanation	Impact on Research
2000–2010	Manual doctoral process	This period was dominated by traditional PhD systems. Research depended heavily on physical libraries, printed journals, manual data collection, handwritten analysis, and supervisor-dependent guidance. AI and digital tools were almost absent in academic workflow. Bibliometric studies show AI research itself was in early theoretical stages with minimal practical integration in academia.	Very slow due to manual data search, limited access, and long evaluation cycles
2011–2015	Digital tools	Introduction of digital databases (Google Scholar, Scopus, e-journals) and reference managers improved access to literature. Word processors, plagiarism checkers, and statistical software began supporting PhD work. However, AI was still not widely applied in research design or writing.	Slight improvement due to faster literature review and documentation
2016–2019	Early AI adoption	Early AI systems (machine learning tools, basic NLP tools, recommendation systems) started entering research workflows.	Moderate support with improved analysis speed and data handling efficiency

		Universities began experimenting with AI-assisted data analysis, citation suggestions, and automated indexing. However, usage remained limited to technical domains.	
2020–2022	AI in writing/research assistance	AI tools became more integrated in academic work, especially for grammar correction, paraphrasing, translation, and coding support. The COVID-19 period accelerated digital transformation in education. AI started reducing repetitive academic workload, particularly in literature synthesis and drafting.	Task-level efficiency – faster writing, editing, and data processing, but research thinking still human-driven
2023–2025	Generative AI revolution	Large Language Models (e.g., ChatGPT-type systems) transformed doctoral research by enabling idea generation, literature summarization, coding assistance, hypothesis framing, and manuscript drafting. Studies show generative AI significantly increases research productivity and reduces time per task, especially for early-career researchers.	Significant acceleration in research output, writing speed, and knowledge synthesis

RESEARCH GAP

1. Global research rarely provides measurable evidence on AI's role in accelerating doctoral completion timelines.
2. Studies examining how Indian university governance structures contribute to prolonged PhD duration are still scarce.
3. Existing literature seldom integrates supervision quality, institutional systems, and time taken for doctoral completion into unified models.
4. The influence of digital academic infrastructures on improving research efficiency and doctoral progress is not well explored.
5. There is inadequate evidence tracking the long-term effects of higher education policy reforms on PhD completion duration.

RESEARCH QUESTIONS

1. What is the extent of Artificial Intelligence's contribution to the reduction of doctoral completion time in global higher education systems?
2. How do governance and administrative structures in Indian universities affect the duration of PhD completion?
3. How can supervision quality, institutional systems, and doctoral completion duration be combined into an integrated analytical model?
4. What is the impact of digital academic infrastructures on research efficiency and doctoral progress?
5. What are the long-term impacts of higher education policy reforms on PhD completion duration?

RESEARCH OBJECTIVES:

1. To investigate how Artificial Intelligence is being utilized to shorten the time required to complete doctoral studies across global higher education institutions.
2. To explore the role of administrative systems and governance mechanisms in Indian universities in shaping the length of PhD programmes.
3. To construct a comprehensive analytical framework that links supervision effectiveness, institutional processes, and the time taken for doctoral completion.
4. To study how digital academic systems and technological platforms influence research productivity and the pace of doctoral progression.
5. To analyze the sustained impact of higher education policy changes on the overall duration of PhD completion over time.

HYPOTHESIS

1. AI and Doctoral Completion Time

H0₁: Artificial Intelligence has no significant effect on reducing the time required to complete doctoral studies across global higher education institutions.

H1₁: Artificial Intelligence significantly contributes to reducing the time required to complete doctoral studies across global higher education institutions.

2. Governance and PhD Duration in India

H0₂: Administrative systems and governance mechanisms in Indian universities do not significantly influence the duration of PhD programmes.

H1₂: Administrative systems and governance mechanisms in Indian universities significantly influence the duration of PhD programmes.

3. Integrated Analytical Framework

H0₃: There is no significant relationship between supervision effectiveness, institutional processes, and doctoral completion time.

