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Exploring the impact of visual literacy and user experience on the usage and adoption rate of a Learning Management System in Higher Learning Institutions

by

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DECLARATION

I, Daghlaan Davids, declare that the contents of this thesis represent my own unaided work, and that the thesis/dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed:  **Date: November 2023**

ABSTRACT

Learner Management Systems exist to make a significant contribution to the housing and distribution of digital data. Whether it acts as a content creation tool or a repository, it is useful in helping users navigate a notable amount of content. A user's perception of the digital environment is subjective and perception can dictate reality, especially when the environment is comprised of both text and visual cues. Visual literacy is a skill that can be used to help a user navigate the vast dimensionality of a Learning Management system. Using qualitative research methodology methods, the study proposes that if the user possess the necessary interpretive visual literacy skill, it can translate to an enjoyable and positive user experience that will influence the usage and adoption rate of a Learning Management system. The study examines the interconnected relationship between the user and the Learning Management system in the context of visual literacy and user experience. To explore the interpretive nature of visual literacy usage in a Learning Management system environment, I present insights into the interaction, functionality and aesthetic value of elements and affordances contained in a Learning Management system and how visual literacy and user experience can influence the usage and adoption of the Learning Management system.

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DEDICATION

For those who are not here anymore that helped shaped my journey.

ABBREVIATIONS AND ACRONYMS

Abbreviation/Acronym	
DVL	Digital Visual Literacy
HEI	Higher Education Institutions
HCI	Human-Computer Interaction
ICT	Information and Communication Technology
IT	Information Technology
LMS	Learning Management System
NRT	Non-real-time
PEoU	Perceived Ease of Use
PU	Perceived Usefulness
ROI	Return on investment
RT	Real-time
TRA	Theory of Reasonable Action
TPB	Theory of Planned Behaviour
TAM	Technology Acceptance Model
VL	Visual Literacy
UI	User Interface
UX	User Experience

DEFINITIONS

- **Data administration** in the context of an LMS, can be defined as a process where the relevant parties manage, facilitate and track content with the LMS structure (Dutt, et al., 2019).

- **Human-Computer Interaction (HCI)** is defined by Rogers (2012) as the interaction between technology and the people that use it.

- **Learning Management System (LMS)** as defined by Turnbull, Chugh, and Luck (2019) is an online technology used for the creation, management, and distribution of content.

- **Technology adoption** is defined by Straub (2009) as the onboarding of complex, yet social processes facilitated by systems.

- **User experience (UX)** is defined by ISO FDIS 9241-210 as a user's perception that results from the use of a system or service (Mirnig, et al., 2009).

- **Visual Literacy (VL)** is defined by Brill, Kim, and Branch (2000) as images that communicate meaning and the user's ability to read and comprehend them.

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CHAPTER 1
Introduction

1.1 Introduction

It is often suggested that digital images are the cave paintings of the 21st century, and the systems that store them serve as the modern-day caves.

The metaphor is appropriate because just like explorers who are trying to decipher these cave paintings, our journey navigating digital systems is exploratory as well. Just as those explorers needed literacy skills to interpret the cave painting, users require their own form of literacy skills to interpret the digital world.

Visual literacy of a digital system can show users what cave paintings were to explorers. Our ability to navigate the digital world and its vast landscape is fraught with buttons, text and images and at times it can be daunting. We might think of getting a map to help us navigate, but instead of just reaching for our guide, we should first get the tools to be able to read the map.

The current digital landscape provides us with an infinite number of apps, websites and systems and as proficient as we think we may be in using them, perhaps we are not using them to their full potential. The aforementioned statement provides us with an opportunity to evolve how we read, write and interact with the digital material of the many systems available to us.

Literacy, at its core, is the skill of reading and writing but in a digital environment (Gee, 1991; Keefe and Copeland, 2011; Perry, 2012). All types of visual curiosities are introduced and if we don't understand them, how can we "read" them to assist us on our digital journey? The concept of visual literacy can go a long way to giving us more tools to interact with the many systems available to us.

In this study, the core focus will be on how certain factors influence the usage and adoption of an LMS (Learning Management System) (technology) using the theoretical framework of the Technology Acceptance Model (TAM) (Davis, 1989) as a lens.

It will examine how visual literacy together with our user experiences can influence our usage and adoption of LMSs in the context of a higher education institution environment.

Before the onset of internet usage in the digital age, as we know it, the possibilities of learning in isolation were more prevalent (Dickey, 2004). Learning, by current technological standards, does not take place in isolation and with the continuous development of a variety of digital solutions specifically for learning, a collaborative space for active learning can be established.

To address the issue of inadequate or limiting educational solutions, especially those in online digital spaces, resources in the form of digital solutions need to be available. It would be done to properly address and problem-solve effective collaboration learning (Maclean, 2012).
These digital solutions provide tools (Fardoun, et al, 2012) that can be used in an online, web-based medium that is conducive to enhancing academic development but also has an application to provide reinforcement for knowledge gained and shared, through offline functionality. When providing solutions to a learning-related problem, the possibilities of the internet as a resource (Duffy, 2000), in particular, web-based tools, should not be underestimated, as it has the potential for, but is not limited to, its distribution of learning content and academic-related information.
As the internet is an information resource almost without limitation and can therefore be used for knowledge enhancement, it mirrors an argument that Kiel (1999) makes about education being a process that does not end.
We, therefore, need to create, develop and enhance tools in digital spaces that allow for the facilitation, dissemination, and collaboration of content for the purpose of learning.

1.2 Background to the study

Learner management systems (LMSs) enable users to develop and administer content through technology (Alaofi, 2016**)**. Whether the technology is new, old or in a feverous development cycle, there are strengths and weaknesses to it.
Users require visual literacy skills to interpret a system's many nuances and if there is a negative perception **(**Alenezi, 2018**)** of the tools or system, user engagement could be negatively affected. The aforementioned could be due to an ineffective user experience (UX) or misinterpretation of

visuals (User Interface (UI)) owing to limited visual literacy (VL) and therefore the usage and adoption of the LMS could be impeded. This study aims to examine the aforementioned, regardless of whether the LMS forms an integral part of the institution's systems or not (Earnshaw, et al, 2017).

The LMSs provide tools that can be used in an online, web-based medium that is conducive to enhancing academic development (Fardoun, et al, 2012). The administration of information, usage and adoption of the LMSs should not only be for exclusive online interaction but should cater for knowledge reinforcement through offline functionality. The adoption and usage of the LMS instruments, where learners actively participate, should create a user experience (UX) that is conducive to both data sharing in real-time (RT) and non-real-time (NRT) (Wahl, et al, 2016).
If the visual literacy of the LMSs does not translate to a sustainable user experience that abides by Human-Computer Interaction (HCI) principles, the impact can negatively affect its usage and overall adoption (Coffey, 2017). It would, therefore, have an impact on information acquisition, knowledge implementation, and academic advancement regardless of industry sector or faculty discipline. Kiel (1999) argues that education is a process that does not end and therefore the ability of LMS stakeholders to interpret the visual language used in LMSs to support and access information, need not only be in place but also be of a standard that facilitates the UX to increase adoption at the institutions housing them. Learning is no longer limited to geographical or physical spaces and therefore does not occur in the form of an isolated or confined, physical environment (Dickey, 2004). These spaces can now be accommodated online to facilitate a more collaborative environment that is not bound by physical location or border restrictions. Learning in collaboration happens between the Users, the initiator (student, instructor, lecturer, faculty), and the LMS (software), and while different, individualised perspectives have previously been documented, this study plans to explore how input, regarding UX and VL, from all aforementioned stakeholders, influences usage and adoption in Higher Education Institutions (HEI).

1.3 LMS Adoption

As it is, currently there is a multitude of LMSs available for adoption. They range from the free and open-source varieties such as Sakai and Moodle to the more proprietary versions such as Desire2Learn and Blackboard (Alenezi, 2018). Although technology has the ability to alter how people learn (DeNeui and Dodge, 2006), it is important that we don't just understand the technology and how to implement it but also how to interact with it. These elements are where one of the foci of this study, which is how users' visual literacy influences the usage of LMSs, comes into play.

Perception of visual aesthetics and our interpretation of those aesthetics through our innate visual literacy cognition is vital to a continuous positive perception of technology and by way of that, our continued usage and adoption of the technology. Blackboard, since its inception in 1997 (Falvo & Johnson, 2007) is a widely used LMS in HEIs because it caters for a variety of learning environments, such as online or distance learning and conventional classroom learning (Coates, 2007; Malikowski et al, 2007) and is therefore suited to be a good baseline for the study.
Blackboard has also undergone a massive change in its use of visuals or UI that is geared to positively enhance user experience (Kolko, 2020) and because of this, it is also suited for the study because for those who have used it before and after the visual change, might have had their perception altered in how the LMS operates. The change could influence the user perception to either positive or negative and by that logic, directly influences usage and adoption.
This study will use Blackboard as the LMS and attempt to answer the question of how visual literacy and user experience influence its adoption in Higher Education Institutions.

1.4 Research Problem

The problem driving this research is that we do not know how visual literacy and user experience influence the usage and adoption of an LMS at Higher Education Institutions.
This study will focus on this relevant but often overlooked perspective when it comes to technology adoption and use. Users' perception and interpretation of the visual literacy of LMSs will be shown to be relevant based on the influence it has on the UX. A direct correlation may exist

between the collaborative nature of UX and its quality, user interaction through visual literacy, and perception and interpretation of signs that link to visual literacy in the application of the learning process. The correlation of the aforementioned is what this study seeks to explore.

