

**THE ROLE OF BLOCKCHAIN TECHNOLOGY IN EDUCATION SYSTEM IN BANGLADESH**

**BY**

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This Report Presented in Partial Fulfillment of the Requirements for the  
Degree of Masters of Science in Computer Science and Engineering

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## APPROVAL

This Thesis titled “The Role of Blockchain Technology in Education System in Bangladesh”, submitted by Sinthia Sohrab Surovi, ID No: 232-25-045 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of M.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 11-01-2025.

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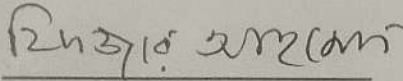
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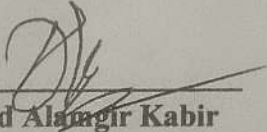
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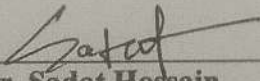
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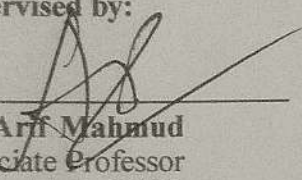
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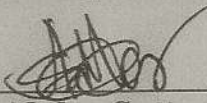
## DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Dr. Arif Mahmud, Associate Professor, Department of CSE Daffodil International University**. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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## ABSTRACT

This paper explores Blockchain Technology, focusing on how incentives impact teamwork, which improves learning outcomes in academia. Blockchain is linked to decentralization, confidentiality, encryption, security, and integrity. It can also be viewed as a smart contract that rewards academics, institutions, and scholars through a consensus system. As a result, the application of these technologies has improved academic performance. It also enables individuals with less knowledge to interact with peers and mentors who possess more knowledge. Ultimately, the aim of these investigations is to increase our understanding of blockchain applications as they stand today. The research methodology includes content analysis, literature review, document examination, and survey methods. It introduces an innovative framework for seamless guidance regarding scholarly data, covering essential information like daily assignments, attendance, extracurricular activities, and detailed institutional grades. By leveraging Blockchain, we can create a unique system that ensures the integrity, clarity, and usability of these records, marking the beginning of a new era in efficient record-keeping. To conduct this exploratory study, 500 survey links were sent out, and 450 responses were received. A total of 416 responses were selected for final analysis, while 34 responses were excluded for various reasons.

**Keywords:** Digital Ledgers, e-learning, Transparency, Smart Agreement, Electronic instruction, Pedagogical Innovation, IT.

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# CHAPTER 1

## INTRODUCTION

### Introduction

Blockchain technology has been recognized as an exceptional tool to transform numerous sectors. It is an advanced method of data collection that ensures the authenticity of information by preventing interruption, malicious activity, or alteration. Using sophisticated chain ledgers, transactions across multiple databases can be securely stored in a network known as a “chain.” These databases are connected through peer-to-peer networks, offering maximum stability and security. The digital ledger has immense potential to support various fields, such as economics, transportation, and commodity production. Its adaptability promotes innovation and change in many industries, creating numerous opportunities. Blockchain is now being utilized as a valuable educational tool or even as a platform for storing and sharing pedagogical information. Moreover, Blockchain can help verify the ownership of intellectual property. [1]

The distributed ledger operates on a simple concept. It gathers information through blocks that are interconnected. These blocks rely on a network of electronic devices called nodes to stay updated. Each node can be controlled by one party, or multiple parties can manage them. A distributed system becomes centralized when nodes handle different, distinct tasks. As a result, no single entity has control over the data. Among all network participants, this structure is seen as reliable, trustworthy, and transparent. Blockchain systems, both private and public, are easily accessible. Access to private systems is granted only to those who are verified .

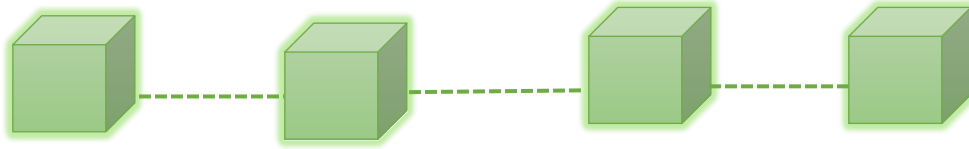
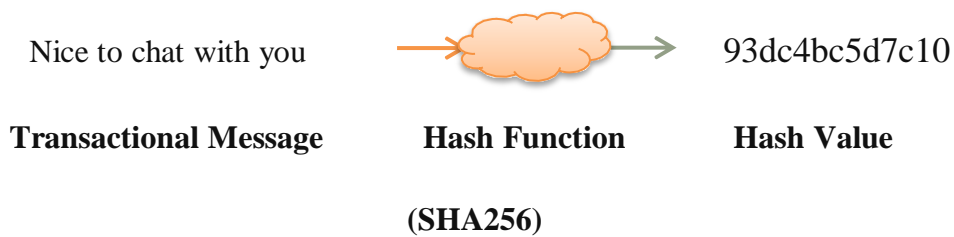


Figure 1.1: Blocks with Chain

Let's examine the components of a block. When discussing Blockchain, it is important to understand what a block is and what it consists of. Each block contains four key components.

- Ex-Hash- It is the attribute that links a block to the block before it. So, the ex-hash attribute consists of the hash value of its previous block.
- Data- The variety of operations inside each block will be precise, and each of them will include the identity of the sender, the identity of the recipient, and the overall value over every cryptocurrency transfer as well as other sorts of details or documents. Multiple transactions involving various senders as well as recipients may also occur.
- Nonce- Bitcoin uses a validation activity to do its activities. It is utilized to create a hash key and modify the results.
- Hash- Hash behaves similarly to a virtual footprint. It represents the block's exclusive fingertips, creating a specific-length output from a keyword based on the data's prior hash.



Let's examine a setup where the idea will become clear. The following scenario contains sensitive data in every block.

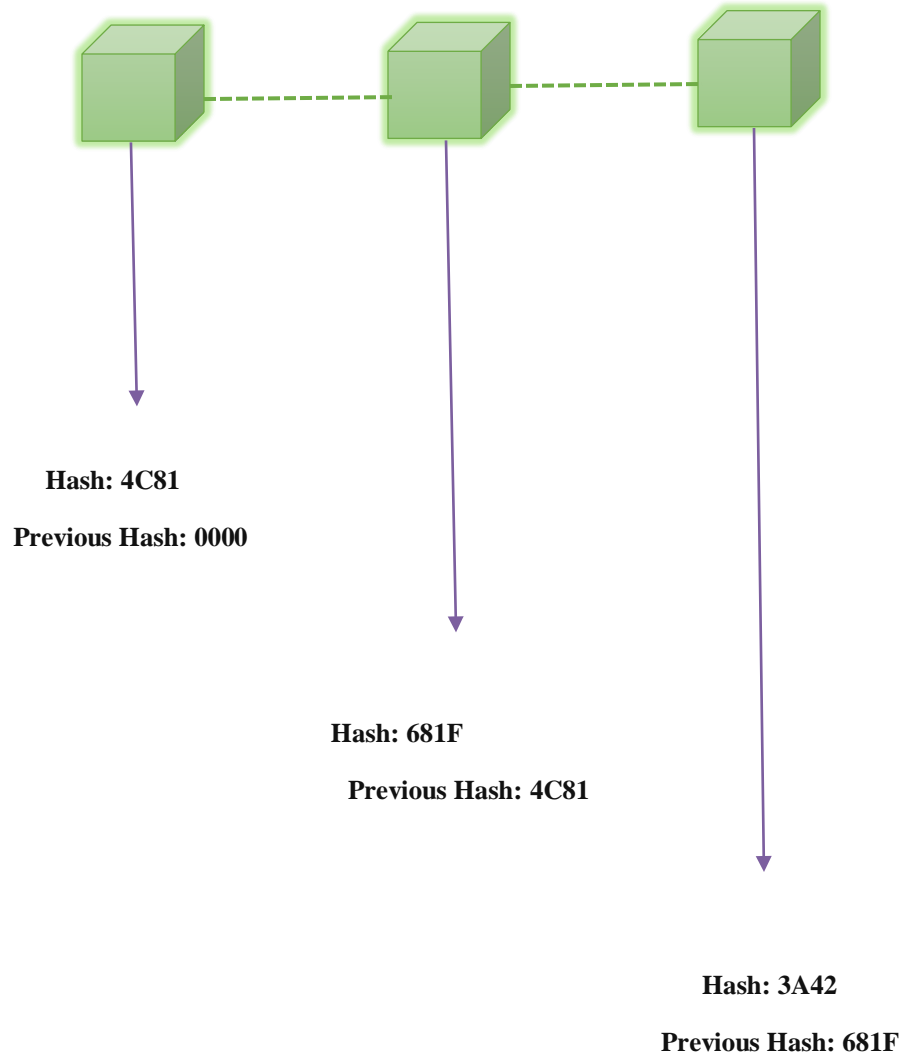


Figure 1.2: Blocks Function

## **Blockchain Technology in Education**

As the government works to reform educational access, new institutes and colleges are continuously emerging. However, with this growth, diploma mills or unaccredited institutions are also on the rise, significantly affecting students and potential employers. While the government has implemented strict measures against these unaccredited establishments, there is an urgent need for a proactive solution that harnesses the transformative power of digital ledgers. [1] [2] It provides an innovative framework for seamless management of academic records, covering essential information such as daily assignments, attendance, extracurricular activities, and detailed institutional grades. By utilizing Blockchain technology, we can create a unique system that ensures the integrity, clarity, and usability of these records, ushering in a new era of smart and efficient data management.

Blockchain technology essentially delivers rapid assistance to each logged-in user, allowing them to pass on data and provide comprehensive, up-to-date transparency. [3] It will be helpful in distinct contexts as it involves monitoring requests, expenditures, furthermore finances. Blockchain is committed to identifying parties who can verify operations as well as safeguard that all regulations are strictly met. Considering the report's purposes, an exploration into IEEE & Google Scholar occurred then a list of widely cited scholarly articles was gathered and examined. I looked at around 25 papers relating to Blockchain technology in learning. An increase particularly in the promised usage of the distributed ledger via educational programs is highlighted in Fig: 1.3.

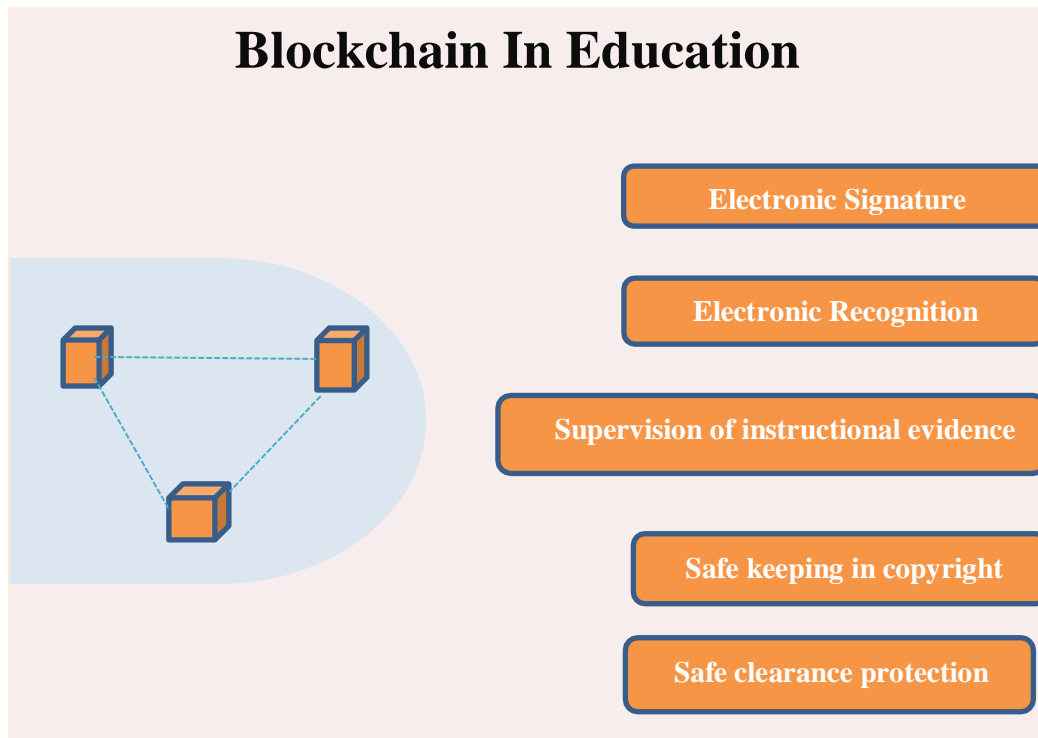


Figure 1.3: The promise usage of Blockchain technology via pedagogic programs

### **Scholar's Feature**

Each learner obtains a distinct identification number that allows for their recognition via the Blockchain protocol. Scholars have the flexibility to enter enrollment for theoretical courses, project grades, testing outcomes, and assessment results into the Blockchain. Whenever a certifying organization has verified the learner's identity, the learner is able to come in details via electrical agreements into the digital ledger. It is committed to identifying parties who can verify operations and ensure that all regulations are strictly met.