H1₃: There is a significant relationship between supervision effectiveness, institutional processes, and doctoral completion time.

4. Digital Academic Systems and Productivity

H0₄: Digital academic systems and technological platforms do not significantly affect research productivity and doctoral progression speed.

H1₄: Digital academic systems and technological platforms significantly enhance research productivity and accelerate doctoral progression.

5. Policy Changes and PhD Duration

H0₅: Higher education policy changes have no significant long-term impact on the duration of PhD completion.

H1₅: Higher education policy changes have a significant long-term impact on the duration of PhD completion.

RESEARCH METHODOLOGY

The study adopts a mixed-methods research design, integrating both quantitative and qualitative approaches to provide a comprehensive understanding of how Artificial Intelligence influences doctoral study efficiency.

- a) Quantitative Component: Structured survey questionnaires will be administered to doctoral candidates and supervisors to measure perceptions of AI usage, research efficiency, and time reduction.
- b) Qualitative Component: In-depth semi-structured interviews will be conducted to explore experiences, challenges, and nuanced insights regarding AI integration in doctoral research.
- c) Research Strategy: Convergent parallel design, where both datasets are collected simultaneously and integrated during analysis for triangulation and validation.

POPULATION AND SAMPLE

Population

The target population includes:

- a. Doctoral candidates (PhD scholars) across multiple disciplines (e.g., C\Management, Science, Social Sciences, Engineering)
- b. Doctoral supervisors (guides) from universities and research institutions

Sample Size

- a. Doctoral Candidates: 130
- b. Supervisors: 30

SAMPLING TECHNIQUE

Stratified Random Sampling

1. The population will be divided into strata based on academic disciplines.
2. Participants will be randomly selected from each stratum to ensure representation and diversity.
3. This approach minimizes bias and improves generalizability of findings.

Key Variables

- a) Independent Variable: Use of Artificial Intelligence tools
- b) Dependent Variable: Doctoral study efficiency (time reduction, productivity)
- c) Moderating Variables: Discipline, institutional support, digital infrastructure
- d) Mediating Variables: Research skills, supervision quality

DATA COLLECTION METHODS

A. Primary Data

- a. Online/Offline questionnaires (Likert scale-based items)
- b. Semi-structured interview schedules

B. Secondary Data

- a. Research articles, policy documents, university reports, and AI usage studies

DATA ANALYSIS TECHNIQUES

A. Quantitative Analysis

- a. Descriptive statistics (Mean, Standard Deviation)
- b. Inferential statistics (Correlation, Regression Analysis, ANOVA if required)

B. Qualitative Analysis

- a. Thematic analysis to identify patterns and insights from interviews

C. Integration

- a. Triangulation of quantitative and qualitative findings for deeper interpretation

DEMOGRAPHIC VARIABLES AND AI EFFICIENCY RESULTS

Variable	Category	Frequency	Percentage (%)
Respondent Category	Research Scholars	130	81.25%
	Supervisors	30	18.75%
Gender	Male	92	57.5%
	Female	64	40.0%
	Prefer not to say	4	2.5%
Age Group	Below 25	18	11.25%
	25–30	84	52.5%
	31–35	36	22.5%
	Above 35	22	13.75%
Discipline	Social Sciences	48	30.0%
	Management/Commerce	26	16.25%
	Science & Technology	52	32.5%
	Humanities	20	12.5%
	Interdisciplinary	14	8.75%
Stage of PhD (n=130)	Coursework	20	15.38%
	Proposal Stage	26	20.00%
	Data Collection	34	26.15%
	Thesis Writing	38	29.23%
AI Experience	Submission/Viva	12	9.23%
	No Experience	16	10.0%
	Basic	48	30.0%
	Moderate	72	45.0%
AI Usage Frequency	Advanced	24	15.0%
	Rarely	16	10.0%
	Occasionally	56	35.0%
	Frequently	60	37.5%
Impact on Time Efficiency	Very Frequently	28	17.5%
	Significant Reduction	68	42.5%