In an age where technology is a part of nearly every aspect of life, Users can be hampered by poorly designed User Experience (UX), the visual nature of the User Interface (UI) and other visually engaging elements. A positive outcome concerning the visual side of things can be gauged through the Visual Literacy (VL) of the user and how their innate or acquired knowledge of various design elements can assist in navigating the visual rigours of any digital tool, regardless of the system
Digital platforms such as LMSs have tools that enable users, at any given time, to access and manage information. The participation of lecturers and students will vary depending on the effectiveness of the human-computer interaction (HCI) principles implemented for user experience (Calp and Akcayol, 2019). To facilitate collaboration between the users and the platform, a level of interaction is required that is contextually immersive using the correct set of tools, regardless of connectivity (Zimmer, 2007).

The vast majority of literature that explores adoption, focused on the systemic nature of various LMSs or the functionality of these digital systems. The context was mainly approached from the strengths, weaknesses or absence of features and/or technology. A vast majority of studies also focused mainly on singular elements such as the UX, which can be subjective but also quantifiable through various analytic tools (Adikari, McDonald, and Campbell, 2016). Rarely has the research delved into more abstract concepts such as visual literacy, which is subjective, but relevant because of the graphical nature of most systems and their interaction elements (menus, icons, etc.) of the UI (Cantoni, Cellario and Porta, 2004).

One such means of achieving this is through visual literacy and/or design, which in context, is the common visual language that helps us to understand the environment of the digital platforms we engage with.

Visual Literacy is of value in the digital space and the understanding and interpretation of an LMS are vital to continued usage and adoption by its users (Bleed, 2005).

How this interpretation is initialised is however based on the fact that the visual data being perceived, is relevant and updated to fit in with current standards of UX and visual language.

This study, therefore, proposes that if the interpretation of the LMSs' visual literacy does not translate to a relatable and positive user experience (UX), it will negatively influence the usage and adoption rate of the LMS. Visual literacy in a digital environment is mostly subjective and communication problems may arise between lecturers and their students. An understanding of the LMSs' visual literacy needs to be unambiguous between users, to support good HCI principles for learning through the LMS (Jacoby, 2017). The collaboration dynamic between the various user types, through visual literacy, must be effortless and consistent (Metros and Woolsey, 2006). The collective engagement by all parties will translate to the sharing of more content as more users will be engaged. It could also potentially lead to the development of more captivating content (Cantoni, Cellario and Porta, 2004) where more of the LMS's tools are involved because of consistent visual literacy.

Consistency is vital for good UX practices which leads to continuous usage and increased adoption of the LMS. Visual literacy and UX are of value in LMS usage and are paramount for adoption (Fehnert, et al., 2008).

1.5 Research Questions

This study proposes the primary research question to be answered is;

- *How do visual literacy and user experience influence the usage and adoption of LMSs in Higher Education Institutions?*

The support or sub-questions that will assist in contextualising the main question are;

- *How does perception of user interface elements influence user experience?* and
- *How does perception of aesthetics of a Learning Management System influence user experience and usability?*

An LMS, as a digital tool, is an ever-evolving inevitability. Interactivity that is perceived to be outdated may have a negative effect on the continued usage and adoption of the technology, in this case, concerning an LMS. For this to be negated, the system (LMS) at times requires updates that bring it in line with current technology standards. These updates aren't always successful for every part of the system and sometimes various sections that require user input can be affected. An example of this is if a system has a navigation update where instead of just being text-based, the navigation now uses icons instead. If the visual literacy level of the user is not able to identify the intention of the icon, the user experience will be influenced because confusion might occur, or an item from the navigation could be lost in translation.

This brings the concept of affordance into the discussion. Affordances in UX are perceived properties of a visual element can suggest how that instance of the visual element (e.g. an icon) can be used.

The visual literacy influence is an example of what the primary research questions seek to answer.

LMSs are information repositories which require a transactional exchange between the users and the system to ensure that return visits to the LMS are made such that successful adoption of the LMS occurs (Rosenblatt, 1987). Once users are engaged in the LMS, there needs to be an impactful return on investment (ROI) so that the engagement continues. For the different users (Lecturers and Students) these could take on the

form of a myriad of things that reinforce their continued investment in the LMS. For lecturers, it could be the addition of new tools to enhance teaching and for students, it could take on the form of increased marks because the content is delivered in a manner that reduces cognitive load. If something is hard to interpret, it could also be hard to relate to. If this happens between what content the Lecturer uploads and if the students struggle to access the content because of system UI vagueness or their understanding thereof. It could create a disconnect that results in a negative influence on LMS usage (because it is the source) and a negative attitude towards technology. All of the aforementioned forms part of the Human-Computer Interaction (HCI) and the principles that could be of influence within the environment of the LMS.

The correlation between users' (Lecturers and Students) understanding of the LMSs visual literacy and their shared user experience is important because of the symbiotic relationship between the providing of content and the facilitation of receiving that content.
For the user experience to be successful regarding the functionality of the LMS, a viable understanding of visual literacy is needed from all users, to have a positive adoption outcome for the LMS. This study proposes that the implementation of the understanding of the above-mentioned can influence the usage and adoption of the LMS. For this to happen we need to examine the level to which users' visual literacy is enabled so that the knowledge base and input for improvements will increase thereby improving HCI implementation for functionality, usage and adoption. Therefore, the user experience (UX) and visual literacy (VL) will directly be influential, and advances will be yielded so that adoption can continue. The elements speak to the collaboration and interconnectivity of all users.

1.6 Research aim

The aim of the study is to explore the influence of visual literacy and user experiences within a learning management system (Blackboard).
The research also aims to thoroughly examine the opinions of users of this LMS environment (Blackboard), and show how the elements of User experience and visual literacy are symbiotic and that they contribute to the interactions (or lack thereof) within the LMS.

The main goal is to determine whether visual literacy and user experience have an influence on how LMSs are used and adopted, as well as how perceptions of the Blackboard LMS are influenced. To determine this and to encourage usage, achieve a favourable perception and assess the effects on HCI within the LMS, it is necessary to ascertain the level of visual literacy among users interacting with the platform.

Usage pattern analysis and the perceived usability of Blackboard's LMS interactions will be looked at. This study will also attempt to ascertain how HCI concepts apply to the LMS user experience. The aforementioned will demonstrate how the usage or adoption of an LMS are impacted by visual literacy and user experience.

1.7 Purpose of the study

The purpose of this study is to obtain a broader understanding of how visual literacy and user experience influence LMS usage and adoption. There are many reasons for LMS usage and adoption in Higher Education as a variety of literature has already explored or hypotheses many other reasons for the usage and adoption of LMSs.

The assumption that this study makes is that to have a continued positive experience with an LMS, there needs to be some form of visual literacy knowledge that the user already possesses and that past technology engagements affect the user experience. These are all theorised within the parameters of existing HCI principles.

An additional assumption of the researcher was that the low uptake of LMS usage could be improved by a more cohesive accessible and perhaps simplified form of visual literacy, packaged into the system and learnt by the user through engagement and frequent use.

As technology advances, additional software is introduced to the market. The additions could range from tackling education-based challenges in a learning environment or acting as a repository for information/content for retrieval when needed.

There is generally not one digital solution to solve all the technology challenges. Therefore, as Queirós, et al. (2016) state interoperability of software into an LMS is important as it can become a useful mechanism for centralising learning, information storage, content creation and

collaboration. The same reasoning can be assumed for the interoperability of user-friendly visuals in the UI so that the interaction can be more seamless thereby favourably increasing user experience, usage and adoption.

1.8 Rationale of the study

This study will contribute to the existing literature by using the existing theoretical Technology Acceptance Model(TAM) as a framework. There are also some key concepts that need to be expounded on that will justify the purpose of this research within the existing literature, so that a connection can be made between the various concepts being explored. These concepts are as follows;

- **Data administration** in the context of an LMS, can be defined as a process where the relevant parties manage, facilitate and track content with the LMS structure (Dutt, et al., 2019).

- **Human-Computer Interaction (HCI)** is defined by Rogers (2012) as the interaction between technology and the people that use it.

- **Learning Management System (LMS)** as defined by Turnbull, Chugh, and Luck (2019) is an online technology used for the creation, management, and distribution of content.

- **Technology adoption** is defined by Straub (2009) as the onboarding of complex, yet social processes facilitated by systems.

- **User experience (UX)** is defined by ISO FDIS 9241-210 as a user's perception that results from the use of a system or service (Mirnig, et al., 2009).

- **Visual Literacy (VL)** is defined by Brill, Kim, and Branch (2000) as images that communicate meaning and the user's ability to read and comprehend them.

Having an understanding of visual literacy influences, will assist users in easily navigating and interacting with the LMS and also reveal any weaknesses in UI construction. The information can then theoretically be used to improve the functionality and interaction based on the fundamentals of HCI theory.

1.9 Introduction to the Theoretical Framework

Technology advancements are at most times relevant to aid users in achieving their goals when interacting with a digital tool or system. When there is a functional or visual change in a component that users have become accustomed to, it can precipitate that we shift our way of interaction and engagement to be in alignment with that change. When discussing the literature, we draw upon the existing structure of the Technology Acceptance Mode (Davis,1989). By utilising this model we can contextualise the research in a manner that pertains to the questions asked by this study. TAM can provide a framework that assists in pinpointing constructs that shape perception for system usage.

To further enhance the framework, we also draw on the research done by Collis and Verwijs, (1995). They propose the use of certain constructs that are not included in the TAM framework hypothesised by Davis as part of an evaluation methodology for digital environments. In keeping with the aim of establishing the influence of visual literacy and user experience on usage and adoption, the user needs to accept the system and its functional elements. It is speculated by Collis and Verwijs (1995), that three constructs can lead to User acceptability, namely; Usefulness, Attractiveness and an element that “makes work easier”. I, therefore, propose that for the purposes of this study, the three aforementioned constructs be utilised in this framework as Usefulness can deal with UX considerations, Attractiveness can deal with visual literacy considerations and “makes work easier” deal with HCI considerations. They are factors that influence acceptance and in Chapter 2, I will expound on how these constructs are relevant to TAM and can be used to deal with the aforementioned considerations.

