TECHNOLOGY READINESS AND FLOW THEORY INFLUENCE TOWARD ACCEPTANCE OF AUGMENTED REALITY AMONG STUDENTS IN PRIVATE UNIVERSITIES IN JAKARTA, INDONESIA

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ABSTRACT

Students today benefit from various tools that enhance their learning, including digital platforms, online courses, and virtual classrooms, with augmented reality (AR) becoming increasingly popular. However, in Indonesia, most AR research in higher education focuses on software development rather than assessing students' technology readiness and acceptance. This impacts their motivation and effectiveness in using AR for learning. The level of technology readiness of students will affect their acceptance, and motivation to learn using AR in education that affects focus and academic achievement. This study examined how technology readiness and flow theory affect augmented reality acceptance in Jakarta's private higher education institutions. The Technology Acceptance Model supported this study and also integrated the Technology Readiness Index and Flow Theory to examine how readiness and motivation affect student uptake of augmented reality. This research uses Mixed Method Design to gather, analyse, and validate quantitative and qualitative data. A total of 602 students from 20 private universities in Jakarta is acquired to the survey questionnaire as a basis for the quantitative analysis using SmartPLS, then followed by qualitative research from a total of 10 students as a respondent to validate the quantitative findings using Nvivo12. Based on the results, three variables were rejected in the Technology Readiness Index: Optimism (OPT) towards Perceived of Usefulness (PU) and Perceived Ease of Use (PEOU), and Discomfort (DIS) towards Perceived Usefulness (PU) towards AR acceptance. The Technology Acceptance Model accepts all variables that significantly affect augmented reality acceptance, including Perceived Ease of Use (PEOU) towards Perceived of Usefulness (PU) and Attitude Towards Using (ATU), PU towards Intention to Use (IU) and Attitude Toward Using (ATU), and Attitude Toward Using (ATU) towards the intention to Use (IU). Lasty, Enjoyment, Control, and Concentration towards the Intention to Use in the Flow Theory are accepted. The result of the qualitative research confirmed that the findings in the quantitative results are valid. The implication of these findings for private universities should focus on other factors like innovation, insecurity, and control that significantly impact AR acceptance. Recognizing that readiness and motivation play crucial roles in AR acceptance, institutions should develop strategies to boost students' confidence and interest in using AR technology.

Keywords: Augmented reality, modified technology acceptance model, influence of readiness and flow theory, private higher education institution in Jakarta, technology acceptance model

APPROVAL

This is to certify that this thesis conforms to acceptable standards of scholarly presentation and is fully adequate, in quality and scope, for the fulfilment of the requirements for the Degree of Doctor of Philosophy

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This thesis was submitted to Asia e University and is accepted as fulfilment of the requirements for the Degree of Doctor of Philosophy

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9 July 2024

DECLARATION

I hereby declare that the thesis submitted in fulfilment of the PhD degree is my own work and that all contributions from any other persons or sources are properly and duly cited. I further declare that the material has not been submitted either in whole or in part, for a degree at this or any other university. In making this declaration, I understand and acknowledge any breaches in this declaration constitute academic misconduct, which may result in my expulsion from the programme and/or exclusion from the award of the degree.

Name: Budi Arifitama

Signature of Candidate: **Date**: 9 July 2024

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

AR	Augmented Reality
ATU	Attitude Toward Using
CN	Concentration
CTRL	Control
DIS	Discomfort
ENJ	Enjoyment
FT	Flow Theory
INN	Innovativeness
INS	Insecurity
IU	Intention to Use
OPT	Optimism
PEOU	Perceived Ease Of Use
PLS	Partial Least Square
PU	Perceived Usefulness
SEM	Structural Equation Model
TAM	Technology Acceptance Model
TRAM	Technology Readiness and Acceptance Model
TRI	Technology Readiness Index

CHAPTER 1

INTRODUCTION

1.0   Introduction

The first chapter represents an introduction to the study, which includes a description of the background of the research, as well as an overview of augmented reality. This Chapter also review about the current situation on Augmented Reality (AR) in Indonesia, the use Augmented Reality (AR) in learning, and how learning impact the motivation of students. Additionally, the technology readiness, and flow theory towards the acceptance of Augmented Reality (AR) domain were explained. The problem statements of the research are stated, subsequently the research questions and research objectives are presented. The research scope is discussed and followed by the significance of the research. Organization of the thesis are stated in subsequent sections. This chapter is then ended with the summary.