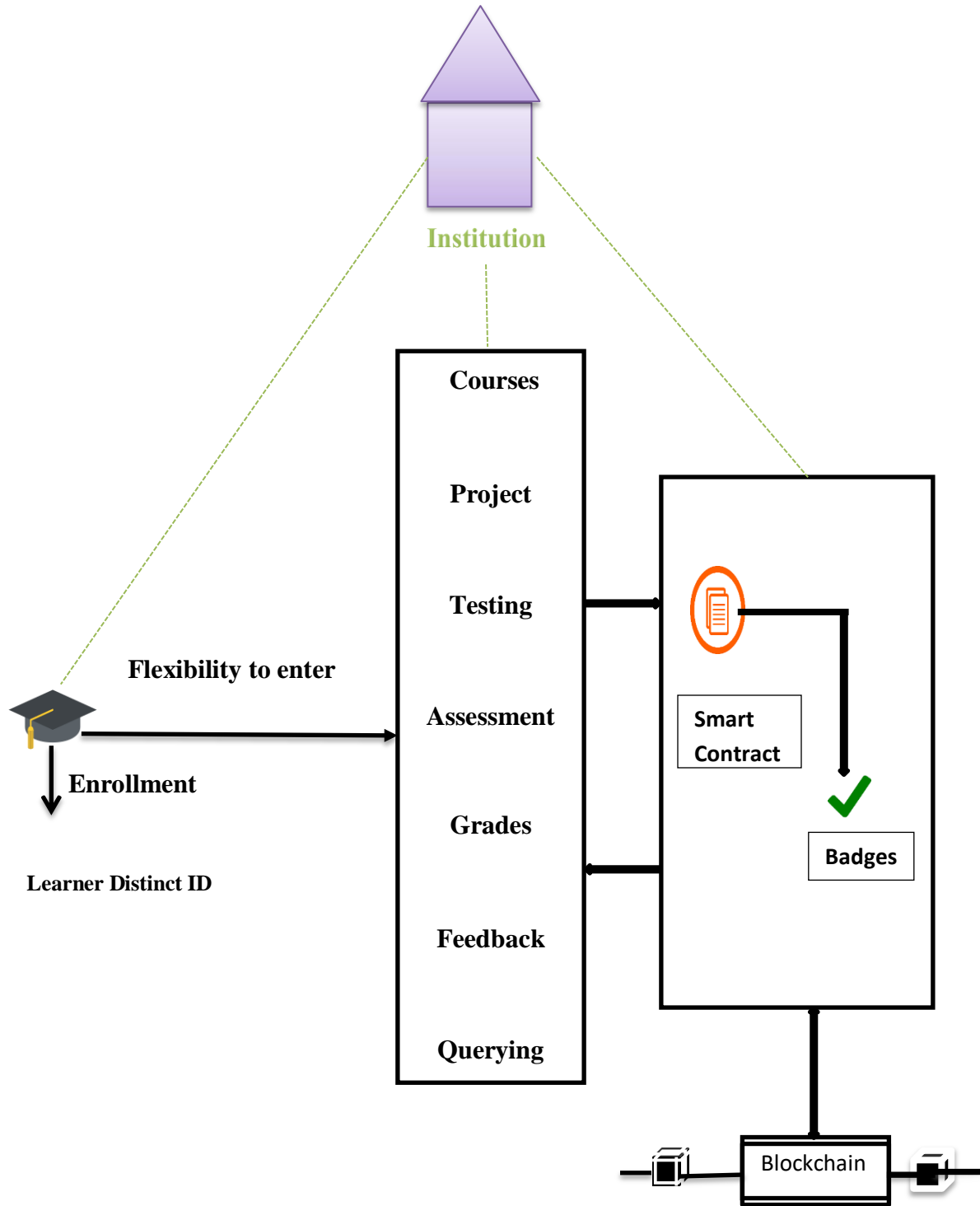


Figure 1.4: Scholar's Feature on Blockchain

## **Applying Digital Certification**

The prospective student first enters his details using a distinct ID, and all of it occurs subsequently stored within the scholar's digital ledger. Details are subsequently transmitted to the appropriate academy for verification. The scholar receives an award token confirming correct information validation, and then details are subsequently safely archived throughout the institute's private Blockchain network. [5] [6] Following the creation of hash, the badges are kept electronically in the Blockchain network. Case in point, the electronic ledger required for archiving the electronic badges functions separately between the providers as well as the certifying institution. Instead of current virtual accreditation, it is easier to grab, arrange, and even maintain. Hash behaves similarly to a virtual footprint. It represents the block's exclusive fingertips, creating a specific-length output from a keyword based on the data's prior hash.

## **Motivation**

Blockchain scheme in pedagogy motivates pupils by guaranteeing faithful and tamper-resistant intellectual documents, instilling faith in credential verification. Pupils obtain forthright supervision over their credentials thanks to its transparent and dispersed system, which lessens their reliance on centralized organizations. The fixity of blockchain manufactures a faithful space by suppressing fraudulence and encouraging honesty in pedagogical performance. Furthermore, blockchain's dispersed contracts offer incentives that expedite organizational tasks and digitize processes like course completion certification, which improves pupils' engagement. The inclusion of blockchain in pedagogy not only strengthens the safeguarding and openness of pedagogical notes but also empowers pupils, cultivating trust, integrity, and motivation.

## **Rationale of the Study**

The study, Assurance and Data uprightness, looks at how blockchain ameliorates pedagogical notes assurance by safeguarding data consistency and shielding against interference access. The intention is to inspect and scrutinize how blockchain ameliorates utilizer empowerment by giving utilizers'—including associations and pupils—more control over data, credentials, and administrative procedures. Diminishing faith in mediators, blockchain has the prospect of elevating and expediting accreditation scrutiny methods. Meanwhile, by streamlining legislative methods, blockchain schemes can shield pedagogical authorities' time and money. By shielding pedagogical milestones from Infringement and substantiating their authenticity, the study scrutinizes how blockchain schemes might sustain pedagogical integrity. It's pertinent to apprehend how the blockchain which serves as an impregnable scheme for administering delicate information, deals with safeguarding data secrecy issues in the pedagogical setting. Concerning of facts safeguards, the study explores how pedagogical associations might manage regulatory obstacles related to blockchain emplacement. At last, the study looks at how blockchain motivates inventiveness in pedagogy by opening doors for dispersed and unified pedagogy contexts.

## **Research Question**

1. What factors observe a pivotal duty in influencing the endorsement of blockchain advancement in the context of educational institutions?
2. To what extent does the blockchain bolster the shielding and lucidity of scholastic dossiers in pedagogical environments?
3. How can an invulnerable, unregulated connectivity that sustains interconnected pedagogy realms be manufactured by utilizing blockchain?
4. What factors facilitate to the successful take up or resistance to blockchain amidst mentors and pupils?

## **Expected Output**

The consolidation of blockchain with the SmartPLS tool in pedagogy is foreseen to yield several optimistic outcomes. These entail the enhancement of a transparent and reliable pedagogical sphere, the efficacious administration of scholastic documents, and credential substantiation that is impervious to tampering. The SmartPLS tool will guarantee pupils greater dominion and influence over their pedagogical data. Additionally, the integration aims to bolster endeavors, proficiently regulate managerial procedures, and guarantee adherence to data protection laws. The study anticipates distinguishing cost-effective consolidation tactics, progressing interactive interfaces, and fostering ingenious pedagogical ambiances through the potentiation of SmartPLS and blockchain in pedagogy.

## **Project Management and Finance (PMF)**

The efficacious fulfillment of blockchain in pedagogy needs a meticulous tactic for PMF. This entails unfolding a thorough budget that accounts for diverse outlays, notably formation, preservation, software deployment, and technology acquisition. Additionally, enhancing a translucent PMF with defined obligations guarantees swift resource earmarking. Organized progression through diverse project facets is promulgated by a methodical trajectory with explicit signposts. Perpetual repercussions entail accounting when allotting capital for pedagogical sessions that elevate the competencies of the workforce. Unending scrutinizing and regular financial reporting support informed decision-making throughout the project lifecycle.

Finance is an indispensable term in any research. In this study for aggregating data, a survey questionnaire is utilized and some expenses have been incurred while aggregating the data.

## **Report Layout**

Chapter 1: This segment addresses the introduction, motivation, the reasoning for the study, project management and budget, expected output, and report layout.

Chapter 2: This portion addresses the preliminaries, related works, comparative analysis, scope of the problem and at last challenges

Chapter 3: The research topic, data-gathering process, statistical analysis, suggested technique, model, and implementation requirements are all covered in this section.

Chapter 4: The following part discusses the experimental design, outcomes, analysis, and discussion.

Chapter 5: This section entails the impact on society, impact on environment, ethical aspects and sustainability

Chapter 6: This part entails the summary of the study, conclusions, and at last implication of future study

## **Synopses Pertaining to Thesis Chapters**

Six parts constitute the frame of this study. First, read the 1st chapter, Introduction to the Digital Ledger within Learning which takes a closer look at Blockchain-based technology as well as highlights the Pros of Blockchain Innovation on account of academics. The literature concerning adoption concepts that are currently available is then examined in the 2nd chapter. Following that, an extensive explanation of the techniques is given in Chapter 3. After that, according to the information obtained from the last survey, the discussion and outcomes from the investigation items are covered in Chapter 4. The effect is covered in Chapter 5. Chapter 6 delves into the limits along with suggesting latent futures to studies.

## **CHAPTER 2**

### **BACKGROUND**

#### **Preliminaries**

This chapter's primary goal becomes figuring out the current state as concerns Blockchain-based systems in education. There exist multiple sections in this chapter. Let's start with an overview of earlier studies regarding the utilization of Blockchain-based systems within academia. The comparative analysis, challenges of it are covered in the following part. Finally, display a table with an author's outline.