This research is relevant ecause it focuses usage and adoption of an LMS, which is a system for delivering content and a multitude of processes (Learning Management System (LMS), 2019) based on a logical structure and Visual literacy which is a concept-based on an amalgamation of theories (Avgerinou and Pettersson, 2011; Avgerinou and Ericson,1997; Bradent and Hortinf, 1982) and yet somehow the two entities appear to influence each other. TAM will be used as the lens to understand the influence of visual literacy and user experience perception on the usage and adoption of the LMS environment.

1.10 Chapter Overview

Chapter 1 - Introduction

The opening chapter outlines the necessary information pertinent to an overview of the study. TAM is briefly introduced as a theoretical framework, as well as certain elements from Collis and Verwijs which will support the framework. Its use is briefly discussed as a lens as well as the concept of LMS adoption. The aforementioned provides a summary of the essence of the study. A problem based on the existing literature was identified and subsequent questions were developed to address the problem. The aim and purpose are to more broadly understand the questions proposed, and the rationale identifies terminology used and explains how this study will contribute to the existing literature. The last part of chapter one provides a summary of the chapters to follow.

Chapter 2 - Framework and Literature review

The chapter details the literature where past research will be discussed. In addition to the literature examination, the chapter opens with a discussion of the theoretical framework for this study and how its application can be used to attempt to answer the questions posed here. The chapter also briefly examines past models which have contributed to this study's framework.

Following this, literature that explores LMS usage in the field of IT (Information Technology) to contextualise the study, visual literacy and user experience to address elements that form part of the primary research question, and finally semiotics are discussed to identify components which contribute to answering the sub research questions.

Human-Computer Interaction (HCI) is also explored but as a complement and support to all the aforementioned elements in their various sections. The literature discussed in this chapter seeks to provide insights and contextualise the nature of usage and technology adoption of an LMS.

Chapter 3 - Research design and methodology

This chapter puts forth the design and methodology for the research which will assist with answering the research questions. It outlines the population sample and the characteristics of the participants chosen. The chapter discusses the various instruments used to gather data for the purposes of analysis. These instruments are a survey and an observational study. The criteria for the construction of these instruments are described here. The ethical considerations of the study and data analysis techniques used are discussed here as well.

Chapter 4 - Findings

In this chapter, the findings of the data collected from the survey and observational study are unpacked and discussed. Here I explore how the two instruments' data correlate to form evidence that contributes to answering the primary research question and the sub-questions.

Chapter 5 - Conclusion/ Recommendation for further study

This chapter summarises and discusses the research, asserts conclusions and consolidates the information to put forth recommendations for any further study.

CHAPTER 2
Literature Review

2.1 Introduction

Adoption of technology has been influenced by a variety of factors such as, but not limited to perception, technology advancements or skill level. While this topic has been widely researched, the influence of visual factors, such as aesthetics and visual literacy, on adoption has not been extensively focused on. This chapter will provide the framework and examine the core question of this study which is; *How do visual literacy and user experience influence the usage and adoption of LMSs in Higher Education Institutions?*

In this chapter, the literature is reviewed and concepts are explored and re-evaluated to both support and show gaps in the research of factors influencing the usage and adoption of a Learning Management System (LMS).

To put things into context and provide a structure, I draw on the Theoretical framework of the Technology Acceptance Model (TAM) as put forth by Davis (1989). I also briefly discuss the two theories that serve as pre-cursors to the TAM framework; namely the Theory of Reasonable Action (TRA) (Fishbein and Ajzen, 1975) and the Theory of Planned Behavior (TPB) (Ajzen, 1985, 1991). The relevance of briefly discussing the aforementioned pre-cursor theories is that they serve to illustrate, that while some of the elements which make up their theory are relevant to certain aspects of technology adoption, they are however not relevant to this study. They do however serve to lay the foundational elements of the TAM model which is relevant to this study. To support TAM, certain elements from the Collis & Verwijs model (1995) will be used. These elements will aid in strengthening the study's exploration parameters especially when the data is analysed to try and answer the research questions.

A thematic approach was used to organise the literature review. The focus is to answer the research questions and for this purpose, various themes such as visual literacy, semiotics and symbolism for example, have been identified that this study assumes will be beneficial to the study's exploration parameters of connecting visual literacy and LMS adoption.

This study will attempt to address some of the concerns and potential drawbacks of LMS usage and adoption when visual literacy and user experience are contributing factors.

Many studies prior to this one have focused on a myriad of Human-Computer Interaction (HCI) factors that influence the usage and adoption of an LMS, however, few researchers have taken the relationships between aesthetics and visual literacy with its foundation in semiotics and how it can influence usability into account. The literature will be explored through five main categories, namely; Theoretical Framework, LMS in the IT field, Visual Literacy (VL), User Experience (UX) and its connection to the User Interface (UI), and Semiotics. These five main categories will have sub-categories that will narrow the focus to the elements concerning this study namely; visual literacy awareness, interaction design, aesthetic perception and Human Computer Interaction (HCI) design.

2.1.1 Theoretical Framework

The main theoretical framework discussed is the Technology Acceptance Model (TAM) (Davis, 1989) and how this model was utilised to explain users' computer usage and their acceptance of Information Systems (IS). Through his Doctoral thesis, he set out to explain the components that lead to user behaviour when interacting with system-based technologies. In his theory, he postulated that Perceived Usefulness (PU) and Perceived Ease of Use (PEoU) were two constructs that mainly informed user motivations (Koul and Eydgahi, 2017) that lead to behavioural intent for IS usage.

There is a sizable amount of research literature on TAM, and it is widely utilised in the field of information systems (IS) to establish, in addition to the aforementioned acceptance, the intention of systems usage. It has therefore been a proven and reliable indicator of user intention and system usage (Tang and Chen, 2011; Park, 2009).

While the core literature of TAM lays the groundwork for the adoption and usage of technology and IS, the discussion is not limited to the original TAM framework (Koul and Eydgahi, 2017; Lai, 2017), many other frameworks or variations of the original technology acceptance model examine the usage and motivations for systems and technology usage.

The first iteration of TAM was modified to simplify the original put forth by Venkatesh and Davis (1996).

An LMS environment is structured, regarding the function that it serves, yet somewhat customisable (in its aesthetic presentation) to facilitate ease of use. The user is also perceived to be adaptable (Zhou and Lin, 2016). It stands to reason that if presented with a new challenge, in order for user engagement to be considered successful, a certain level of user satisfaction needs to be reached (Muraven and Baumeister, 2000) as this could directly be tied to well-being (Martin, et al., 2013; Maggiori, et al., 2013; Zhou and Lin, 2016) and with regard to the purposes of this study, relate to behavioural intention to use a system.

The framework is relevant to this study as one of the key constructs hypothesised by Davis (1989), is that for system usage to occur, Perceived Usefulness (PU) and Perceived ease-of-use (PEoU) need to be considered.

Content delivered over the internet, whether it be for e-learning, updating data, information retrieval from a repository or collaboration, the systems that facilitate these tasks need to be user-friendly and resource-optimised for them (systems) to be task-relevant and useful. The construct of perceived usefulness is another consideration that Davis (1989) put forth in his thesis, so it lends credence that the framework is relevant to the study as it is a construct of the TAM framework.
LMS usage plays a vital role in Higher Education Institutions (HEIs) and because distance and e-learning systems, such as an LMS, have garnered a lot of the Information and communication technology (ICT) market share with projected growth value in the billions (Dahlstrom, et al., 2014), TAM has become more relevant therefore attracting more attention (Ahuja & Thatcher, 2005; Khor, 2015; Liaw, 2008; Shin & Kang, 2015; Teo, 2009)

When it comes to system adoption, the existing literature states that the originality of the TAM framework is relevant and useful (Ibrahim, et al., 2017) in understanding systems' usage such as an LMS. It is however argued by (Al-Aulamie, 2013; Wahdain, et al., 2014; Tseng, et al., 2008;

Chung, et al., 2013), that TAM is limited in explaining the adoption and acceptance of technology because it does not take into account all factors which can have an influence on the framework. Graf (2007) states that users have a myriad of needs, wants, beliefs, system and platform preferences (Dung and Florea, 2012; Felder & Silverman, 1988; Graf and Kinshuk, 2007; Graf, Viola, Leo and Kinshuk 2007; Labib, Canós and Penadé, 2017; Popescu 2009). It is therefore that I refer to certain attributes of a model by Collis and Verwijs (1995) in order to add some nuance to the existing TAM framework. As this study addresses the notion that certain constructs affect the usage and adoption of an LMS, the constructs that this study will be taking into account from the Collis and Verwijs (1995) model and how it gives more meaning to the framework are; Usefulness, which I propose deals with UX considerations and can affect perceived usefulness (PU), Attractiveness, which I propose deals with visual literacy considerations and can affect perceived Ease of Use (PEoU) and finally, “makes work easier” which I propose deals with HCI considerations, thereby affecting PEoU as well.

By doing this, the hope is to address the gap in the research that this study aims to contribute to, namely; how visual literacy and user experience influence LMS usage and adoption. While the frameworks are comprehensive from a technology standpoint for the adoption of LMS, visual literacy is not a considered factor for adoption perhaps because of its qualitative nature.