1.1   Background of the Study

Augmented Reality (AR) is a new technology that is becoming increasingly common in today's environment. It provides an optical illusion that allows for the elevation of virtual model in the real environment. With the exponential growth in cell phone usage and the rapid increase in search engine technology over the last decade, Augmented Reality (AR) is set to be one of the most disruptive technologies of this decade. The majority of Augmented Reality (AR) research in Indonesia is still in the application development stage because The technology is still relatively new in Indonesia, particularly in higher education, where Augmented Reality (AR) is being developed to introduce campus structures as three-dimensional objects (Sitompul et al., 2020) and (Hamdani & Sumbawati, 2020). Another research on the implementation of

Augmented Reality (AR) has been performed by Prasetyo et al. (2019) on Digital Systems Courses in the Informatics Department, Universitas Negeri Surabaya to enhance the learning of the students.

There has been limited research that applies AR to online learning environments, thus we are uncertain whether this technology will have an impact on student use, which will have an effect on student learning motivation in learning. According to previous research by Warden et al. (2022) investigated the impact of technology readiness on students' learning independence and discovered that students with lower technology readiness also have lower independency that leads to a low possibility in education achievement. Thus, AR application development without considering the level of readiness and acceptability of the student can have an impact on the lack of use of the implemented technology and motivation in learning.

Online learning has been in existence for a considerable duration and has mostly been used into learning approaches to enhance the educational experience for students. According to Alyoussef (2023), online learning has emerged as a crucial technological tool for universities to enhance their learning processes and maintain operational efficiency by effectively controlling costs. Motivation plays a significant role in influencing learners' willingness to successfully finish a course according to Dubey and Piroska (2019), the competencies of students in conventional education may not be sufficient to sustain a high level of motivation in online learning, online learning provides students with increased flexibility in terms of scheduling, geographical location, and learning speed. Flow Theory (FT) is used as a means to measure student motivation, where Optimism (OPT), Innovativeness (INN), Discomfort (DIS) and Insecurity (INS) (Beese & Martin, 2019), where Optimism (OPT) reflects the positive expectations students hold towards their learning experiences and outcomes, fostering

resilience and perseverance. Innovativeness (INN) captures the students' willingness to embrace new ideas, approaches, and technologies, which is essential for adapting to dynamic learning environments. Discomfort (DIS) refers to the unease or apprehension students may feel when confronted with challenges or unfamiliar tasks, which can hinder their ability to fully engage in the learning process. Insecurity (INS), on the other hand, pertains to the lack of confidence in their abilities or fear of failure, which can significantly impact their motivation and willingness to take academic risks. By analyzing these dimensions, researchers can gain insights into the factors that either promote or inhibit student flow experiences. High levels of optimism and innovativeness are generally associated with greater engagement and intrinsic motivation, while elevated discomfort and insecurity can serve as barriers to achieving optimal flow states. Understanding the interplay between these components allows for the development of targeted interventions aimed at enhancing student motivation, fostering a supportive learning environment, and ultimately improving educational outcomes.

Previous research has indicated that learner disengagement in courses is mostly linked to two key factors: insufficient time and insufficient motivation (Dubey and Piroska, 2019). Promoting motivation to acquire knowledge is a fundamental component in facilitating effective instructional practices (Filgona et al., 2020). Furthermore, it might be anticipated by researchers that students who exhibit higher levels of motivation to study may have less chance of achieving success in online educational settings (Yahiaoui et al., 2022). On the contrary, a lack of motivation can lead to diminished student enjoyment and concentration during classroom instruction, resulting in a greater risk of students preferring to discontinue their studies (Nasrullah et al., 2022). This highlights the issue of enhancing the design of online courses,

particularly through the integration of Augmented Reality (AR) as a medium, with the aim of fostering student motivation and engagement in the learning process. Furthermore, Tan (2021) explained the necessity for enhancements in the implementation of online learning through the comprehensive gathering of pertinent information pertaining to students' learning. Furthermore, it is vital to assess the level of readiness and acceptance of students who will be using this technology. The success factor of implementing Augmented Reality (AR) lies in the readiness of students.