#### **Related Works**

P. Panagiotidis, preferred through the arrival of the Internet of Things (IoT), smart, connected gadgets, 5G networks, and other new technical advancements, has entered an era where safe data transit and storage are essential. Blockchain-based technology will prove of the utmost significance in this new reality for the reason it comes with the ability to lower costs, speed up transactions, and provide the necessary foundation for systems to operate safely and inviolably. It also offers the chance to develop brand-new cutting-edge services and applications. [1]

Afnan H. Alsaadi et al. said Blockchain-based technologies have drawn an extensive amount of attention, and remain highly considered, and appreciated for their unique infrastructure. All consumers globally may anticipate real-time fairness and democracy thanks to the forthcoming Blockchain technology. Via expanded admittance moreover the provision of assured, affordable, transparent, and immutable communications throughout their educational platforms, the instructional industries are probably going to modernize their communication system, and accessibility, and expand their market globally. [2]

Akshay Karale et al. said numerous learning-related problems could be solved by utilizing Blockchain technology, as it will help students as well as teachers in evaluating how they're doing. The design can hold degrees and certificates. It could decrease the total degree and certificate fraud and manipulation. The Blockchain's capacity to expand may boost the curriculum as well as be successfully utilized in educational settings. [3]

M.-F. Steiu et al. said the digitization as well as centralization of pedagogic credentials accompanying the promotion also motivation for perpetual instruction are the main digital ledgers used for instruction the fact that have been considered issues alongside commercial reception additionally invention highlights that the Blockchain revolution towards learning remains a fairly fresh creation. [4]

Piotr Gutowski et al. proposed that due to the multitude of advantages it offers, ready-made solutions leveraging the technology known as Blockchain are growing more and more popular athwart the economy. It is necessary for the way that instructional institutions teach. Since digital ledger remains in the early stages from a technical standpoint, it is developing at a rapid rate because of favorable regulatory frameworks, encouraging policies, and more economic stimulus. [5]

P. K. Paul et al. said that Blockchain is growing to become an integral component of industrial advances and is now used in many facets of culture and communities alike. Blockchain's steady growth has rendered it a newly invented tool that is referred to as "Blockchain Technologies." It simply offers an address for saving details that can't be altered due to its ethical and safe mechanisms. Blockchain is a particular type of transactional record in digital form that permeates every exchange or network. [6]

E. P. Fedorova et al. proposed that flexible transparency, the lack of forgeries, safe knowledge retention, as well as a decrease in dealing expenses related to evidence checking, monitoring, and validation, constitute all positive aspects of the system known as Blockchain. Currently, academia as well as society are simultaneously facing certain obstacles integrating Blockchain technology. [7]

Mulyati Mulyati et al. proposed that Blockchain is a technical invention that may serve ahead of conventional educational transcripts and offer a new method of exchanging scientific knowledge. Blockchain is now applicable as a helpful learning aid or even as a channel or storage system for academic data. Additionally, Blockchain has the latent to establish who owns someone's creativity. [8]

Ali Alammary et al. said that Blockchain is an innovative innovation that first appeared in early the year 2008. It started out working to function as a collaborative database, recording Bitcoin digital currency transactions. The intent intended to abolish unnecessary mediation services along enable individuals to do activities firsthand. Blockchain has been developed exactly as a centralized system regarding neighboring nodes for handling this. The most prominent of them is a learning tool on behalf of a quality education. Its special attributes, which involve decentralized operation, safety, dependability, and data credibility, are mostly to blame for this. [9]

Ninda Lutfiani et al proposed that Blockchain-based technology, a means of authorization, shall safeguard content privacy and security in addition to remaining secure against intrusion while storing knowledge in the context of sensitive text, Mainly in the implementation of asynchronous learning. There are a pair of benefits. The initial one is that owing to the autonomous structure of Blockchain another one is that all data kept in the educational system is guaranteed, which will boost trust from caregivers, instructors, as well as other individuals. [10]

Anissa Cheriguene et al. said the technology assures prospective efficacious didactics and objective appraisal while esteeming the agenda of courses and exams. The incentives generated by blockchain technologies stimulate both instructors and pupils to proceed with endeavors hard despite the fact they are at home. A great deal of institutions have transitioned to online-based studying owing to the epidemic outbreak incidents and lockdown. [11]

Valentin Kuleto et al. said that Blockchain is the underpinning technological scheme used to allow streaming currencies to be authenticated and other verifications to be carried out. With creative blockchain techniques, an increasing amount of fields are appearing. Prolonged individual inquiry, significant social connection with interest groups, and expert mentorship relationships are common components of innovative science learning interactions and facilitates communication between pupils in addition to experienced tutors and contemporaries. [12]

J. P. Tamara Savelyeva et al. said Blockchain is recognized truly as an indicator of the impending large macroeconomics. It is an interpersonal mechanism that is digitally dispensed and dispersed and operates evenly in a restricted connection. The bulk of academics supposition the remarkable possibilities that blockchain encompasses commercial entities biz, and pedagogical administration. By emulating a blockchain-backed pedagogical commons and educating policymakers and educators, it also advances the notion of knowledge metamorphosis for durable education. [13]

Yuliana et al. said a rising number of blockchain blueprints are exceedingly helpful to people or pedagogical associations. In essence, blockchain implies the dispersed, inalterable aspect of data demonstrated as being hosted on a network and having become part of it. Blockchain assures that dispersed material and records are safeguarded by conducting cryptography. [14]

M. M. et al. proposed that digital reformation is constantly occurring in educational resources. Enrollments, scores, admissions, and credential recognition must all be handled effectively and safely by the managerial departments. Specifically, e-learning and e-assessment should inspire confidence in curriculum administrators. Technology is more applicable in the area of pedagogics owing to its capability to secure data and the upliftment of school controlling systems and governance capabilities. And last, learning resources ought to be accessible from any location, and exams ought to be administered outside of schools. [15]

## Comparative Analysis and Summary

Table 2.1: Comparative Analysis

No.	Author Name	$R^2$	$Q^2$	$\beta$
01	Ammar AL-Ashmori, Gunasekar Thangarasu [16]	0.719	0.496	0.090
02	Daeheon Choi, Chune Young Chung, Thou Seyha[17]	0.792	0.458	0.307
03	Mauro Sciarelli, Anna Prisco, Mohamed Hani Gheith[18]	0.741	0.552	.....
My Outcomes				
04	.....	0.717	0.476	0.775

If the  $R^2$  value is between 0.02 and 0.12 the weak variation is clarified by exogenous variables if the  $R^2$  is between 0.13 and 0.25 the variation is considerable and if the  $R^2$  is above 0.25 the variance is significant. All  $R^2$  values are substantial, as can be seen in the table.

## **Scope of the Problem**

Introducing blockchain in pedagogy tackles complications in credential validation, data safeguarding, and scholastic proficiency. The scope integrates elevating transparency in pedagogical records and propagating cross-institutional cooperation. Credential portability is facilitated, easing the transfer and validation of pedagogical conquests. However, consolidation challenges and the requisite for regulatory consistency must be addressed. Digital literacy initiatives and diminishing the environmental effects of certain blockchain networks are indispensable aspects of the scope. Digitized literacy schemes and diminishing the conservationist effects of specific blockchains are indispensable facets of the scope.

## **Challenges**

Consolidating blockchain in pedagogy faces multifaceted complexities. Additionally to its complexities, blockchain upkeep requisites tailored proficiency, and compatibility pertaining to the current configuration may necessitate major revisions. Blockchain has numerous challenges notably specialized technical complexity, scalability issues, execution cost, interoperability issues, privacy concerns, pedagogical inequality, environmental impact, and smart contract safeguard. Strict safeguards must be taken to avoid insecurities and infringements to guarantee the protection on the blockchain.

## **Bibliography List**

The Blockchain continues to be changing. Not only it is updating and modifying the code it contains and its frame, but it is additionally establishing brand-new application domains. The following multifaceted expansion is interconnected and driven by one another. Thanks to a digital ledger, these resources can be shared on an open platform in a secure and cost-effective manner In table 2.1 all of its bibliographies that help to know

for preparing a paper are listed along with the authors of the paper, year of publication, Volume, Number, etc.

Table 2.2: Bibliography List

NO	Authors	Year	Journal Name	No	Vol
1	Panagiotidis, Panagiotis	2022	European Journal of Education	1	5
2	Afnan H. Alsaadi, Doaa M. Bamasoud	2021	International Journal of Advanced Computer Science and Applications(IJACSA)	5	12
3	Akshay Karale, Harmeet Khanuja.	2019	International Journal of Computer Applications	38	178
4	Steiu, Mara-Florina	2020	PEER-REVIEWED JOURNAL, ON THE INTERNET	9	25
5	Piotr Gutowski, Joanna Markiewicz,Piotr Niedzielski,Monika Klein4	2022	European Research Studies Journal	4	25
6	P. K. Paul, P.S. Aithal,Ricardo Saavedra.	2022	International Journal of Applied Science and Engineering	2	11
7	Fedorova, Elena P; Skobleva, Ella I	2020	European Journal of Contemporary Education	3	9
8	Mulyati Mulyati, Ilamsyah Ilamsyah,Aris Aris,iketut gunawan,Muhammad Suzaki Zahran	2021	The International Journal of Cyber and IT Service Management	1	1
9	Ali Alammery, Samah Alhazmi, Marwah Almasri, Saira Gillani	2019	A Systematic Review," Applied Sciences	12	9

10	Ninda Lutfiani, Qurotul Aini, Untung Rahardja, Lidya Wijayanti	2021	INTERNATIONAL JOURNAL OF EDUCATION AND LEARNING	3	3
11	T. K. A. K. Anissa Cheriguene	2022	IT Professional	2	24
12	Valentin Kuleto, Ana Sofia Coelho	2022	Sustainability	2	14
13	J. P. Tamara Savelyeva	2022	British Educational Research Association	6	53
14	Yuliana, Agustina	2022	Blockchain Frontier Technology (B-Front)	2	1
15	M. M. , . M. Z. Ali	2022	Journal of Hunan University Natural Sciences	10	49

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **Research Subject and Instrumentation**

The study goal is to appraise how blockchain influences pedagogy by the usage of assessments and statistical analysis with SmartPIs. The Research Paradigm is then examined. A positive ontology, pragmatic epistemological theory, and quantitative technique are all going to be employed in the indicated study. Following, perceptible research plus exploration design become given gradually. After that, the final estimate is provided root on the pilot test outcomes for our measuring approach. Demographic questionnaires along with evidence are additionally covered. Finally data analysis tools additionally technology acceptance models are revealed in this chapter.

#### **Approach to This Study**

Each action required for doing a study involves outlining the subject of the study, researching relevant literature, adopting methodology, designing a study, obtaining and interpreting evidence, and creating the final report, as suggested by Kothari (2004). Thus, as seen in Figure 3.1, the following procedures have been followed in this research:

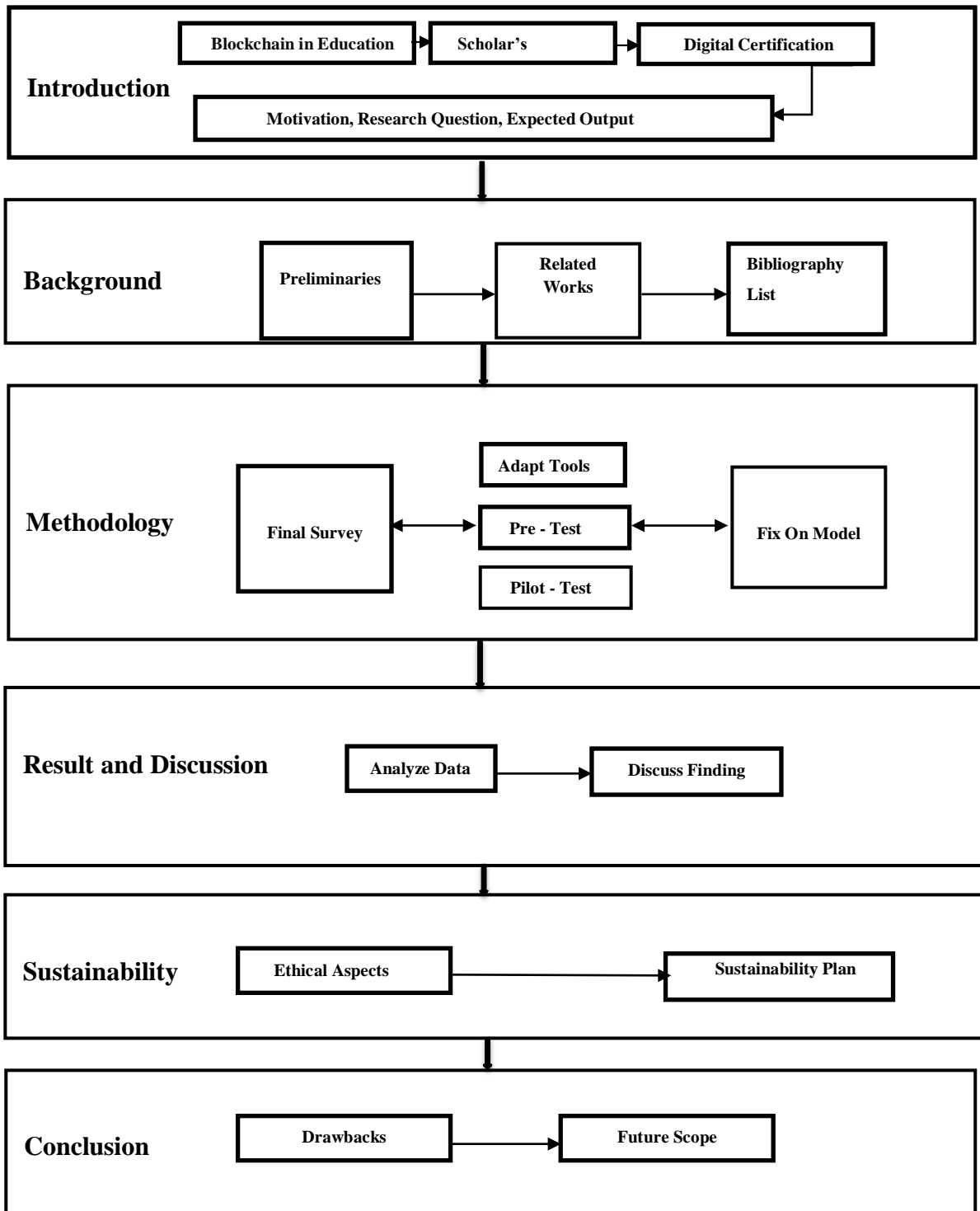


Figure 3.1: Approach to This Study

## Research Paradigm

The determination of the topic of a research paradigm must always occur initially in the planning phase of an experiment (Creswell 2003). A paradigm is a fundamental set of beliefs, a set of hypotheses that scholars are willing to take on which act like benchmarks to guide their activities as defined by Guba and Lincoln (1989). A positive ontology, empirical epistemological theory, and quantitative technique are all going to be employed in this study (See Figure).

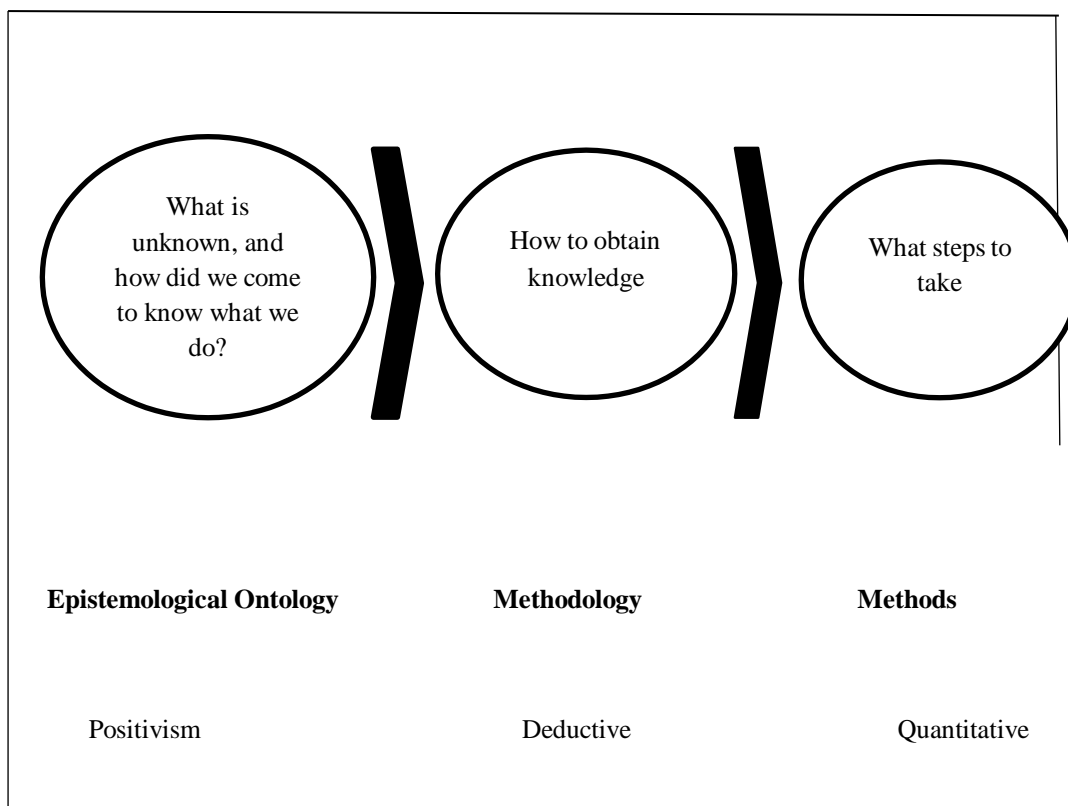


Figure 3.2: Research Paradigm

The Greek terms for existence and science/study respectively “Onto” and “Logia” are the roots of the word ontology. Ontology is used by researchers to tackle difficult problems, develop theories or models, and get a better perception of the state of ontology in general. However, the non-philosophical portion of ontology describes many aspects of society or structure that may have an effect on people or groups. The selection of research design can be guided by the identification of the ontology early in the process of research. According to Collis and Hussey (2003), epistemology is the study of knowledge and what is considered to be reliable knowledge. According to Easterby-Smith, Thorpe, and Lowe (2002), positivism was the predominant epistemological paradigm in social science. They distinguished between positivist phenomenology and ontology which are given below in Table 3.1

Table 3.1: Compares positivist and phenomenological approaches. (Easterby-Smith and colleagues, 2002)

	Positivist	Phenomenological
Basic conviction	<p>The world is outside and impersonal</p> <p>The observer is impartial</p> <p>Science has no value</p>	<p>The social construction of the Globe</p> <p>A party serving as the observer is observed</p> <p>Human passion is what promotes science</p>
Researcher	<p>Fact-focused researcher</p> <p>Find the relationships between the variables</p> <p>Applying a deductive process</p>	<p>Focus on content</p> <p>Try to comprehend what is going on</p> <p>Inductive methodology</p>
Methods Include	<p>Operationalizing notions is one method</p> <p>Using a big sample size</p> <p>Quantitative methods</p>	<p>Using several techniques to establish several perspectives on a phenomenon</p> <p>A qualitative approach</p>

Throughout research there are two fundamental justifications for employing a positivist ontology:

Generating data that is transferable. Researchers who have a positivist perspective think that a neutral world may be discovered and evaluated. Since they may create ideas and hypotheses that can be examined in many situations and populations. It is possible to make predictions and create interventions that work well for a variety of people using such transferable details.

To boost the accuracy and precision of study results. Positive research methodologies aim to reduce bias and increase data dependability. This is accomplished by utilizing organized research tools, gathering data from sizable samples, and analyzing the data using statistical methods. This examination ensures that the outcomes of positive research are accurate.

Also, there are two fundamental justifications for using a phenomenological approach:

Comprehend people's actual experiences. The goal of phenomenological study is to comprehend the importance and meaning of human experiences. It is especially well suited for researching complicated and individualized experiences like grief, ailment, or trauma. Phenomenological scholars can gain a deeper knowledge of lived experiences and how they are influenced by personal and social circumstances by gathering and studying in-depth reports of people's experiences.

To revise and broaden our comprehension of the world. It is typical in phenomenological study to investigate novel and little-known occurrences. It can also be applied to refute ideas and presumptions about human experience that are currently held. Phenomenological studies may be beneficial to us by giving an in-depth and nuanced knowledge of people's lived experiences.

## **Enhancement of the Research Instrument**

The constituents in the variables are acquired from the body of the current study. Due to the fact that Straub (1989) suggests utilizing the formerly validated appliance when utilizing survey techniques. Furthermore, the scholar can evaluate the assessing characteristics of the specified criteria by doing an authenticity and reliability scrutiny of the accessible data (Bryman & Bell, 2007). But before these items are modified, certain factors must be prudently analyzed to guarantee that the settings of these study essays align with the settings of this investigation. The numerical approach is predominantly utilized in these selected works. Then, interactional conduct is assessed, and the studies emphasize the usage of gadgets.

### **3.1.3(a) Acclimatization Research Instrument**

Preliminarily, items of the variables notably security (5 items), transparency (4 items), traceability (6 items), task characteristics (4 items), technology characteristics (3 items), perceived compatibility (4 items), perceived relative advantage (3 items), personal innovativeness (3 items), attitude (4 items), trust (4 items), and intention (4 items) adopted from Thompson et al. (2017).

## **Data Collection Procedure**

### **Survey Questionnaire Development**

The questionnaire, which was developed by the late Sir Francis Galton, is a research tool mainly made up of an inventory containing queries employed for recording what people say in a consistent way. There are both organized and unorganized questions. Organized inquiries require participants to determine an answer from a list of options, whereas unorganized inquiries encourage participants to offer an answer in a manner that suits them. Virtual as well as web-based polls are a relatively recent style of

questionnaire survey. Through the use of interactive forms, these surveys are distributed online. An electronic mail demand regarding answering the online poll could be addressed to those polled, in addition to a link to the survey's online page. As an alternative, the poll can be completed and returned through email that has been integrated with the survey. These surveys may be quickly changed, the outcomes are promptly stored in a digital database, and they are relatively affordable to administer.

The highest variance is provided by seven-point scales of liking, as stated by Eutsler and Lang (2015). The measurement items, having varied between "strongly disagree" to "strongly agree," were thus anchored with a scale based on seven Likert points.

The parameters for variables have been altered using earlier research. For this cross-sectional analysis, a Likert scale with seven points with a strongly disagree to strongly agree range was adopted. Prior to getting rid of the final survey, significant pre-test and pilot surveys took place to validate the survey items. During the prior test and pilot surveys, a total of 45 students were chosen. The participants double-checked the wording and length of the items during the pre-test. They then offered insights and advice to help people understand things better. Participants received the pre-test modified questionnaire throughout the pilot project. The final survey concept is provided below based on the pilot test outcomes for our measuring approach.

Table 3.2: Final Survey Questionnaire

Variable	Code	Items
Security	SEC1	I would feel secure about the record of educational data performed using Blockchain.
	SEC2	The provider would take security measures to protect my educational data.
	SEC3	The provider would verify academics' identities using Blockchain.
	SEC4	The provider would use Blockchain.
	SEC5	I would feel safe recording educational data using Blockchain.
Transparency	TRAN1	Blockchain processes would be transparent to me.
	TRAN2	Blockchain would provide in-depth access to educational data.
	TRAN3	Applications of Blockchain would be well described to me.
	TRAN4	Blockchain usability would be clear to me.
Traceability	TB1	I believe I would be conveniently tracking all educational data using Blockchain.
	TB2	I believe that it would be easy to trace the location of all educational data using Blockchain.
	TB3	I believe that it would be easy to trace the history of all educational data using Blockchain.
	TB4	I believe that it would be easy to verify all educational data using Blockchain.
	TB5	I believe that stakeholders would facilitate my understanding of how all educational data could be traced using Blockchain whenever I would need to verify them.
	TB6	I believe that stakeholders would assist me in gaining a clearer understanding of how all educational data could be tracked using

		Blockchain whenever I would require verification.
Task characteristics	TAC1	I would have real-time control of my educational data.
	TAC2	I would be able to manage my educational data anytime anywhere.
	TAC3	I would be able verification of educational data anytime anywhere.
	TAC4	The educational data I record would be accessed without tampering.
Technology characteristics	TEC1	Blockchain would provide a quick service.
	TEC2	Blockchain would provide ubiquitous services.
	TEC3	Blockchain would provide secure services.
Perceived compatibility	COMP1	Blockchain would be compatible with my educational system.
	COMP2	Blockchain would fit well with the way I record educational data.
	COMP3	Blockchain would be completely compatible with my current situation.
	COMP4	Blockchain would be a good match for my needs.
Perceived relative advantage	PRA1	Blockchain would be more convenient than traditional educational record systems.
	PRA2	Blockchain would be better than traditional educational record systems.
	PRA3	Blockchain would have more advantages than traditional educational record systems.
Personal	PI1	If I heard about Blockchain to record educational data, I would look for ways to experiment with it.
	PI2	Amongst my peers, I would usually be the first to try out Blockchain to record educational data.
	PI3	I would not be hesitant to use Blockchain to record educational data.

innovativeness	PI4	I would like to experiment with Blockchain to record educational data.
Attitude	ATT1	Using Blockchain to record educational data would be a good idea.
	ATT2	Using Blockchain to record educational data would be a wise idea.
	ATT3	I would like the idea of using Blockchain to record educational data.
	ATT4	Using Blockchain to record educational data would be a pleasant experience.
Trust	T1	I feel Blockchain to record educational data would be trustworthy.
	T2	I feel Blockchain to record educational data would be reliable.
	T3	I feel Blockchain to record educational data would be controllable.
	T4	I feel Blockchain to record educational data would be efficient.
Intention	IA1	Given the opportunity, I would use Blockchain to record educational data.
	IA2	I would like to use Blockchain to record educational data.
	IA3	I would be willing to use Blockchain to record educational data in the near future.
	IA4	I would use Blockchain to record educational data when the opportunity arises.