2.2. Technology Adoption Frameworks

To proceed with discussions as to how technology is used and adopted, recognising other technology acceptance models that have either come before or have in some way contributed to the construction of this study’s framework. It can be used to contextualise the questions posed that seek to address the existing gap in research. To this end, a very brief discussion on The Theory of Reasoned Action (TRA), The Theory of Planned Behaviour (TPB) will be presented.

2.2.1. Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1977) is a precursor to TAM (Davis, 1989) because it evaluates technology

acceptance based on psychological and sociological constructs that could potentially explain the acceptance of technology.

The theory was developed in the context of rational human behaviour (Gunasinghe, et al., 2019) where attitude and norms can drive behavioural intention. Prior research does point to some believing in this theory to explain technology acceptance (Teo and Noyes, 2011) however TRA does not take into account prior technology experiences, which can influence acceptance and adoption (West, et al., 2007). While this theory has some validity in the larger focus of adoption, it is not feasible for this study because there is some connection between visual aesthetics and technology usage (Tractinsky, et al., 2000; Bertelsen and Pold, 2004; Mahlke, 2005) and this theory does not take that into account as far as explaining technology usage and adoption behaviour.

2.2.2 Theory of Planned Behaviour (TPB)

Developed by Ajzen (1991), the Theory of Planned Behaviour, much like its "successor", TAM, is still an acceptable model for explaining technology adoption due to the fact that behaviour (albeit in different contexts) has a direct influence on usage and adoption (Koul and Eydgahi, 2017). Behavioural intention can be influenced by a variety of factors that pertain to a specific scenario. The difference between TPB and TRA is how behaviour is implemented. Where TRA was considered more suitable to situations where the elements influencing behaviour were considered more unpredictable (Sparks and Sheperd, 1992), TPB could be used in a more organisational and structured (Taylor and Todd, 1995) environment that supports more predictive behavioural intent. Although the two theories of TPB and TAM apply their constructs of behaviour in different ways as revealed in the research conducted by Arts, et al. (2011), they are both still viable for the explanation of the adoption of technology. For this study, however, TPB is not as viable a framework as TAM because TPB considers perceived behavioural control, which is linked to social norms in certain contexts (Orbell, et al., 1997; Mun, et al., 2006) and for the context of this study, it is not as relevant as the context of behavioural intention for usage and adoption of an LMS.

2.2.3 Collis and Verwijs Model

The various theories explaining usage and adoption have been broadly covered and examined in a variety of scenarios. For this study, one of the main constructs that it proposes is Visual Literacy and User Experience can also influence usage and adoption. To this end, without extending or theorising a new model, this study proposes that certain constructs of the model in Fig 2.2.3 be used to add nuance to TAM. The aforementioned is done to assist in contextualising the elements this study proposes to have an influence on technology usage and adoption. The constructs (as discussed later) used from the Collis and Verwijs model (1995) are considered more qualitative and abstract and this could nuance the existing TAM model. While many of the elements in the Collis and Verwijs model (1995) have validity, this study has identified three constructs that tie- in and speak directly to the aim of the research carried out here. As user acceptability is a major consideration when evaluating systems usage and adoption, as illustrated in Fig 2.2.3, the three constructs that lead directly to that user acceptability, are the ones this study seeks to adopt. The constructs of the Collis and Verwijs model (1995) that will be used in supporting TAM are; Usefulness, which can drive User Experience (UX) considerations, Attractiveness which can speak to aesthetics and visual literacy (VL) and “Makes work easier”, which takes Human-Computer Interactions (HCI) into consideration. These aforementioned constructs all tie directly into user acceptability which speaks to the usage and adoption of technology.

The aforementioned are all elements that will be further explored in this chapter to attempt to establish how their relationship can answer the question of how visual literacy and user experience influence LMS usage and adoption.

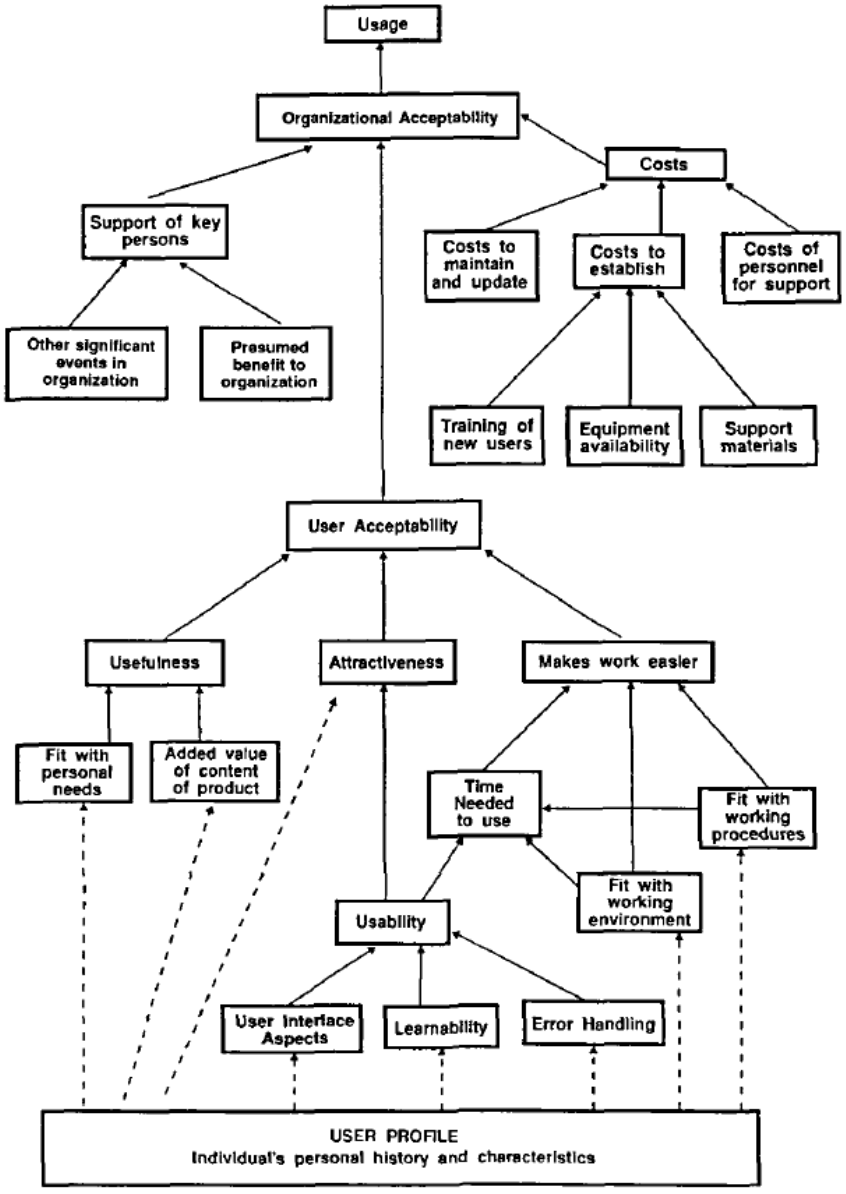


Fig. 2.2.3 Decision map for an Electronic Performance Support System (EPPS)

2.3 LMS in the IT field

2.3.1 What is an LMS

The role of Information and Communication Technology (ICT) has always had an influence on our lives. Whether it was watching a VHS cassette tape, playing a song on an iPod or driving an electric car, there has always been a need for ICT. With the onset of the provocative use of the internet as a source for the majority of information, the role of ICT has evolved to not only provide innovation for the future but also to maintain and occasionally enhance existing technology, in an ever-changing digital world.

Repositories of information need to be accessible for the above-mentioned innovation but also need to be available for the masses to find, use and create presently regardless of level of technology savvy. Information is unbiased and uncontextualised until used by someone for a purpose. Much like a hammer and a nail are just separate tools, until used together for a common purpose, i.e. to hold something in place.
This is an LMS. A defined tool with which to integrate all available resources (Kulshrestha and Kant, 2013). In the case of Higher Education Institutions, it is the delivery system of knowledge for education, learning and training or as Alias and Zainuddin (2021) indicate it is a web-based framework to promote sustainable learning in educational institutions. Currently, students now have the ability to equally gather and disseminate information faster than any preceding generation (Siddiqui and Masud, 2012). For higher educational purposes, a centralised “structure” needs to be in place to house the information, and deal with a further influx of data but still be accessible to deal with the outflow, simultaneously.
In an educational context, the system needs to be used by students and teachers, in order to perform knowledge sharing and evaluation within the context of the subject matter.

According to Ken Research (2019), the South African E-Learning market is at its beginning stages of adoption. It can argued that because of the close relationship between e-learning and LMSs (Bradley, V. M. 2021), the latter is, to some extent, at the early stages of adoption, albeit only in certain sectors, as well. Ken Research (2019) states that these sectors are

mainly comprised of corporate firms and therefore the major market share of technology adoption is centred around LMSs.

Since the early 2000, the impact of LMS adoption at educational institutions has been significant, especially but not limited to online course-building (Vrasidas, 2004)

Adopting a learning management system can facilitate many IT needs for an institution, however, three uses seem to be the most relevant, according to existing literature, when it comes to Higher Education Institutions (HEI). These are improving learning efficacy, the efficiency of content delivery, and offering a different method of training and instruction. Altekruse and Brew (2000); McArthur, Parker, and Giersch (2003) believed that LMSs and their online functionality can enhance training, instruction, and content delivery. Smith and Rupp (2004) support this by suggesting that one of the dominant uses of LMSs at HEIs, namely online instruction, and web-based content delivery, are becoming more frequent in their usage and adoption. Hotrum (2005) however postulates that the LMS at HEIs can be regarded as a hindrance to the learning paradigm and the delivery of content, particularly if there is a dominant focus on learning, whether online or offline, and Hill (2000) adds to this postulation by suggesting that users might need substantial training first before engaging the LMS, therefore adding to the hindrance by increasing the time taken before usage of the LMS is even possible.