Based on previous research, there are investigations related to student acceptance of Augmented Reality (AR) that investigate the factors that affect the intention to use Augmented Reality (AR) of students in higher educational institution using Technology Acceptance Model (TAM) by Davies (1989), where Augmented Reality (AR) factors that affect the intention to use Augmented Reality (AR) by students in educational institution learning system studied by Cabero-Almanera et al. (2019), investigate the acceptance of Augmented Reality (AR) by student in higher education institution using Technology Acceptance Model (TAM) where the results are through the use of Pearson's correlation coefficient and structural equation modelling to the various factors included in the Technology Acceptance Model (TAM) provide support for the internal coherence between the different dimensions of the Technology Acceptance Model (TAM). This implies that the Technology Acceptance Model (TAM) model of AR in Higher Education Institution can be regarded as suitable for understanding the level of acceptance of a technology, as well as the future intention of its users to utilize it.

Research on technology readiness and acceptance in Indonesia is still limited, especially in higher education institution. One research found that is conducted by Suryaman et al. (2022), where the research investigated the acceptance of AR by

students at higher education institution using Technology Acceptance Model (TAM) model at Universitas Singaperbangsa Karawang, Indonesia, the factors used in the research were Perceived Usefulness, Perceived Ease of Use , Enjoyment, Behavioral Intention, Attitude. The results showed that that the perceived ease of use when using Augmented Reality (AR) has no effect on student attitude in using Augmented Reality (AR). In other words, student attitude is more influenced by perceived usefulness and a sense of enjoyment when using the technology during the process learning.

In this research, an investigation was carried out to investigate on the influence of readiness and flow theory on the acceptance of Augmented Reality (AR) among students at higher education institutions in Jakarta. Technology Acceptance Model (TAM) is used as a baseline model, in which Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) is studied to determine how users' attitudes (ATT) influence their intention of use (IU) of Augmented Reality (AR) is used as factors. then based on the Technology Acceptance Model, a Conceptual Model is proposed in this study by adding Technology Readiness Index (TRI) to measure the readiness where factors such Optimism (OPT), Innovativeness (INN), Discomfort (DIS) and Insecurity (INS) are investigated. Both of point of view are combined is a model that can be used to measure the level of readiness of a user. The Technology Acceptance model is a model used in exploring the level of acceptance from users for the use of a technology, the two models can be combined to simultaneously measure the level of readiness and acceptance of a user for a new technology. Additionally, Flow Theory (FT) is added to the model where Flow Theory (FT) is used to investigate students motivation while using Augmented Reality (AR) technology with factors such as Enjoyment (ENJ), Concentration (CN) and Control (CTRL).

This research follows a sequential explanatory design, prioritizing quantitative over qualitative methods. Initially, quantitative data is collected and analyzed to form a comprehensive understanding of the research problem. This quantitative phase serves as the foundation, providing numerical evidence and statistical insights, where a quantitative analysis is performed first to analyses the technology readiness, technology acceptance and flow theory based on the conceptual model. Subsequently, qualitative methods are employed from the quantitative analysis where Technology Readiness Index (TRI) and Flow Theory (FT) is investigated for further observation and investigation to find new information. The qualitative analysis serves to know more deeply about some of the significant variable. Online questionnaire is used for data collection in higher education institution students in Jakarta served as respondents as a basis form for the quantitative research then followed by online interview using online conference as a basis for of qualitative data collecting to explain and interpret the quantitative findings, offering deeper context and understanding. By emphasizing the quantitative aspect, the study ensures robust, objective, and generalizable results, while the qualitative phase enriches the data with nuanced, contextual interpretations. This approach allows for a balanced yet quantitatively driven examination of the research questions. This study examines the influence of technology readiness and flow theory toward the acceptance of Augmented Reality (AR) among student in Private Higher Education Institution in Jakarta.

1.2 Problem Statement

Augmented Reality (AR) is an innovative technology that merges the real and virtual worlds, allowing users to interact with virtual things and learn about them. The rapid development and spreading of Augmented Reality (AR) in Indonesia since 2012 and has created an impact and opportunity for industries, especially with the large number

of smartphone users around 345.3 million users in 2020 (Kemp, 2020). The focus of this research is to identify the influence of technology readiness and flow theory toward the acceptance of Augmented Reality (AR) among student in private higher education institution in Jakarta, Indonesia.

Past researchers concluded that the primary effects of disregarding technology readiness is decline in academic performance (Geng et al., 2019). When students lack of the required technological skills and competencies, they struggled to utilize digital learning materials and resources effectively (Barrot et al., 2021). This could lead to lower grades, a lessened understanding of course material, and a diminished learning experience. In courses that extensively rely on digital tools and online resources, students who lack adequate technological literacy can end up at a disadvantage.