## Demographic Questionnaire

The primary portion is going to pose queries regarding demographic data in line. Age, gender, education level (Laumer et al. 2014), ICT usage, ICT experience, (Ayyagari et al. 2011), and prior experience with Blockchain Technology in Education (Park et al. 2007) are all relevant factors for the generic questionnaire. The overall findings gathered from the ethnic research are listed in the table that follows beneath 3.4

Table 3.3: Demographic Questionnaire

Name	-----
Do you use Blockchain for education purposes?	YES/NO
Gender	Male/Female
Age	18 years to 26 years
Marital Status	Married/Single
Academic Qualification	Undergraduate/Postgraduate
ICT usage	Number of hours per day
ICT experience	In years

## Data Analysis

It consisted of 416 competitors in total. It included 208 males and 208 women. According to demographics, the bulk of those who took part were between the ages of 18 and 26. Additionally, the majority of attendees were undergraduates as well as postgraduates, respectively. Additionally, the most youthful attendees were unmarried.

Table 3.4: Demographic Data

Variables	Classification	Occurrence
Gender	Men	50%
	Women	50%
Age	18 Years	0%
	19 Years	0%
	20 years	5.3%
	21 years	9.9%
	22 years	21.2%
	23 years	28.6%
	24 years	10.3%
	25 years	10.3%
	26 years	14.4%
Academic Qualification	Undergraduate 1 <sup>st</sup> year	7.5%
	Undergraduate 2 <sup>nd</sup> year	15.4%
	Undergraduate 3 <sup>rd</sup> year	22.6%
	Undergraduate 4 <sup>th</sup> year	39.4%
	Postgraduate 1 <sup>st</sup> year	5.7%
	Postgraduate 2 <sup>nd</sup> year	9.4%
	Single	91.3%

Marital Status	Married	8.7%
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## **Statistical Analysis**

### **Common Method Variance**

Tehseen et al. (2017) define CMV as the methodical error variance that influences the presumptive interconnection amidst the variables. Podsakoff and Organ (1986) stipulated that CMV occurs if a single item accounts for over 50% of item covariance. In contrast, an in-vogue statistical technique for verifying CMV is Harman's single factor (Rodríguez-Ardura & Meseguer-Artola, 2020). In order to combat CMV, this research uses Harman's single factor.

### **Factor Loading**

A minimal loading value of 0.7 is indispensable to accomplish satisfactory outcomes. Sarstedt et al. (2017) emphasize that it is crucial to eradicate an item from the measurement model if the loading value is below 0.5. Nonetheless, numerous items with a factor loading of 0.4 to 0.7 can also be eliminated if the CR and AVE are enhanced, as Domínguez-Quintero et al. (2018) and Suprihartini et al. (2021) contend.

## Collinearity Statistics

Interaction amidst multiple extrinsic factors enclosed is determined as collinearity. Consequently, the disruption of data that can be verified utilizing the VIF criteria is perceived as collinearity. If  $VIF = 1$ , then this VIF is not associated; if  $1 < VIF \leq 5$ , then it is moderately correlated; and if  $VIF > 5$ , then it is highly connected. That is why any VIF value higher than five ought to be rejected (Daoud, 2018). In addition, Urbach and Ahlemann (2010) suggest that 10 is the VIF cutoff value.

## Discriminant Validity

According to Urbach and Ahlemann (2010), one facet of discriminating validity is the dimension of variation in the measurements of the numerous factors. It should be noted that this study utilized Hair et al. (2014)'s recommended methodology of applying Fornell and Larcker's (1981) techniques to establish discriminant validity. To assess the measurement model should follow (Hair et al., 2014) the table 3.5.

Table 3.5: Summary of validity Standard of Measurement Model

Validity and Reliability	Criteria	Threshold Value and Guideline
Indicator reliability	Factor loadings (FL)	$FL \geq 0.5$
Indicator validity	Variance inflation factor (VIF)	$VIF \leq 5$ or, $VIF \leq 10$
Internal consistency reliability	Composite reliability (CR)	$CR \geq 0.7$
Convergent validity	Average variance extracted (AVE)	$AVE \geq 0.5$
Discriminant validity	Fornell and Larcker (1981)	The AVE of each variable has to belarger than the maximum squared correlation of any other variable

### **Coefficient of Determination**

$R^2$  appraises the interrelation amidst the variance stated. A minimal, moderate, and upward level of elucidative vigor is notably 0.19, 0.333, and 0.67, respectively, according to Chin (1998). In contrast, the weak, moderate, and significant levels of elucidative vigor notably are, respectively, 0.25, 0.5, and 0.75, according to Hair et al. (2014).

### **Cross-Validated Redundancy**

The interior model's prognosticating implication can be ascertained by utilizing the  $Q^2$  technique. According to Urbach and Ahlemann (2010) and Hair et al. (2014),  $Q^2 > 0$  is the desired threshold value.

### **Path Coefficient**

The path value also regarded as a measured  $\beta$  (Komalasari et al., 2015), is the theoretical interrelations amidst the components. In addition, Pursuant to Hair et al. (2014), this value has a range of +1 to -1, with both values prospect being statistically essential. Crucially, the value at least requires to be above 0.1 (Lohmöller, 1989) or 0.2 (Chin, 1998).

### **Effect Size**

In the SEM, the analyst can establish the effect size of each path by ensuring Cohen's  $f^2$ . The  $f^2$  can be Categorized as small (when  $0.02 \leq f^2 < 0.15$ ), medium (when  $0.15 \leq f^2 < 0.35$ ), or high (when  $f^2 \geq 0.35$ ) based on the value of  $f^2$ . (Hair et al., 2014) and  $0.01 \leq f^2 < 0.02$  is regarded as extremely tiny. To assess the SEM should follow the table 3.6.

Table 3.6: Summary of validity Standard of Structural Model

Validity	Criteria	Threshold Value and Guideline
The validity of the model	Path coefficient ( $\beta$ )	$\beta > 0.1$ or, $\beta > 0.2$
	Coefficient of determination ( $R^2$ )	Substantial $\rightarrow 0.67$ , moderate $\rightarrow 0.33$ , weak $\rightarrow 0.19$ or, Substantial $\rightarrow 0.75$ , moderate $\rightarrow 0.50$ , weak $\rightarrow 0.25$
	Cross validated redundancy ( $Q^2$ )	$Q^2 > 0$
	Effect size ( $f^2$ )	$0.01 \leq f^2 < 0.02 \rightarrow$ very small effect $0.02 \leq f^2 < 0.15 \rightarrow$ small effect $0.15 \leq f^2 < 0.35 \rightarrow$ medium effect $f^2 \geq 0.35 \rightarrow$ large effect

## Proposed Methodology/Applied Mechanism

### Research Methods

As stated by Antwi and Kasim (2015), methods are primarily split into qualitative and quantitative scrutiny. Qualitative study is clarified utilizing words, signs, symbols, clarifications, and objects. Nonetheless, social systems are deemed intricate by qualitative scientists. In light of this, they don't propagate; as opposed, they emphasize only specific groups. In contrast, quantitative facts encompasses explicit value, and detectable facts (Daniel, 2016). Furthermore, verifying the hypotheses is the culminating mission of this tactic (Muijs, 2004). When the conclusion of the survey, the interactions amidst the factors are assessed by verifying these hypotheses utilizing a deductive and confirmatory process. However, consequences can be utilized widely whenever data conglomeration and clarification are done by numerical methods

## Quantitative Research

We can comprehend why Blockchain is able to be utilized to enhance educational achievements across numerous circumstances. Using such knowledge, more potent approaches to implementation using Blockchain in education might be produced. A brief list includes justifications for quantitative research. Details are given in table 3.2.

Table 3.7: Justifications for Quantitative Research

Serial	Condition	In This Research
1	Evaluate the effect of Blockchain on particular learning outcomes in particular contexts.	The effect of adopting Blockchain-based digital credentials on student employment rates in the tech sector might be measured by researchers this would make it possible for academics to separate the effects of Blockchain from other elements that could have an impact on the employment rates of students as the students major or the status of the economy as a whole compare the performance of various Blockchain technologies under particular situations.
2	Compare the performance of various Blockchain technologies under particular situations.	Researchers might evaluate the cost, safety, and scalability of a couple of rival Blockchain-based digital credential platforms in a developing nation; this would make it possible for academics to pinpoint the ideal Blockchain technology solution for a specific scenario.

## **Proposed Conceptual Model**

### **Research Hypotheses**

An unambiguous, meticulous, and irrefutable assertion that forecasts the anticipated consequence of a research inquisition is known as a research hypothesis. An exquisite hypothesis aids in constricting the area of the pedagogy by providing instructions and a structure for identifying the interrelationships amidst various variables. Building a viable inquest initiates with refusing the null assumption and adopting the substitute one.

### **Attitude to Intention**

The convoluted correlation amidst user perceptions and the intention to recruit blockchain gadgets is scrutinized in this study. The complicacies of blockchain and the repercussions of the aspiration to take up it tangibly are the main subjects of this study (Kim, Jungsuk et al., 2017). Negative attitudes cause circumvention, whereas positive attitudes govern robust intentions. To embolden positive motives, there needs to be more insight accessible and chances for interaction.

H1: Attitude influences Intention positively to take up blockchain in education.

### **Perceived compatibility to Attitude**

The opinion to Rogers (1995), PC is the magnitude in which devising is thought to be congruous with the requisites, values, and prior occurrences of possible patrons. As stated by Davis (1989), attitude is a bodily propensity that exhibits a dimension of favorability or unfavorability towards a specific entity. An entity's attitude to ingenuity can be abundantly swayed by the suitability they confide in. A person's attitude is likely to be positively swayed by technology if they apprehend a high level of similitude, which

means the device coordinates well with their contemporary wont and inclinations. Here's the hypothesis:

H2: Perceived compatibility influences attitude positively to take up Blockchain in education.

### **Perceived relative advantage to Attitude**

The immensity to which people's credence effectuating and mobilizing the blockchain in pedagogy bestows unequivocal privileges on substitute tactics is known as the PRA. The consequences of it illustrate a tenacious optimistic causal linkage amidst inventiveness and PRA to ATT (Mazhar Abbas, 2016).

H3: Perceived relative advantage influences attitude positively to take up blockchain in education.

### **Security to Attitude**

This exploration scrutinizes the affiliation amidst security apprehensions and collaborators' demeanor in pedagogy. Considering the ramifications of secrecy and safeguarding facets regarding of blockchains on user attitudes and behaviors, this investigation presents a major guesstimation for valuating conviction in blockchain systems (Don D.H. Shin, 2019). Security has morphed into a vigorous credence (Nishant Kumar et al., 2021).