2.3.2 Characteristics of a learning management system

The system needs to be able to be engaging for the students to keep their interest because learning is a continual learning process (Meenakumari, et al., 2013). The world is evolving constantly and so do the way we teach or get taught. While in some countries with more advanced ICT functionality in place, students may not be interested in traditional means of learning or accessing content. An example is that Google has become synonymous with searching for information using a smartphone, laptop, or computer, that it is used as a verb— “Just Google it”. In the past, a library would be used to search for information and the computer in the library would be used as an indexing tool.

Interaction, collaboration, etc., can be the buzzwords that can explain the characteristics of an LMS. Each LMS has their advantages, disadvantages, selling points and tipping points however there is a centralised interactive functionality that is at the core of the LMS. Perception of how the data is represented can be a problem or if the data needed is not adequately delivered by teachers perhaps due to inexperience (Nurakun, et al, 2018).

Technology advances rapidly in a society that is willing to adopt and implement it (Li and Perkins, 2007) and this is true especially for LMSs regardless if the system is used for the distribution of content, online learning, collaboration or assessment purposes. An LMS can be a structure that not only provides sustainable instructional value through textual content but should also be an interactive platform that incorporates multimedia elements (McManus, 1995; Henke, 1997; Ritchie and Hoffman, 1996) that enhances the perception of value. As LMSs evolved in the early 2000s, these systems, for the purpose of general, broad-based interactivity, became capable of integrating different types of elements such as graphics, audio, and video (Jong, 2009). As their (the LMS) functionality needed to be expanded to facilitate other in-demand uses such as online learning, Ko and Rosen (2017) state that elements such as chat functionality and a way to deliver online instruction and assessments were added to support this need.
When it comes to the learning paradigm, Volery (2001) believes that there is a direct link between a user's positive attitudes toward technology and online course delivery, and positive learning outcomes.

Technology advances meant that LMSs could onboard a more diverse toolset for knowledge acquisition.

2.3.3 Learning management system adoption/use in Higher Education

While LMSs have been around for a majority of the new century, some have risen and evolved, and some have been relegated to the obscurity of the technology recycle bin. These differences in adoption can be attributed to the characteristics, features and functionality of the LMS. It is because of this, that LMS adoption is so prevalent in High Education (HE) (Loannou and Hannafin, 2008; Sclatter, 2008; Lonn and Teasley, 2009; Kember, et al., 2010). In the previous sections, it is mentioned that the Collis and Verwijs model (1995) can nuance TAM and it now speaks to the evolution of an LMS and the user's ability to adopt an LMS.

Bouhnik and Marcus (2006) iterate that the usage of technology in education will improve student outcomes and indirectly will enhance the learning experience. The point is supported by literature (Paul and Lal, 2018; Jaiswal, 2020; Mashhadia and Kargozari, 2011) that states digital environments such as an LMS, aid in inter-stakeholder (Student, Faculty, and Academics) communication thereby sharing experiences and providing collaborative, digital environments. The aforementioned is supported by Venter, et al. (2012) stating that academic advancement can be enriched through the tools, and facilitate communication and collaboration.

It is however contested by Mercader and Gairín, (2020) that certain barriers or the perception thereof from certain stakeholders can impede usage and adoption. To support this, Mercader, et al., (2017) refer to a study that surmises that the majority of useful tools that can aid communication and collaboration are infrequently used. The infrequent usage of the tools is echoed by Marcelo, Yot and Mayor (2015) and Kedrova and Potemkin (2015) who refer to statistics that they deem to be less than favourable when it comes to average usage rates.

There has also been a split in the development of the LMSs. Some have gone the open-source, community development route and some have maintained their propriety establishment. In the higher education context, there are drivers which are considered for the institution to make informed decisions about which one they adopt. Besides the macro-conventional elements such as cost and support, elements such as functionality,

diversity, and quality of tools accessible to both Educators and Students, are a fundamental consideration for their adoption.
Barreto, et al., (2020) list in a comparative table, various categories that adopters need to consider, and Griffiths (2020) takes this further by discussing the advantages and disadvantages of the expandability of tool development frameworks of the LMSs.

When it comes to the adoption of an LMS in a higher education institution (HEI), there are a myriad of options available but also a myriad of factors to consider, both from an extrinsic and intrinsic standpoint. Key among them, but not limited to are, budget, purpose and ease of use. An evaluation of the LMSs needs to be done to understand both the institution's and student's needs (Brown & Czerniewicz 2009; Kasim and Khalid, 2016).
Considering the three aforementioned factors, ease of use can perhaps be considered the most subjective of the three, partly because user perception has been established (Davies, 1989), as a driving factor in how it is factored into the adoption equation.

Perception has become a driving component in how users evaluate a product/service/system (Garrido-Morgado et al., 2016; Lemon & Nowlis, 2002; Doyle, 2000; Olson, 1978); Customer and User Perception of Value and What It Means to Designers, 2020),
(Deng, et al., 2015; Kalmyk, 2019) argue that the User Experience (UX) can be a deciding factor in how the perception is cultivated.

According to research done into the factors which drive the UX function (The 7 Factors That Influence User Experience, 2021), desirability and aesthetically appealing user interfaces (UI) are considered to be vital determinants for ease of use. Certain LMSs were previously considered not user-friendly by different types of users because of their visually arduous UI (Blackboard Learn LMS Review, 2017b), and this perhaps prompted an evaluation not only by the HEI but by the LMS providers as well. The LMS is not an industry or profession-specific tool and because of that, the perception, based on the UI and UX of the adopted system, could be construed in a limited and linear manner, such as an administrative tool

(Alhazmi and Rahman, 2012) instead of a tool for interaction and content development and learning.

An LMS can be considered to be an ICT vehicle for communicating knowledge (Stappers and Giaccardi, 2017; Back et al., 2016; Mlitwa, 2006) through content representation and therefore the ICT instrument (the LMS) in which these knowledge elements are delivered, needs to have both visual and practical appeal, adequate and logical sequencing of information and organisation of content, for the uptake of knowledge and its retainment (Bol, et al. 2014; Al-Samarraie, Teo, & Abbas, 2013).

The LMS can be seen as a transformative, support tool (Sarkar, 2012) in how educational content is delivered, how faculty and students communicate and how digital collaboration through the LMS tools can shift the paradigm by supporting how people learn (Vovides, et al., 2007; Dahlstrom, Brooks, & Bischel, 2014; Koehler & Mishra, 2005; Niess, 2005). Knowledge acquisition and retention are arguably one of the core tenants of HEIs and the institutions' usage and adoption of systems such as an LMS, aids in this.
It is however argued by West, et al. (2007) that users can struggle with the initial adoption of the LMS based on previous experience with other ICT tools. The aforementioned could lead to learning through the LMS being hampered, and the effectiveness of the LMS put into question (Al-Hunaiyyan, et al., 2020). This is supported by Alenezi (2018) who suggests that insufficient training and a negative perception of technology could act as barriers to the adoption of LMSs. As these perceptive factors vary in nature and depend on the knowledge of the user in various facets of acceptance, the study aims to see if visual literacy (VL) is one of the factors influencing the usage and adoption of the LMS.

2.4 Visual Literacy

2.4.1 Visual Literacy: What is it?

Visual literacy (VL) is by no means a new subject matter. It has been visible in all facets of both analogue and digital technology. This being said, VL has predominantly been the focus of art or design-centric focuses (Dake, D.M.,2007).

When reading about the concept of visual literacy (VL), there does not seem to be a consensus on exactly how to define it. The term was coined by John Debes in 1968 and while, as stated, no exact definition currently exists, certain organisations dedicated to the concept of visual literacy would use Debes' original definition of the term. An example of this is the Visual Literacy Standards Task Force (VLTF) (ACRL, 2011) which states: *"Visual literacy is a set of abilities that enables an individual to effectively find, interpret, evaluate, use, and create images and visual media."*
Visual literacy skills equip a learner to understand and analyse the contextual, cultural, ethical, aesthetic, intellectual, and technical components involved in the production and use of visual materials. A visually literate individual is both a critical consumer of visual media and a competent contributor to a body of shared knowledge and culture.

The context for VL was done to conceptualise and standardise the definition for Higher Education Institutions because as Brill, Kim, & Branch (2007) states there does not seem to be a consensus for how VL is to be defined.
Pettersson (2007) goes further in saying that the reasoning for many definitions of VL is that the concept is not constrained to just one or a few fields and that it (VL) can be used in almost any discipline, regardless of profession.

The late United States Supreme Court Justice, Antonin Scalia said; *"Words have meaning. And their meaning does not change."* (Is Language Now Meaningless? A Ruling in the Matter of Scalia V. SCOTUScare., 2015).
This is true in a linguistic sense however since the advent of the digital age, and the evolution of how we interpret information in the digital world, our interpretation and representation of words can be altered. The shift from analogue to digital has, as Ervine (2016) states, given rise to a new term, digital visual literacy (DVL).

2.4.2 Visual Literacy and Learning

Baby boomers, Gen-x, and Millennials are all names given to categorise the cultural exposures of groups of people born at a certain point in time, and just a casual discussion with someone from any one of these categories will reveal how confusing those labels can be. It can however be simplified if we consider peoples' exposure to technology and how and on what level they interact with it to learn. Schoen (2014) states that certain users don't remember the world before the internet, so for most demographics, asking a question such as; "Is technology native to their everyday activities or not?" If the answer is yes, then with each exposure to technology, the user would evolve and the interactions would become more intuitive. The assumption is that in a digital age, interactions are constant and with constant exposure, familiarity can become the norm for digital interactions.