Variable	Category	Frequency	Percentage (%)
	Moderate Reduction	58	36.25%
	No Significant Impact	22	13.75%
	Increased Complexity	12	7.5%

The consolidated analysis reveals that the sample is predominantly composed of research scholars (81.25%), with a majority belonging to the 25–30 age group, indicating early-career researchers are the primary users of AI in doctoral studies. Most respondents possess moderate to advanced AI skills and use AI tools frequently, highlighting widespread adoption. Furthermore, a significant proportion (78.75%) reported that Artificial Intelligence reduces doctoral research time either significantly or moderately. This suggests that AI enhances efficiency in research processes, particularly in writing, data analysis, and literature review, although it does not completely replace the time required for doctoral completion.

1. What is the extent of Artificial Intelligence’s contribution to the reduction of doctoral completion time in global higher education systems?

H0₁: Artificial Intelligence has no significant effect on reducing the time required to complete doctoral studies across global higher education institutions.

H1₁: Artificial Intelligence significantly contributes to reducing the time required to complete doctoral studies across global higher education institutions.

Table: Observed and Expected Frequencies on AI Contribution

Response Category	Observed Frequency (O)	Expected Frequency (E)	(O–E) ² / E
Strongly Disagree	8	32	18.00
Disagree	12	32	12.50
Neutral	20	32	4.50
Agree	55	32	16.53
Strongly Agree	65	32	33.03
Total	160	160	84.56

A. Test Statistics

- Calculated Chi-square value (χ^2) = 84.56
- Degrees of Freedom (df) = 4
- Significance Level = 0.05
- Critical χ^2 value (df = 4, α = 0.05) = 9.488

B. Analysis and Interpretation

The Chi-square analysis clearly demonstrates a significant association between Artificial Intelligence usage and reduced doctoral completion time in global higher education systems. A large proportion of respondents fall under “Agree” and “Strongly Agree,” indicating a strong positive perception of AI’s effectiveness.

The high χ^2 value suggests that the observed distribution is not due to chance but reflects a meaningful trend. Additionally, the low standard deviation confirms that respondents share similar views, strengthening the reliability of the results.

Overall, the findings imply that AI tools (such as literature review automation, data analysis software, and academic writing assistance) play a crucial role in improving research efficiency, thereby shortening the duration required to complete doctoral studies.

C. Result

The null hypothesis (H_{01}) is rejected, and the alternative hypothesis (H_{11}) is accepted

2. How do governance and administrative structures in Indian universities affect the duration of PhD completion?

H_{02} : Administrative systems and governance mechanisms in Indian universities do not significantly influence the duration of PhD programmes.

H_{12} : Administrative systems and governance mechanisms in Indian universities significantly influence the duration of PhD programmes.

Observed and Expected Frequencies

Response Category	Observed Frequency (O)	Expected Frequency (E)	(O-E) ² / E
Strongly Disagree	10	32	15.13
Disagree	18	32	6.13
Neutral	22	32	3.13
Agree	54	32	15.13
Strongly Agree	56	32	18.00
Total	160	160	57.52

Test Statistics

- Calculated Chi-square value (χ^2) = 57.52
- Degrees of Freedom (df) = 4
- Significance Level (α) = 0.05
- Critical χ^2 value (df = 4, α = 0.05) = 9.488

Decision Rule

Since the calculated χ^2 value (57.52) is greater than the critical value (9.488), the result is statistically significant.

Result

The null hypothesis (H_{02}) is rejected, and the alternative hypothesis (H_{12}) is accepted.

Interpretation and Analysis

The Chi-square analysis reveals that administrative systems and governance mechanisms in Indian universities have a significant influence on the duration of PhD completion. The high χ^2 value indicates that the variation in responses is not due to chance but reflects a strong pattern in the data.

A majority of respondents fall under the “Agree” and “Strongly Agree” categories, suggesting that governance-related factors play a crucial role in determining how quickly doctoral programmes are completed. These factors may include:

3. How can supervision quality, institutional systems, and doctoral completion duration be combined into an integrated analytical model?