H4: Security influences attitude negatively to take up blockchain in education.

### **Task characteristics to Attitude**

In the midst of enacting blockchain in a pedagogical realm, this experiment appraises the convoluted intercommunication amidst TAC and the attitudes of educators, pupils, and overseers. TAC boosts traits and users' attitudes pertaining to usage, which in turn ameliorates users' readiness to disseminate acumen (Shengtai Zhang, 2023).

H5: Task characteristics influences attitude positively to take up blockchain in education.

### **Technology characteristics to Attitude**

As stated by F.-J. Batz et al. (1999), TECs are appraised using a scoring scheme that incorporates evaluations from agents operating in the inquiry space. The motive is to bestow momentous insightfulness about demonstrating favorable attitudes and approaching the adoption of digital-learning tools by investigating how characteristics like usability, flexibility, and interaction affect stakeholders' perspectives.

H6: Technology characteristics influences attitude positively to take up blockchain in education.

### **Transparency to Attitude**

Transparency and attitude have a subtle, multifaceted affiliation. In a nutshell, TRAN is the rectitude, lucidity, and receptivity with which acumen is conveyed. Conversely, attitude conveys a person's contemplations, sensations, and inclinations regarding an explicit article or occurrence. Using a multifarious tactic, the dissertation explores how incorporation patterns in the pedagogical arena are dictated by stakeholder perspectives pertaining to blockchain's perceived transparency.

H7: Transparency influences attitude positively to take up blockchain in education.

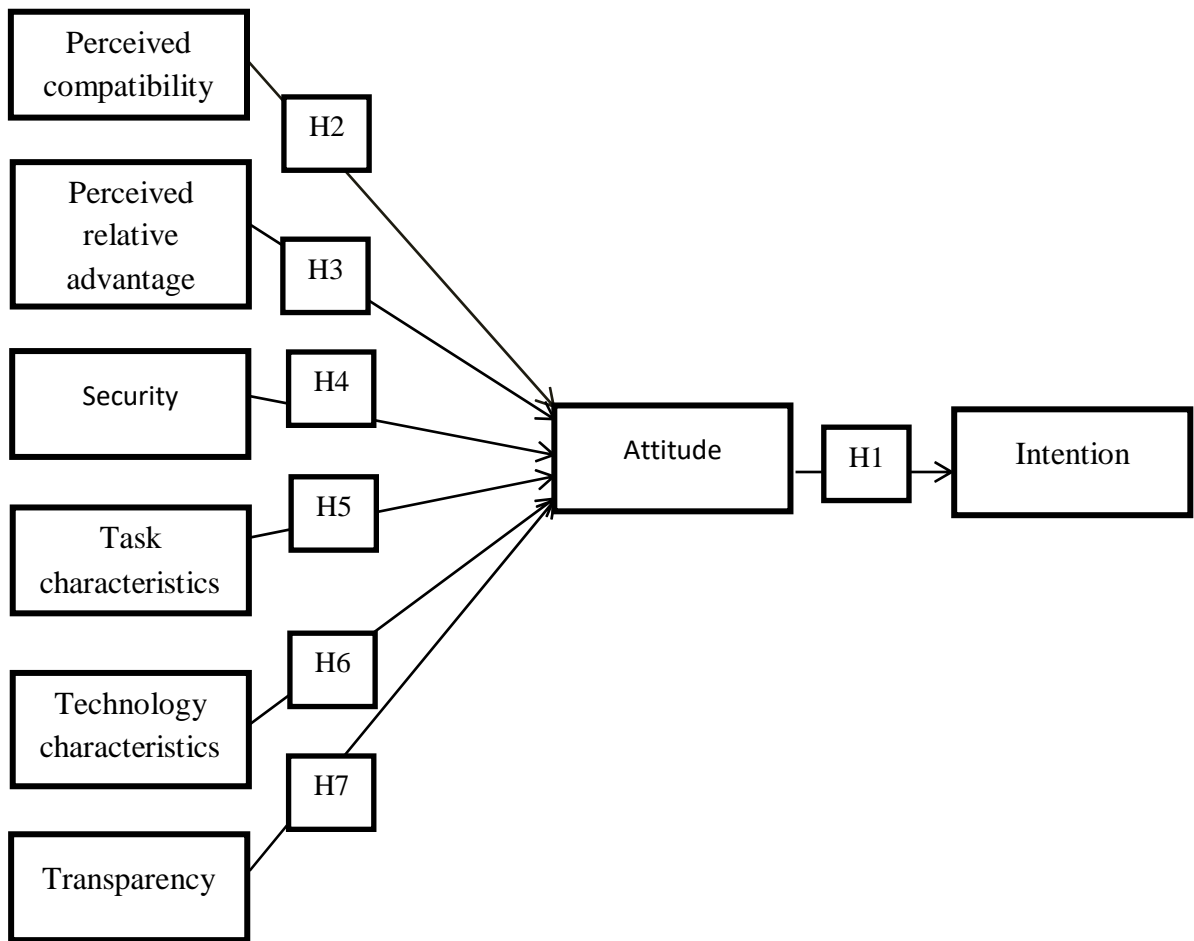


Figure 3.3: Proposed Conceptual Model

## **Implementation Requirements**

Here I've chosen SPSS edition 23 and SmartPLS edition 3.3.3 to analyze data.

### **Statistical Package for Social Science**

A demographic questionnaire additionally preliminary findings are analyzed utilizing SPSS version 23. Furthermore, utilizing SPSS, the CMV from the data set is computed using Harman's test.

### **SmartPLS**

A component of the second-generation model-based structural equations tools, SmartPLS is mostly utilized in computing systems and management fields. As numerous uses along with supremacy, it remains one of the most widely used tools (Garson, 2016). Because the pedagogical community may easily use the SmartPLS technology, this study has concentrated on it. Additionally, this application has a vibrant online bulletin board that provides a reliable means of knowledge exchange (Wong, 2013).

## **Technology Acceptance Model**

### **Task-Technology Fit**

The task-technology fit (TTF) approach originated in early 1995 by Goodhue and Thompson in order to assess harmony among task-technology aspects while figuring out how technological expertise enhances productivity (Hsiao, 2018). The way whereby technologies help a person complete a project spectrum is known as the TTF. Task-specific alongside technological qualities serve as principal indicators for factors, which in turn affect exploitation and performance effect (Hsiao, 2018)

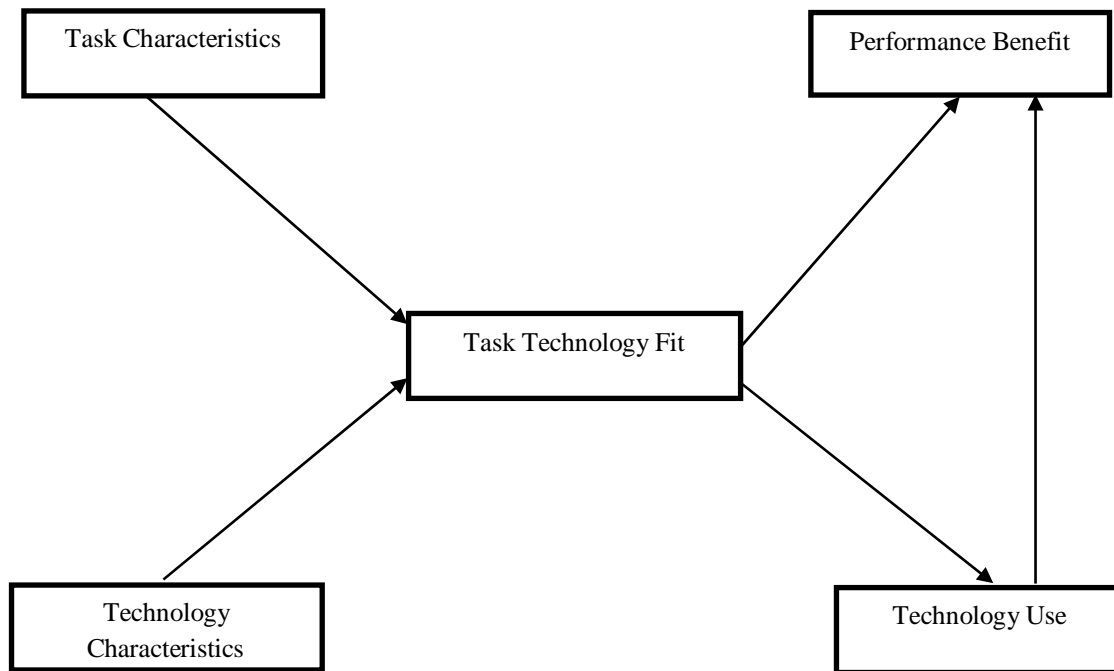


Figure 3.4: Task Technology Fit Model

### **Diffusion of Innovation**

Sociologist E.M. Rogers devised the DOI theory in 1962 as a conceptual schema to delineate how novel concepts, commodities, or gadgets gradually permeate a community. Something that someone adopts as their own is called an innovation. The uptake of pioneering is impacted by 5 major norms within its diverse facets of diffusion. COMP, observability, intricacy, trialability, and RA are a cluster of facets that are pertaining to the qualities of the innovation itself (Nazir Ullah, 2021). To address the exceptional traits, this work enhances and amends Rogers' idea of the function of TEC in the DOI theory.

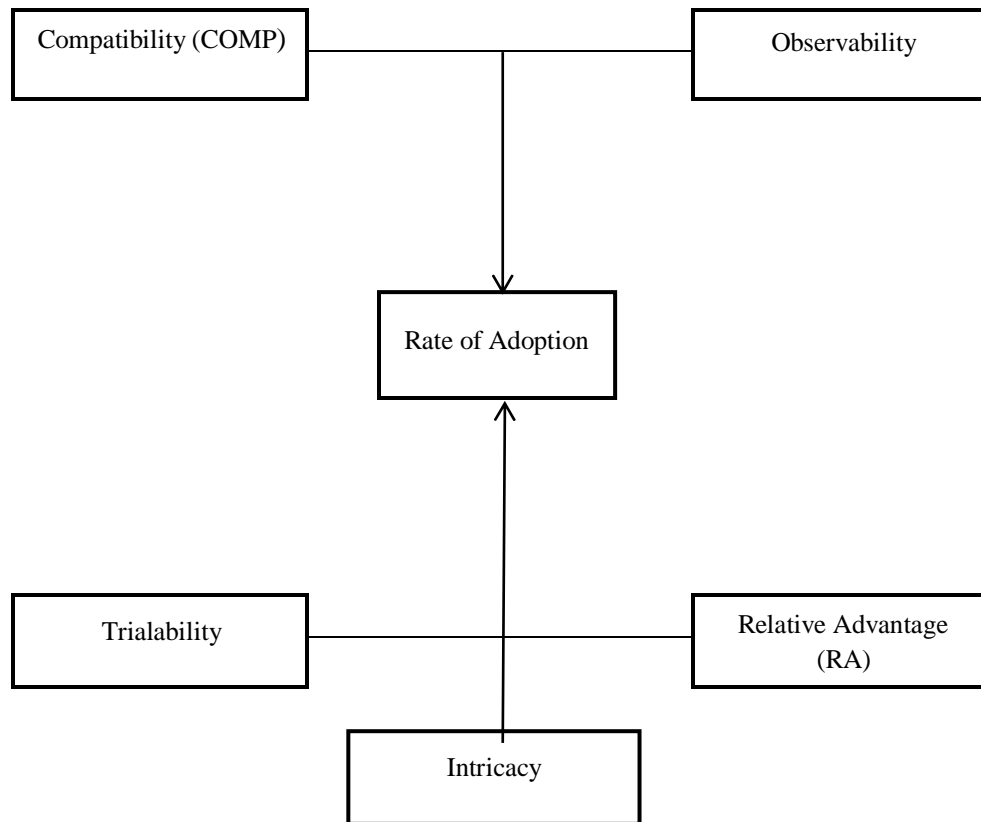


Figure 3.5: Diffusion of Innovation (DOI) Model

## **CHAPTER 4**

### **EXPERIENTAL RESULTS AND ANALYSIS**

#### **Introduction**

This chapter covers research results, involving data preparation, missing entries, and results for AVE, CR, discriminant validity, R-Square value, path coefficient, hypothesis, and cross-validated redundancy. Here are also displayed the results of the measurement and structural models' direct effect.