The more prevalent question could however be; "Does this extensive interaction automatically create visually literate users?" Being visually literate is a process of being able to understand and critically analyse what you read and see (ACRL, 2000), and an article by Felten (2008) supports this by stating that even though users exist and interact in a media-rich world, it does not mean that they possess visual literacy skills. Matusiak, et al. (2019) also found that certain users lack skill in evaluating images. In a post-literate society (Kohl, 2010) and as stated above, individuals now need to examine and evaluate digital information critically within a contextual perspective. A statement made by Considine (1986) reiterates this by suggesting that a certain demographic should be able to interpret visual messages. There needs to be a foundation of visual literacy knowledge to draw upon (Beatty, 2013) to evaluate and understand the digital environment. Chamorro Koc, et al. (2005) argue that the human experience determines our knowledge base and this statement is supported by Emanuel and Challons-Lipton (2013) who discovered that certain demographics identify elements based on their own experiences.

Visual literacy and how it applies in the higher education (HE) context can be difficult to establish as Ervine (2016) points out that visual literacy is difficult to define (Arbuckle, 2004; Avgerinou and Pettersson, 2011). It is because of this that HE institutions are slow to integrate visual literacy

course material or apply visual literacy theory and practicals to the existing curriculum. As technology becomes even more integrated into our daily lives, there is a case to be made that visual literacy skills should be taught alongside normal literacy skills (Metros, 2008) as this shift could bring about a better engagement and learning experience. Traditional literacies involve text-based solutions and while this is adequate, there could be a possibility for concepts and items from digital environments to be better contextualised and understood because of the introduction of visual literacy (Kędra, J. and Žakevičiūtė, 2019).

The understanding could not only enrich the outcomes of engagement with digital environments but could improve system and interaction design through the creation of digital libraries, navigational structures and overall improved human-computer interactions. While the inclusion of visual literacy in HE institutions is considered by some to be a formality because of the perceived benefits, Matusiak, et al. (2019) argue that most users at HE institutions still use images and other visual resources informally than in a way that enhances academic work.

This could be problematic as systems are generally based on formal logic and structure and if elements of an informal or unstructured nature are introduced to said system, visual literacy and interpretation won't only become a burden (by increasing cognitive load) but the interactive elements could become indecipherable, therefore negating any positive user experience.

The aforementioned therefore adds relevance to the concept of interactions of digital systems such as LMSs, because the ability to navigate the User Interface (UI) can rely solely on a user's ability to accurately interpret the visual nature of the system. The concept of affordance then comes into play. Understanding of these affordances will undoubtably influence the users' perception.

The question then becomes how visual literacy, and the concept of aesthetics can be implemented to enhance users' understanding and at the same time also enhance digital systems for better interactions and user experiences?

2.4.3 Visual Literacy Awareness

Messaris (1996) defines visual literacy as awareness of how visual meaning is created. This can be a double-edged sword when it comes to

our understanding and interpretation of the digital world and its systems. We tend to interact with the digital system based on how interpretive knowledge shapes whatever visual input or cues we are presented with. It, therefore, stands to reason that if our knowledge base is based on incorrect or misaligned information, it will hamper our understanding and could affect our engagement with these systems. To inform our perceptions we tend to draw from reality and as Messaris (1993) points out images can make sense to anyone regardless if there is a disconnect from reality. This then begs the question of why become visually literate if we can “see”, discern and recognise images with no apparent effort (Spalter and Van Dam, 2008). Messaris (1996) supports this by noting that our ability to recognise what is being represented in an image is based largely on our perceptions of reality.

2.4.4 Visual Literacy, Aesthetics and Interaction Design

The combination of aesthetic and interaction design is a relatively new concept as this conceptualisation was first put forth (Hallnäs, 2011; Hummels, et al., 2003) at the turn of the new century (the 2000s).
The visual nature of an interface is a practical implementation derived from a theoretical understanding of how an interface might function. However, regardless of the functionality or aesthetic, it (the interface) is born from general interface design culture (Bertelsen and Pold, 2004) and understanding. It is this understanding that lets users interact naturally within their digital environments. This intuitive approach is possible from previous experiences and interactions or it can be due to aesthetic appeal whereby our cognitive processes are engaged from our everyday experiences (Petersen, et al., 2004). If the phenomenon is due to previous interactions, then there needs to be some form of consistency (Kellogg, 1989; Nielsen, 1995) to establish a pattern of recognition for Human-Computer Interaction (HCI). The need for consistency of interaction is not an isolated circumstance as entire tools or systems can be built on the users’ ability to interact in a known way. Satzinger and Olfman (1998) state that users can draw on existing knowledge to achieve the desired interaction goal. Companies such as Microsoft and Apple have designed a variety of tools and entire systems that are examples of this reliance on consistency. A real-world example of this is the UI for window control and management. To close a window in a Microsoft system environment, the

controls are situated on the right-hand side of the window, however, on an Apple system, those same controls are situated on the left-hand side of the window.

One issue that speaks to consistency is the concept of visual aesthetics and the role a user's visual literacy plays in the perception of an aesthetic. Malone (1982) notes that a strong aesthetic can lead to more interesting, positively perceived and usable interface designs. Tractinsky, et al., (2000) support this by affirming that the level of aesthetics will influence how usable the interaction elements of a system are. If the system is usable because the aesthetic is consistent, user engagement will be effortless. If there are numerous inconsistencies and vagueness in the system design, so much so that the user's visual literacy knowledge struggles to contextualise the UI so that interaction becomes unpredictable, the user will be put under more stress (van Merriënboer and Sweller, 2005) therefore creating a negatively perceived interactive space.

2.4.5 Visual Aesthetics Perception

When concerned with the practical nature of aesthetics and how the user might gain value from this type of implementation, Petersen, et al. (2004) note that aesthetics is connected to context and instrument use. The context can however be skewered due to the subjectivity of the user. As technology has evolved so has our perception thereof and Wiegel (2010) argues that our aesthetic perception has shifted from an objective-centred approach to a more embodied perception related to subjectivity.
Lavie and Tractinsky (2004) believe that two main constructs drive aesthetic perception and these are classic aesthetics which deals with convention and is a driver for many usability elements and expressive aesthetics which is more creative in its approach and somewhat breaks convention as far as design for usability is concerned.
The extension of the perceived aesthetic parameter is however argued by Moshagen and Thielsch (2010) who conclude in their research that four additional elements drive aesthetic perception and that together they are a sound measurement for the evaluation. The question then becomes where is the common ground to create a cohesive understanding for a consensus on visual aesthetic perception for usability?

2.4.6 Visual Literacy and Semiotics

Interaction with a system can be precise or exploratory. There are many instances when a user “moves” around an LMS environment in an exploratory fashion. It could be to familiarise themselves with the User Interface (UI) or to establish a connection with the tools on offer or the exploratory movement might be because the user might be unfamiliar or not able to interpret the meaning of the UI. This could be because the usability elements are foreign or because their inherent visual literacy is not adept enough to overcome the interpretive challenges. Regardless of whether the interpretation is foreign or not, affordance dictates that if done correctly, the user’s understanding of the visuals should be increased because commonality exists for interpretive purposes.

Complications arise when there is a specific destination or precise functionality that needs to be initiated from the UI of the LMS in a timely manner and the user cannot overcome the visual obscurities to proceed. While there are many different types of interfaces for different LMSs, there still needs to be functional and interpretive knowledge to draw on to deal with the various forms that an LMS’s UI might take on.

UI’s can be presented in different forms depending on the needs of the user base. Generalised examples are; icon-based, text-based, or a combination of the two. A text-based UI environment could be a digital environment that is made up of UI constructs but in a written context (Anderson, PB, 1997). There could also be a UI that is entirely driven by iconographic cues that depict the function to be performed or construct to be interacted with.

When needed to perform something that is task-motivated (Anderson, PB, 1997) within an LMS, such as creating a folder to upload content, there needs to be a set of signs/symbols that articulate actions that need to be initiated to perform the task. The user, therefore, needs to be able to, as Anderson (1997) states, distinguish between the different sets of actions presented, say by the UI, to perform the process. There has been research that suggests the effectiveness of icon representation in a UI (Levialdi, et al., 1993; Lin, 1994), Haramundanis (1996) however, argues that icons must be supported by text to be understood. If this is true then

how can the concept of visual literacy be used if there is constant support to assist in defining what the user is viewing?

2.4.7 Visual literacy and human computer interaction design

The pre-determined layout or generic structure of an LMS, as defined by system designers, is less likely to be mentally demanding for the user to make decisions, such as navigational ones, than one that is user-defined or customised. Rodden, et al., (1998) support this by suggesting that there is a need for generic application architectures. The aforementioned method of thinking does not however take into account various levels of understanding of user interaction. Users are different in that their interactions are driven by different elements such as perception (Mutuku, 2020; Cowan, et al., 2021). Interaction is made at the user interface (Huang, 2014).

Derboven, et al. (2012) state that a user should be able to "find" functionality with little assistance regardless of design. This is also linked to the concept of affordance. This concept refers to their perception of properties for a visual element.

Westerman (2008) argues against this by inferring that the assumption that a user could know where and how to do things is contrary to how they actually engage and explore systems.

If the user encounters a roadblock when it comes to a linear progression, for example, a navigation decision, the user might find it difficult to progress if there are no meaningful or established "aids" or visual cues to guide them (Kim and Hirtle, 1995). This is especially true if the user needs to focus on understanding the information first before engagement (Chandler and Sweller, 1991). The research done by Beasley and Waugh (1995) supports this. Their findings iterate that the presence of a map/diagram or some form of visual aid can assist in decision-making for interaction within a digital environment and this can be beneficial to the user.