H0₃: There is no significant relationship between supervision effectiveness, institutional processes, and doctoral completion time.

H1₃: There is a significant relationship between supervision effectiveness, institutional processes, and doctoral completion time.

Response Category	Observed Frequency (O)	Expected Frequency (E)	(O-E) ² / E
Strongly Disagree	8	32	18.00
Disagree	14	32	10.13
Neutral	20	32	4.50
Agree	60	32	24.50
Strongly Agree	58	32	21.13
Total	160	160	78.26

Test Statistics

- Calculated Chi-square value (χ^2) = 78.26
- Degrees of Freedom (df) = 4
- Significance Level (α) = 0.05
- Critical χ^2 value (df = 4, α = 0.05) = 9.488

Decision Rule

Since the calculated χ^2 value (78.26) is greater than the critical value (9.488), the result is statistically significant.

Result

The null hypothesis (H0₃) is rejected, and the alternative hypothesis (H1₃) is accepted.

Interpretation and Analysis

The Chi-square analysis indicates a strong and statistically significant relationship between supervision effectiveness, institutional processes, and doctoral completion time. The high χ^2 value suggests that the observed variation in responses is not due to random chance but reflects a meaningful pattern among respondents.

A large proportion of respondents fall under the “Agree” and “Strongly Agree” categories, demonstrating that both supervisory quality and institutional support systems play a critical role in determining how efficiently doctoral candidates complete their studies.

This integrated analytical model highlights that doctoral completion is not influenced by a single factor but by the interaction of multiple dimensions, including:

- a) Supervision Quality: Regular guidance, timely feedback, mentor accessibility, and research expertise significantly accelerate research progress.
- b) Institutional Systems: Administrative efficiency, availability of research infrastructure, digital academic platforms, and streamlined approval processes reduce delays.
- c) Combined Effect: When strong supervision is supported by efficient institutional mechanisms, doctoral scholars experience fewer bottlenecks, leading to faster completion times.

4. What is the impact of digital academic infrastructures on research efficiency and doctoral progress?

H04 : Digital academic systems and technological platforms do not significantly affect research productivity and doctoral progression speed.

H14: Digital academic systems and technological platforms significantly enhance research productivity and accelerate doctoral progression.

Response Category	Observed Frequency (O)	Expected Frequency (E)	(O-E) ² / E
Strongly Disagree	6	32	21.13
Disagree	12	32	12.50
Neutral	18	32	6.13
Agree	62	32	28.13
Strongly Agree	62	32	28.13
Total	160	160	96.02

Test Statistics

- a) Calculated Chi-square value (χ^2) = 96.02
- b) Degrees of Freedom (df) = 4
- c) Significance Level (α) = 0.05
- d) Critical χ^2 value (df = 4, α = 0.05) = 9.488

Decision Rule

Since the calculated χ^2 value (96.02) is greater than the critical value (9.488), the result is statistically significant.

Result

The null hypothesis (H04) is rejected, and the alternative hypothesis (H14) is accepted.

Interpretation and Analysis

The Chi-square analysis clearly indicates that digital academic systems and technological platforms have a strong and statistically significant impact on research productivity and doctoral progression. The very high χ^2 value (96.02) confirms that the distribution of responses is not random but reflects a consistent trend among respondents.

A dominant share of respondents falls under the “Agree” and “Strongly Agree” categories, showing that digital infrastructure plays a transformative role in modern doctoral education.

Key contributing factors include:

- a) Access to Digital Resources: Online journals, e-databases, and digital libraries significantly reduce time spent on literature review.
- b) Research Tools and Software: Data analysis tools, reference managers, and AI-based writing assistants enhance research efficiency.
- c) Academic Management Systems: Online submission portals, progress tracking systems, and automated workflows streamline administrative processes.
- d) Collaboration Platforms: Tools such as virtual meetings and cloud-based sharing improve communication between scholars and supervisors.
- e) Time Efficiency: Reduction in manual processes and faster access to information accelerates overall doctoral progress.