#### **Experimental Setup**

##### **Data Preparation**

The populace in the modern era prefers to leverage Google Forms as their go-to tool when it comes to sending in responses to online surveys. As transpired, about 500 people have been sent the survey links, and 450 of them returned their responses. The exhaustive list of data is acquired in the context of English. 416 responses are chosen for culminating appraisal from the gathered data, and 34 responses are rejected for multifarious reasons. The Google Form predominantly has multiple parts. 1st part is used to identify the desired answerers considering their opinions and 2nd part has a demographic information questionnaire. Finally, the main questionnaire part is used to identify individuals' opinions proficiently.

##### **Missing Entry**

The set of data is assessed as unbroken if there are no missing entries. For research purposes, an unbroken dataset is most suitable for the reason it yields the most accurate and reliable outcomes. However, in practice, unbroken datasets are not common. Missing entries emerge when participants refrain from responding to one or more

questions in a survey. The missing entry challenges are resolved by using the expectation-maximization (EM) technique. An insignificant volume of missing entries, fewer than 5%, is exposed by the record screening procedure as well. Up to 10% of the data may not give rise to momentous issues when analyzing the outcomes, as suggested by Cohen, West, and Aiken (1983).

### **Common Method Variance**

Bias produced by the use of a single data-capturing strategy emerges when a single inquiry participant serves as the source of both the reliance on and distinct data from just one instrument (Chapter 3). This document outlines the most frequently performed or suggested empirical fixes, which may be employed either before or during data analysis. A typical bias could be apparent if a usual underlying factor explains over 50% of the variance. When assessing the common method variance in this empirical investigation, Harman's single-factor test is applied.

#### **4.2.3 (a) Harman's Single-Factor Test**

This investigation used Harman's single-factor test, which was based on technology management studies by Lin et al. (2015), and Sharma, Yetton, & Crawford (2009). According to the test result, there was no CMV issue with the data because the constrained extraction of a single factor only explained 45.36% of the variation.

## Experimental Results & Analysis

### Average Variance Extracted (AVE) and Composite Reliability (CR)

After the research model is built the scholars must evaluate the outer representation, according to Hair et al. (2014). CR and AVE are both of the foremost matrices applied for determining the dependability and accuracy of data. AVE evaluates the level of variance. Broadly, AVE quantities more than 0.5 are usually considered suitable ( $AVE \geq 0.5$ ). CR evaluates the inside coherence. Broadly, CR quantities more than 0.7 are usually considered suitable ( $CR \geq 0.7$ ) (Hair et al., 2014).

Table 4.1: CR and AVE

Variables	CR	AVE
ATT	0.894	0.678
COMP	0.882	0.651
IA	0.893	0.677
PRA	0.899	0.748
SEC	0.901	0.646
TAC	0.875	0.636
TEC	0.893	0.735
TRAN	0.911	0.719

### Discriminant Validity

Researchers appraise the effectiveness of the measurement model's discriminating accuracy via the standards laid forth by Fornell and Larcker (1981). The diagonal components further indicate the square root of AVE, while the squared correlations represent all of the remaining values. Table 4.2 illustrates that the diagonal values are greater than the corresponding row-column values. The model is therefore regarded as discriminating. Meanwhile, illustration 4.1 displays the SmartPLS tool's measurement model findings.

Table 4.2: Discriminant Validity

Variable	ATT	COMP	IA	PRA	SEC	TAC	TEC	TRAN
ATT	0.824							
COMP	0.724	0.807						
IA	0.775	0.690	0.823					
PRA	0.708	0.663	0.655	0.865				
SEC	0.600	0.652	0.615	0.665	0.804			
TAC	0.698	0.675	0.673	0.668	0.664	0.797		
TEC	0.759	0.667	0.703	0.696	0.569	0.632	0.857	
TRAN	0.731	0.697	0.718	0.701	0.614	0.654	0.673	0.848

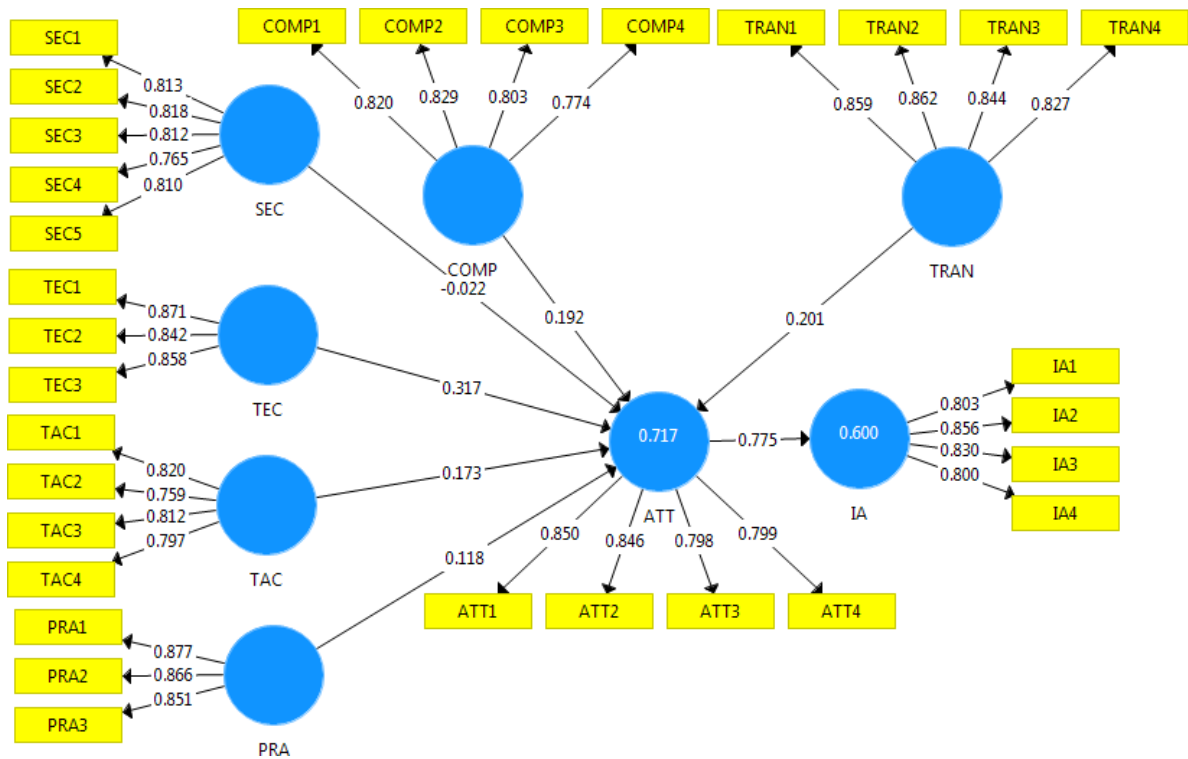


Figure 4.1: Measurement Model Results From the SmartPLS Tool

### Collinearity Statistics (VIF)

If  $VIF = 1$ , then this VIF is not associated; if  $1 < VIF \leq 5$ , then it is moderately correlated; and if  $VIF > 5$ , then it is highly connected. That is why any VIF value higher than five ought to be rejected (Daoud, 2018). In addition, Urbach and Ahlemann (2010) suggest that 10 is the VIF cutoff value.

Table 4.3: Collinearity Statistics (VIF)

	VIF
ATT1	2.142
ATT2	2.135
ATT3	1.729
ATT4	1.762
COMP1	1.875
COMP2	2.007
COMP3	1.760
COMP4	1.464
IA1	1.833
IA2	2.155
IA3	1.890
IA4	1.770
PRA1	2.051
PRA2	1.995
PRA3	1.767
SEC1	1.868
SEC2	2.059
SEC3	2.082
SEC4	1.772
SEC5	1.777
TAC1	1.708
TAC2	1.572
TAC3	1.705
TAC4	1.630

TEC1	1.950
TEC2	1.788
TEC3	1.780
TRAN1	2.175
TRAN2	2.237
TRAN3	2.062
TRAN4	1.943

### Factor Loading

Table 4.4: Factor Loading

	ATT	COMP	IA	PRA	SEC	TAC	TEC	TRAN
ATT1	0.850							
ATT2	0.846							
ATT3	0.798							
ATT4	0.799							
COMP1		0.820						
COMP2		0.829						
COMP3		0.803						
COMP4		0.774						
IA1			0.803					
IA2			0.856					
IA3			0.830					
IA4			0.800					
PRA1				0.877				

PRA2				0.866				
PRA3				0.851				
SEC1					0.813			
SEC2					0.818			
SEC3					0.812			
SEC4					0.765			
SEC5					0.810			
TAC1						0.820		
TAC2						0.759		
TAC3						0.812		
TAC4						0.797		
TEC1							0.871	
TEC2							0.842	
TEC3							0.858	
TRAN1								0.859
TRAN2								0.862
TRAN3								0.844
TRAN4								0.827

## R-Square

In this study, R Square is determined using the SmartPLS tool. Table 4.5 shows that the variance of the model is 60.0% and 71.7%, correspondingly.

Table 4.5: R Square

Variable	R Square	R Square Adjusted
ATT	0.717	0.713
IA	0.600	0.599

## Cross-Validated Redundancy

The erected model is extensively prophetic, as exposed by Table 4.6, displaying that the  $Q^2$  values of ATT and IA as 47.6% and 39.7%, respectively, greater than 0 ( $Q^2 > 0$ ).

Table 4.6: Cross-validated Redundancy

Variable	$Q^2$
ATT	0.476
IA	0.397

## Path Coefficient

For the sake of each relationship, t-statistics are created to establish the importance level. The path coefficient, sample mean, standard deviation, and t-values, along with p-values are all included in Table 4.7. Furthermore, the causal connection is highlighted in red whenever any p-value is larger than 0.05. A p-value is deemed supported if the value is below 0.05. A p-value is deemed to be unsupported if it is above 0.05.