When discussing interaction, there is normally mention of intended use and usability and its implications (Wingrad, 1997; Buchanan, 2001). Hallnäs (2011) supports this by stating that interaction design is the design of functionality for intended systems usage. The system usage can however be influenced by visuals or a visual aesthetic that can, as

mentioned previously support or hinder an interaction. System design can therefore affect the way we perceive elements such as visuals or aesthetics (Hoehe and Thibaut, 2022), which can directly influence our interaction abilities and function usage of a system. Tractinsky, et al. (2000) refute this by stating that aesthetic features are perceived as independent of function.

The customisation of the LMS could be a powerful motivator for adoption as users might wish to orient the design of the system around semiotic or linguistic familiarity (perhaps based on culture) or to use their language as a basis for design (Anderson, PB, 1997).

2.5 User Experience and the User Interface

According to Faran (The Four Types of Digital users, 2018b), there are different categories of digital users and for the sake of interaction, usage and adoption, using categories can assist in establishing an understanding of how users engage and experience technology.

Hassenzahl (2003) suggests that user experience needs to fit in with the goals of the user.

For constructive and positive interaction to take place, it is firstly vital that the user can navigate the digital environment (McDougall, et al., 2001). Only then can the user go about adding in their contribution. The value of aesthetics in interface design is a measurable construct in HCI (Lavie and Tractinsky, 2004).

To facilitate navigating the LMS, useful elements, such as icons, enable others to create (Resnick, 2002) and interact. This is useful because as with any technology, there can be a learning curve however if there is consistency and even familiarity (Silvennoinen and Jokinen, 2016) with visual aesthetics such as icons, the user should have little to no issue getting to where they need to go. Kare (2011) and Lange, (2018) support this by using the analogy that good icons are akin to road signs because they are there to establish function through visual cues. Horton (1993) however, suggests that there are no universal icons so therefore familiarity can be difficult to establish and due to this some form of learning still needs to take place. This lack of unified universal familiarity is mentioned by multiple researchers and contributors to the literature.

Norman and Nielsen (2010) suggest that there is no agreed-on common system of language for user interface design. The lack of a decisive definition for UI development can perhaps somehow cause disharmony in the context of interaction.

What can cause a further disconnect between what the user needs to do regarding the UI and what they understand of the interface, is the fact that there is a divergence between known, common, and system language (Anderson, PB, 1997). How then can the user perceive interaction positively when it comes to the usability of the system?

2.6 Semiotics

The theory and meaning of signs are well established in the writings of Saussure (De Saussure, 1916; De Saussure, 2011 and Eco (Eco, 1979). As a grounding for the literature discussion on Semiotics, I refer to the seminal work of the two authors as their work provides a foundation for the contextualisation of icons as representations of meaning. For the purposes of this study, semiotics can be defined as a study of sign systems (Nadin, 1988; O'Neill, 2008). Saussure (2011) theorises that a sign is a combination of a signifier, which is the actual sign, and the signified which is what the sign is supposed to mean.

2.6.1 Influence of Semiotics

Berghoff (1998) states, that we as users give meaning to a sign based on our personal knowledge because we construct meaning from the perceivable elements presented. Vygotsky (1978) supports this by iterating that we construct meaning from signs through our abilities for learning. An example of this in a digital context would be an icon. This is important in the context of an LMS because it is a system that uses icons to facilitate navigation and interaction within its environment. Signs and symbols play a significant role in digital environments because they not only form part of the functionality but also the aesthetic. This concept of function and form is supported by Saussure (2011) who states that signs are only given meaning in relation to other signs. This is the case with a digital environment where the icons and symbols exist to form a cohesive language to assist the user in navigating a digital environment.

As for functionality, icons are essential to the navigation as they (icons) can at times, be a major part of the User Interface (UI). The UI should

therefore be intuitive for the users to achieve their goals when interacting with the LMS. However, the intuit interaction can only allow the user progression to reach a certain point and Nadin (1988) therefore states that a user has to bring understanding into the interaction activity that is gained from learning.

An unintuitive UI can create confusion (Learning Management System (LMS), 2019) and could cause the user to have a negative perception of the LMS thereby influencing usage and possibly adoption. A user experience that is strong, intuitive and familiar can perhaps lead to an increase in usage and adoption.

2.6.2 Perception of Iconography

As systems evolve, whether it be through reprogramming or redesign, there is a chance of a disconnect between what users are used to and what they must become accustomed to, to continue using the system at an optimal level.

Iconography can be cognitively taxing for a user if their visual literacy knowledge doesn't aid in the interpretation of them and can hinder the process of interaction, however, Silvennoinen and Jokinen (2016) established that if icons are processed quickly enough, they address usability and positive aesthetic value. Nadin (1988) states that exposing the user to different kinds of visual cues, especially ones that are not consistent or change regularly, can confuse the user and often influence user performance. The question then becomes what role iconography holds in user interface design.

2.6.3 The Role and Function of Iconography in User Interface Design

When navigating a system, regardless of computer proficiency, there are times when we pause to think about what to do to proceed with interaction. If we should ever find ourselves asking another for assistance with the next steps, the saying; "click here", will at most times be the answer we receive. That phrase is not only indicative of concepts that can constitute a whole area of research such as Human-Computer Interaction (HCI) but also of the simplicity of how relatively easy it has become to engage with the digital environment and various systems.

As technology evolved and there became a need for the user to interact with a system in a quicker and more efficient manner (Engelbart, 1962) other than text-driven prompts, the Graphic User Interface (GUI) became a constant in the world of interactive environments. The role of icons in the context of the GUI has then become a mainstay in visual computing. Reimer (2005) supports this by stating that icons have an integral part to play in User Interface (UI) design.
So integral are they that Horton (1994) states that they inexplicably linked to the UI.
Nadin (1998) suggests that the more abstract a visual cue becomes, it also becomes more recognisable. The concept of affordance also comes into play here as the interpretive nature of the properties of the visual can therefore influence the user's interaction, whether it be the speed of interaction or its recognisability. De Souza (2005) established that icons are designed as messages that are communicated through the interface. It is because of their visual nature they tend to stand out more than text-based functions. They have more visibility and tend to be more aesthetically pleasing (Harley, 2014; Harley, 2016; Silvennoinen and Jokinen, 2016; MacDougall and Reppa, 2008) than their text-based counterparts.

The concept of an icon increases in value the more integral they become to the user experience within the UI. The value however can be diminished if they are not legible (Gatsou, et al., 2011) or don't serve any comprehension purpose for the context of the interaction. For most users who are visually literate, the understanding of an icon, regardless of the system, could be quite simple and easy to interpret. While some form of learned experience can improve the ability of the user to recognise, interpret and interact with the icon system, it can be argued that if the representation of the icons has a connection to the user's past experiences (Lidwell, et al., 2013) the interpretation can be more effective. Rogers (1989) however argues that icons can be ambiguous and regardless of past experiences, risk confusing the user. Harris (2005) and Tognazzini (2013) suggest that for there to be effective translation and value to the icon and its comprehension, the icon needs some form of context that can be provided by integration with text.

These views then provide a platform for interaction from alternating perspectives and if the LMS system can facilitate both, then a basis for the influence they have on usage and adoption of the LMS can be measured. In the following chapters, the literature discussed here will contribute to the designing and usage of the instruments to gather data that shows how important visual literacy and user experience are to the usage and adoption of an LMS.

CHAPTER 3
Research Design

3.1 Introduction

The goal of this study is to obtain a broader understanding of how visual literacy (VL) and user experience (UX) influence learning management system (LMS) usage and adoption.

The primary question is;

- *How do visual literacy and user experience influence the usage and adoption of LMSs in Higher Education Institutions?"*

The support or sub-questions that will assist in contextualising the main question are;

- *How does perception of user interface elements influence user experience?* and
- *How does perception of aesthetics of a Learning Management System influence user experience and usability?*

In the previous chapter, the literature explored the various elements which contribute to this study. In this chapter, the data collection approach, research design, sampling and the participants who make up the sample will be discussed. The chapter concludes with a discussion of the data analysis and a summation of the entire consolidated process.

3.2 Research Approach

This study is conducted under an interpretative paradigm and utilises a deductive approach based on the existing theory of the Technology Acceptance Model (TAM) (Davis, 1989) and constructs of the Collis and Verwijs (1995) model. The theory serves as a framework to assist in building on existing literature and to be used as a model to better understand technology acceptance and its constructs, in this case, the technology is the LMS.

Interpretative research was used as it attempts to understand, from a participant's perspective, the reason for performing tasks (Elliott and Timulak, 2005) and aims to summarise the data in a certain context. Visual literacy is interpretive (Hattwig, et al., 2013) and as stated, this study is conducted under that (interpretive) paradigm.

The nature of the research conducted through the collection instruments used also lends itself to a qualitative approach. One of the major differentiating factors as noted by Sayre (2001) is the purpose of the research. Sayre (2001) summarises that in qualitative research, the purpose of research comes from the need to understand the subjective experiences of participants.
It is important to contextualise the data gathered and a qualitative approach is best suited to do so, because of the linguistic nature of the data (Maxwell, 2008).
The graph represented in Fig 3.2 (Streefkerk, 2022) is a visualisation of the differences between inductive and deductive reasoning.