Overall, the findings highlight that robust digital academic infrastructure is a critical driver of faster, more efficient, and higher-quality doctoral research. Institutions that invest in advanced technological platforms are likely to see improved research outcomes and reduced completion time for doctoral scholars.

MAJOR FINDINGS

1. Majority respondents are young research scholars actively using AI for doctoral research efficiency.
2. Artificial Intelligence significantly reduces research time through automation, analysis, and writing support tools.
3. Governance and administrative efficiency strongly influence PhD completion timelines and research progress.
4. Digital infrastructure and supervision quality jointly enhance productivity and accelerate doctoral completion rates.

SUGGESTION

1. Provide AI training programs to enhance research scholars' technical skills and effective usage.
2. Encourage integration of AI tools in research workflows for faster and efficient outcomes.
3. Streamline administrative processes and reduce bureaucratic delays to improve PhD completion timelines.
4. Invest in digital infrastructure and strengthen supervision systems to enhance doctoral productivity.

CONCLUSION

The study concludes that Artificial Intelligence significantly enhances research efficiency and contributes to reducing doctoral completion time. Effective governance, streamlined administrative systems, and strong supervision further support timely PhD completion. Additionally, robust digital academic infrastructure plays a crucial role in accelerating

research progress. Integrating AI tools with institutional reforms and policy improvements can create a more efficient, supportive, and time-effective doctoral education system.

FUTURE STUDY

Future studies should examine long-term impacts of higher education policy reforms on PhD duration across disciplines and regions. Comparative international analyses and longitudinal designs can assess sustainability of AI-driven efficiency, governance reforms, and digital infrastructure, while exploring ethical concerns, research quality, and the balance between speed and academic rigor.

REFERENCES

1. Adamopoulou, E., & Moussiades, L. (2020). An overview of chatbot technology. *Artificial Intelligence Applications and Innovations*, 373–383.
2. Bickmore, T., & Cassell, J. (2005). Social dialogue with embodied conversational agents. *Advances in Natural Multimodal Dialogue Systems*, 23–54.
3. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340.
4. Gefen, D., Karahanna, E., & Straub, D. W. (2003). Trust and TAM in online shopping: An integrated model. *MIS Quarterly*, 27(1), 51–90.
5. Gnewuch, U., Morana, S., & Maedche, A. (2017). Designing cooperative conversational agents. *International Conference on Information Systems*.
6. Hill, J., Ford, W. R., & Farreras, I. G. (2015). Human–chatbot interaction comparison. *Computers in Human Behavior*, 49, 245–250.
7. Huang, M.-H., & Rust, R. T. (2018). Artificial intelligence in service. *Journal of Service Research*, 21(2), 155–172.
8. Lankton, N. K., McKnight, D. H., & Tripp, J. (2015). Technology, humanness, and trust. *Journal of the Association for Information Systems*, 16(10), 880–918.
9. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of IT: UTAUT model. *MIS Quarterly*, 27(3), 425–478.
10. Dwivedi, Y. K., et al. (2021). Artificial intelligence adoption and future research directions. *International Journal of Information Management*, 57, 101994.
11. Brynjolfsson, E., & McAfee, A. (2017). *Machine, platform, crowd: Harnessing our digital future*.
12. Susskind, D. (2020). *A world without work: Technology, automation, and how we should respond*.
13. Russell, S., & Norvig, P. (2021). *Artificial intelligence: A modern approach* (4th ed.).
14. Luckin, R. (2018). *Machine learning and human intelligence*.
15. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education*.
16. Selwyn, N. (2016). *Education and technology: Key issues and debates*.
17. Weller, M. (2011). *The digital scholar*.
18. Siemens, G. (2005). *Connectivism: A learning theory for the digital age*.
19. Bates, T. (2019). *Teaching in a digital age*.
20. Laurillard, D. (2012). *Teaching as a design science*.