Table 4.7: Path Coefficient

Relationships	Path Coefficient ( $\beta$ )	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics ( $ O/STDEV $ )	P Values
ATT → IA	0.775	0.775	0.037	20.879	0.000
COMP → ATT	0.192	0.189	0.056	3.443	0.001
PRA → ATT	0.118	0.122	0.053	2.245	0.025
SEC → ATT	-0.022	-0.025	0.046	0.475	0.635
TAC → ATT	0.173	0.184	0.071	2.428	0.016
TEC → ATT	0.317	0.316	0.044	7.286	0.000
TRAN → ATT	0.201	0.191	0.058	3.479	0.001

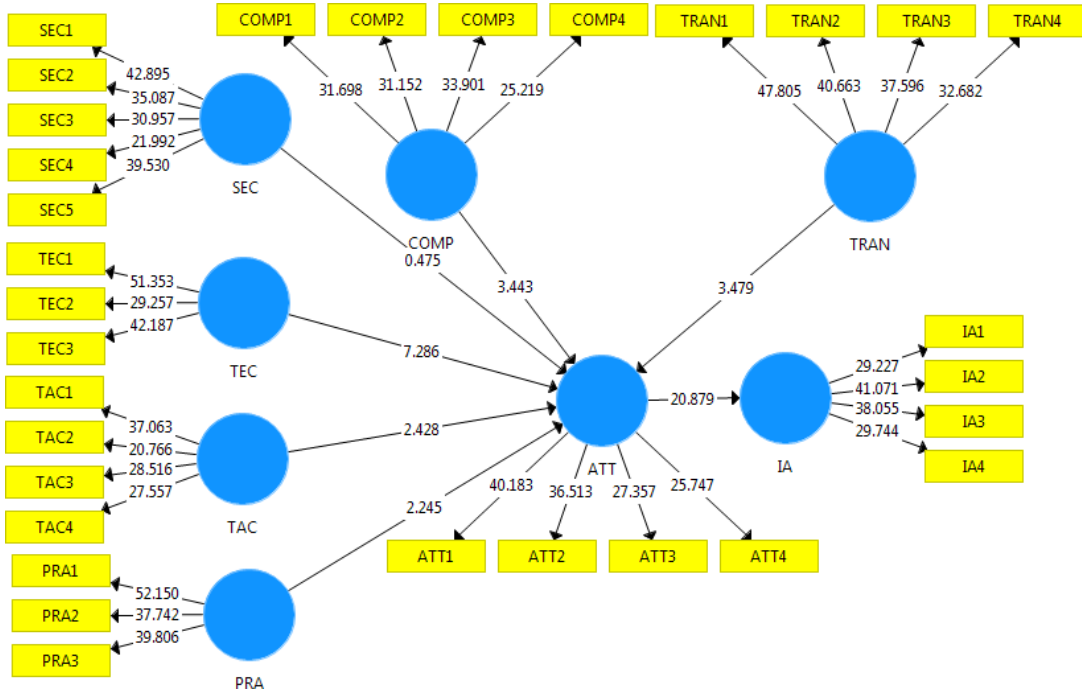


Figure 4.2: Structural Model Results From the SmartPLS Tool.

### Hypotheses Outcome

Six of the seven hypotheses are validated by SmartPLS. Attitude ( $\beta= 0.775$ ,  $p<0.05$ ) Influence on intention (IA) was found to be substantially positive consecutively. When incorporating technostress theory, the result manifests that perceived compatibility ( $\beta= 0.192$ ,  $p<0.001$ ), and perceived relative advantage ( $\beta= 0.118$ ,  $p<0.001$ ) positively persuade attitude (ATT). In H4, security ( $\beta= -0.022$ ,  $p>0.05$ ) had a negative relation with ATT as per hypothesis but no significant effect was found. Furthermore, task characteristics ( $\beta=0.173$ ,  $p<0.05$ ), technology characteristics ( $\beta= 0.317$ ,  $p<0.05$ ), and transparency ( $\beta= 0.201$ ,  $p<0.001$ ) positively affect attitude (ATT).

Table 4.8: Hypotheses Outcome

No	Hypotheses	Remarks
H1	Attitude influences Intention positively to take up blockchain in education.	Supported
H2	Perceived compatibility influences attitude positively to take up Blockchain in education.	Supported
H3	Perceived relative advantage influences attitude positively to take up blockchain in education.	Supported
H4	Security influences attitude negatively to take up blockchain in education.	Not Supported
H5	Task characteristics influences attitude positively to take up blockchain in education.	Supported
H6	Technology characteristics influences attitude positively to take up blockchain in education.	Supported
H7	Transparency influences attitude positively to take up blockchain in education.	Supported

### Effect Size ( $f^2$ )

The f square value is estimated to have a very small impact on the R square if it is more than or equal to 0.01 and less than 0.02. Analogously, if the f-squared score is below 0.15, it will exert an insignificant effect; if the value is below 0.35, it will have a medium effect. Lastly, if the f square measurement is more than or tantamount to 0.35, it will have a notable effect on the R square.

Table 4.9: f square

Relationships	f <sup>2</sup> value	Remarks
ATT → IA	1.501	Large effect
COMP → ATT	0.049	Small effect
PRA → ATT	0.018	Very Small effect
SEC → ATT	0.001	No effect
TAC → ATT	0.042	Small effect
TEC → ATT	0.145	Small effect
TRAN → ATT	0.054	Small effect

## Discussion

The study's findings offer solid confirmation that Blockchain gadgets can be deployed to strengthen scholastic systems' levels of protection, openness, and utility. Additionally, the study suggested that novel pedagogical strategies like micro-credentials and personalized education can be bolstered by Blockchain education. Finally, the AVE and CR values are within their threshold boundaries, which implies that the outcome is optimal. In hypotheses, the majority of the p-values in the path coefficient result are supported (p-values > 0.05), which is advantageous for our study.

## **CHAPTER 5**

### **IMPACT ON SOCIETY, ENVIRONMENT AND SUSTAINABILITY**

#### **Impact on Society**

The effect of blockchain in pedagogy on society is multi-dimensional and metamorphic. Blockchain has sweeping prospect effects on pedagogy that proceed well beyond the classroom. Peer-to-peer pedagogy and micro-badges made feasible by blockchain can boost pedagogical accessibility for those living in underprivileged areas. Pedagogy and documentation based on blockchain schemes can be swiftly corroborated, dismantling the probability of trickery and forgery. This can elevate graduates' employability and increase conviction in pedagogical credentials. Due to blockchain's decentralised structure, certifications and training materials are accessible to people worldwide. Furthermore, blockchain has more impacts on society notably on transparency, global access to pedagogy, empowerment of pupils, efficient employment processes, mitigation of pedagogical disparities, and fostering a culture of lifelong learning.

#### **Impact on Environment**

The impact of blockchain in pedagogy on the atmosphere is essentially positive, with diverse factors contributing to enduring and diminished environmental footprint. Blockchain has more effects on society notably paperless transactions, energy effectiveness, travel diminishing efficient data management, and encouraging environmental awareness. It expedites reliable and transparent transactions, diminishing the dependability on paper-based credentials and administrative practices in pedagogy. This is notably pertinent in pedagogy, where blockchain enforcement streamlines

administrative approaches, markedly diminishing energy usage contrasted with traditional record-keeping systems. Additionally, Blockchain-supported platforms permit cyberlearning, diminishing the need for physical travel pedagogical institutions. The adoption of blockchain aligns with Sustainable Development Goals (SDGs), particularly those pertaining to environmental durability.

### **Ethical Aspects**

While blockchain in pedagogy contains boundless prospects, it's crucial to carefully scrutinize its ethical influences to guarantee equitable and competent execution. Blockchain has numerous ethical aspects notably data secrecy and dominion, inclusivity and accessibility, transparency and fairness, consent and smart contracts, data exactitude, and lastly interoperability. Blockchain in pedagogy raises ethical scrutiny regarding data secrecy and dominion. Explicit guidelines should be in place to guarantee that pupils have sway over their personalized info kept on the blockchain. Additionally, its transparent nature can raise ethical questions about the discernibility of pedagogical records. For ethical reasons, it is indispensable that data exactitude on the blockchain be conserved.

### **Sustainability Plan**

To guarantee prolonged success, improving a durable scheme for blockchain execution in pedagogy necessitates systematic facets. To sustain this study in a prolonged should pursue the notable stipulations -environmental impact assessment, cost-benefit analysis, extensibility and future-proofing, user training and acceptance Strategy, continuous improvement mechanism, community engagement, SDGs, monitoring and reporting, partnerships, and collaboration.

## **Overall Essence**

Blockchain offers better approaches to sophisticated instructional systems on a broader basis. Superior protection, cheapness, enhanced access to evidence, increased responsibility and openness, sense of self-authorization, increased faith, more efficient scholar tracking, aiding scholars' future choices, and increased learner interactivity are just a few of the positive attributes that Blockchain-based technology may contribute to the pedagogy market. It presents an ingenious framework for seamless guidance concerning scholarly evidence, encompassing a spectrum of vital information ranging from daily assignments, attendance, and extracurricular involvements to comprehensive details about their institutional grades and alma maters. By utilizing the power of Blockchain, we would forge an unparalleled system that warrants the integrity, intelligibility, also usability of these records, heralding a new era of smart and efficient informational record-keeping. The electronic ledger required for archiving the electronic badges functions separately between the providers as well as the certifying institution. Instead of current virtual accreditation, it is easier to grab, arrange, and even maintain. The design can hold degrees and certificates. It could decrease the total degree and certificate fraud and manipulation. The Blockchain's capacity to expand may boost the curriculum as well as be successfully utilized in educational settings.[3] It demonstrates the ways to greatly raise learning by minimizing expenses, increasing confidence and transparency, and supplying an encrypted system for exchanging educational data. Subsequently, it indicates there exist troubles with adopting Blockchain technology. Whenever deploying the system, leaders together with legislators ought to take safety, privacy, cost, adaptability, and availability into account. Finally, it demonstrates how restricted the intended uses of Blockchain-based technology for instruction remain. As a result, the Blockchain's future remains unrealized.

## **CHAPTER 6**

### **SUMMARY, CONCLUSION, RECOMMENDATION AND IMPLICATION ON FUTURE RESEARCH**

#### **Summary of the Study**

Blockchain in pedagogy plays a substantial role worldwide. Its dispersed process helps pupils secure their credentials. The introduction discussed the blockchain, its motivation, expected outcomes, and also PMF. Additionally, the background part discussed the paper scrutiny based on the similarity of my topic. In methodology, there discussed the overall data analysis section from which to easily comprehend the effect of data in the blockchain. This study also used DOI and TTF models for the betterment of pedagogy. Furthermore, the result part discussed AVE, CR, VIF, R-square, f-square and path coefficient. To conclude, discussed blockchain's impact on various sectors, and future scope.

#### **Conclusions**

The study using SmartPls to scrutinize the effect of blockchain in pedagogy ensures the model's fit, demonstrating its appropriateness for valuing the interconnections among variables within the pedagogical aspects. Moreover, this study substantiates initial hypotheses, indicating that blockchain consolidation has an essential effect on various pedagogical factors notably transparency, security, and efficiency, as evidenced by the SmartPls analysis. The outcomes guide progressing blockchain-related policies and procedures in the field of pedagogy. Additionally, this study requires deeper scrutiny to analyze gaps that can guide scholars in formulating relevant methodologies. These extensive conclusions, grounded in SmartPls analysis, encapsulate the findings of the study and offer actionable interpretations for both pedagogical and sensible executables within the setting of blockchain in pedagogy.

## **Research's Drawbacks**

Learning-related problems could be solved utilizing Blockchain technology, as it will help students as well as teachers in evaluating how they're doing. The design can hold degrees and certificates. It could decrease the total degree and certificate fraud and manipulation. It may boost the curriculum as well as be successfully utilized in educational settings but it is still concerned with several limitations such as:

**Insufficient Knowledge as well as Unwillingness:** A digital ledger offers a technologically advanced framework for instruction, but it's vital to highlight that there are a few worries about potential users' comprehension and growth of its advantages.

**Safety Concerns:** Since sensitive information is merely kept within blocks, there are times when the privacy of Blockchain users is threatened. Institutions need to consider optimal procedure, necessity, and quality execution for data safety; more security may only be added with authorization.

**Insufficient Planning:** It's imperative that comprehensive solutions be found immediately since institutions require greater investment in their infrastructure, especially in training and competence.

**Budget:** The invention of Blockchain-based technology necessitates an immense amount of equipment and associated technical participation, leading to considerable savings in expenses over the system.

### **6.3 Implication for Further Study**

The prospect of blockchain in pedagogy has sparked tremendous enthusiasm among scholars and pupils. While this study has explored diverse facets of its application, much remains to be scrutinized. The further scrutinize delves into the expertise of users and the integrative dimension of blockchain in pedagogy. In my current study, I did not use moderators and mediators (M & M). In the future, these two will be utilized to strengthen the study. Furthermore, M & M are utilized to envision and inspire the interconnection amidst autonomous and reliant variables. In contrast, the study used just the DOI and TTF models. Apart from these models, there are many models that are exploited for data scrutiny. In upcoming work, I will utilize numerous models for the more effective of my study. Additionally, I collected data from my university's pupils. In the future, I will collect data from other university pupils. The implications for further study bestow a roadmap for advancing the study in the field of blockchain in pedagogy.

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