As a result, it is critical to undertake this study to look at the elements that influence students' readiness of using Augmented Reality (AR) for learning. Furthermore, Technology Readiness Index (TRI) is used as a measurement for students' readiness for AR Technology. The TRI encompasses key dimensions, including technological optimism, innovativeness, discomfort, confidence, and resistance. Understanding and assessing students' technology readiness can inform educators and institutions on how to effectively incorporate AR technologies into the higher education environment. To assess students' readiness for AR technology in higher education, TRI consist of four factors which is Optimism, factor that measures the degree to which students believe that AR technology can enhance their learning experiences; Innovativeness, factor that assesses students' willingness to explore and experiment with AR technologies; Discomfort, factor that gauges the level of unease or apprehension when using AR.; Security, factor that gauge the level of confidence AR technologies will work correctly.

The problem of student motivation in learning environment has emerged as a significant challenge in modern education. While the convenience and flexibility of learning courses that can be taken anywhere offer many advantages, they also present unique hurdles to keeping students engaged and motivated. Without the physical presence of instructors and peers, students often struggle to maintain the same level of enthusiasm and focus. Distractions, a lack of structure, and interactions can all contribute to a decline in motivation. Additionally, the self-paced nature of the way of student learning can lead to procrastination and a sense of isolation, further diminishing students' motivation to actively participate and excel in their studies. Addressing this issue requires innovative approaches to course design, technology integration, and support systems that help students stay motivated and engaged throughout their online learning journey.

To address the problem of student motivation, it is essential to first understand what motivation entails in the context of education. Flow theory (FT) has significant implications for student motivation and the learning process. When students experience flow in their studies, they are more likely to be motivated, engaged, and perform at their best. There are 3 factors used to measure Flow Theory (FT), namely: Enjoyment (ENJ), Concentration (CN), and Discomfort (DIS). Motivation is a complex psychological construct that drives learners to initiate, sustain, and complete learning tasks. Motivation can be influenced by factors such as self-determination, goal orientation, and the perceived value of the learning experience. Additionally, students may be intrinsically motivated, driven by their own interests and curiosity, or extrinsically motivated, motivated by external rewards or pressures (Chang & Hwang, 2018).

Furthermore, Technology Acceptance Model (TAM) served as a baseline model to the modified model where Technology Readiness Index (TRI) and Flow Theory (FT) is added to the model to investigate the influence of Technology Readiness Index (TRI) and Flow Theory (FT) toward the acceptance of Augmented Reality (AR) among students in private higher education in Jakarta.

Based on past research mentioned before, a few problem statements of this research are identified as follows:

a) Research on the acceptance of Augmented Reality (AR) technology among students at higher education institution is limited since there is no study on the acceptance of Augmented Reality (AR) in higher education institution in Jakarta. Therefore, a study is required to determine the readiness and acceptance of students before using Augmented Reality (AR) technology. Neglecting to address technology acceptance among students can directly impact their academic performance. When students resist or reluctant to use technology, they may miss out on opportunities for digital learning, collaboration, and access to resources. This can lead to lower grades, reduced comprehension of course content, and an inability to adapt to modern educational practices.

b) Researchers have applied Technology Readiness Index (TRI) to measure the readiness of potential users within the use of a new technology and Flow theory (FT) to measure motivation on users with new technology. However, the effect of TRI and FT on the use of Augmented Reality (AR) is not currently well documented. Therefore, it is significant to determine the relationships between TRI and FT to explain the readiness and motivation on

the acceptance of Augmented Reality (AR) among undergraduate student in Higher Education Institution in Jakarta.

c) Student motivation in the way of student learn with the use of Augmented Reality (AR) as a media is an issue that demands attention from educators and institutions. The challenges posed by learning can be performed anywhere with the absence of interaction, distractions, and self-regulation difficulties must be addressed with innovative strategies. Without the physical presence of instructors, students often struggle to maintain the same level of enthusiasm and focus which can lead to a decline in motivation in their academic performance.

1.3 Objectives

Based on the background stated, the research objectives developed for this research are as follows:

a) To develop a modified Technology Acceptance Model (TAM) which take into consideration of Technology Readiness Index (TRI) as an antecedent to Technology Acceptance and Flow Theory (FT) as a mediator to the intention of use in Augmented Reality (AR) adoption among students of Private Higher Education Institution in Jakarta.

b) To identify the factors that influence the adoption of Augmented Reality (AR) with the modified Technology Acceptance Model (TAM) among the students in Private Higher Education Institution in Jakarta.

c) To evaluate the model for the adoption of Augmented Reality (AR) among the students from Private Higher Education Institution in Jakarta using a