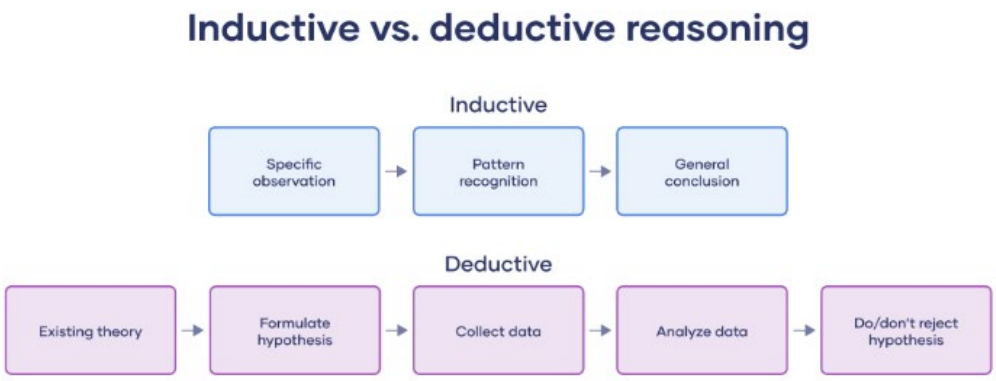


Fig.3.2: Inductive versus deductive reasoning

3.3 Methodology

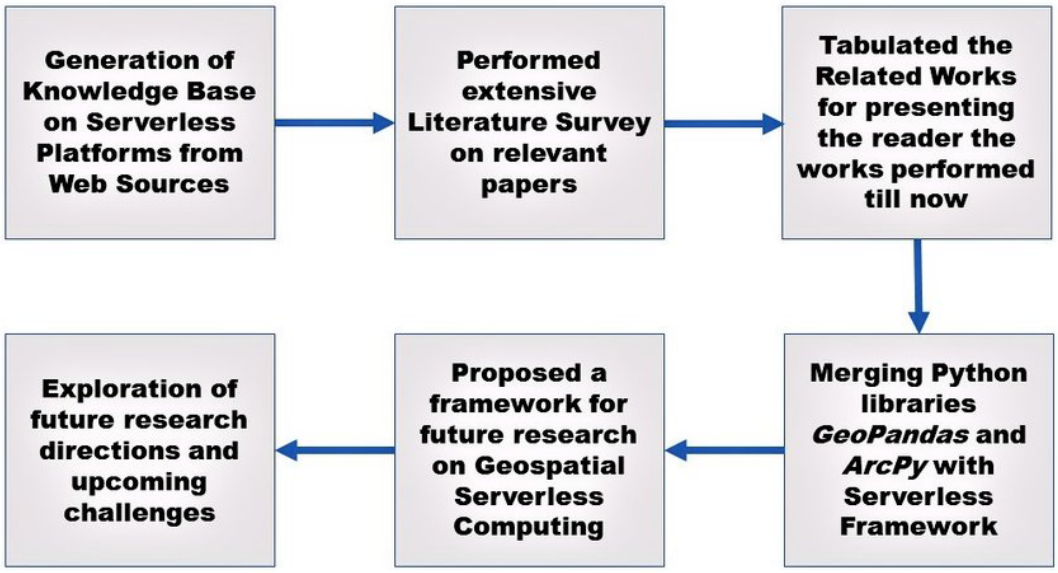


Fig.3.3: Visual representation of methodology

The study was carried out using qualitative methodology at a Private Education Provider in South Africa. The sample population comprised academics and lecturers. The research was conducted across multiple provinces at multiple campuses to avoid bias. The potential bias in the case of this study was that the researcher worked alongside and professionally knew the majority of the participants. Distributing the data collection instrument across campuses ensured that a random sample representative of the population could be achieved. The observational study was conducted among certain participants who met the required criteria namely: being an academic with varying levels of LMS knowledge and engagement. They had to complete a number of tasks that were timed for proficiency.

Using the constructs from the framework (Davis, 1989) and the additional constructs from Collis and Verwijs (1995), themes were created. The foundations for these themes were broken down and discussed in Chapter 2 namely: the literature elements that comprise the main focus of this study for example, visual literacy perception and HCI design.

The constructs identified in the Collis and Verwijs (1995) model that will be used as themes are as follows:

- Usefulness
- Attractiveness

- Makes work easier

Each one of these aforementioned constructs or themes are important for this study. These are User Experience (Usefulness), Visual Literacy (Attractiveness) and HCI (Makes work easier).
These themes namely, visual literacy, semiotics and symbolism are useful as they deal with specifics relevant to this study in that they link to the main constructs of the theoretical framework for this study, namely TAM (Davis, 1989). They are Perceived Usefulness (PU) and Perceived Ease of Use (PEoU).
Fig.3.3.1 and Fig.3.3.2 are variations that Illustrate how the constructs influence each other as they combine to explain usage and adoption. Even though the pathfinding of the constructs varies slightly, they both are feasible as it keeps the original TAM intact and therefore the end goal of finding system usage and adoption remains intact.

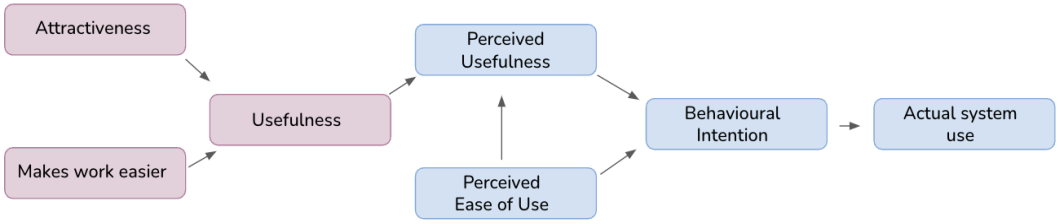


Fig.3.3.1: TAM model with constructs from Collis and Verwijs model (Version 1)

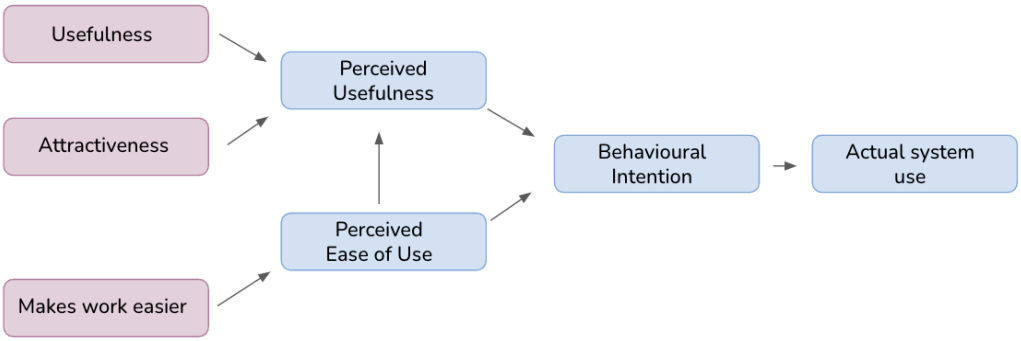


Fig.3.3.2: TAM model with constructs from Collis and Verwijs model (Version 2)

3.4 Instruments

The instruments used in this study are;

- A pilot survey. The pilot was used to assist with the design of the primary survey in that it could identify contradictions and establish the relevance of the questions needed.
- The main survey (see Appendix A). A questionnaire was distributed to the sample population. This data gathering tool was useful as it established to gather criteria that needed to be met by the sample population. The gathered data was analysed to establish findings that would assist in addressing the research problem.
- A user observational study. The study was done to gather additional qualitative data that could support the data derived from the main survey instrument. The visual literacy level was established from the participant's interaction using timed responses.

3.4.1 Survey

One of the instruments used was a self-administered survey which was chosen because of the advantages of this type of instrument as

highlighted by Gnambs and Kaspar (2015). They (Gnambs and Kaspar, 2015) state that this type of survey can produce a more truthful response. Another advantage of surveys is convenience (Evans, et al., 2005), both for the participant and the researcher. If the participant has internet access, they can complete it anywhere, anytime and for the researcher, the data is available almost immediately, if internet access is available.

The survey consisted of four sections namely; interaction/user experience, functionality, visual aesthetics and general information, which were constructed to attempt to answer the main research question. The construction is based on the theoretical framework of TAM (Davis,1989) and elements of the model put forth by Collis and Verwijs, (1995) The survey consisted of different types of questions (Birt, 2021) namely; closed questions that asked for a binary response of yes or no, open questions, where the participant could elaborate based on their own experiences, visual-based recall questions where the participant was presented with an image and asked to identify an image based on empirical knowledge and a majority of questions were evaluated on a Likert scale as to support the qualitative and interpretive nature of the research. For the Likert scale questions, participants had to indicate on a scale of zero (0) to four (4), where 0 was very low, and 4 was very high.

A pilot study was run to vet questions of irrelevance and to evaluate the structure and answer criteria for the consideration fine-tuning, should it be needed.
Sampson (2004) suggests that the pilot study be run to garner experience and to somewhat gauge the time needed for data collection. The pilot study was conducted among users who still form part of the population sample but who can be referred to as “Power-users” due to their proficiency and length of usage of the Blackboard LMS. The surveys for both the pilot and main study are in the Appendix Section.

3.4.2 Observational study

To capture a different perspective on how visual literacy and user experience can influence LMS usage, an observation method in the form of a practical user test was performed. In the survey, Likert scale

questions pertaining to the level of visual literacy level and Blackboard training were asked. The answers to those questions established the visual literacy and Blackboard training level of all participants. This data is found in Table 4.2.4 in Chapter 4.
Two participants from the same population sample were selected to participate in the observational study after the survey was completed. A request was sent to the recipients of the survey (the population sample), asking for participants who perceived their visual literacy level to be high but had low-level Blackboard training and for participants who perceived their visual literacy level to be low but had high-level Blackboard training. Of the received responses, two participants were chosen that represented the aforementioned criteria.

To strengthen the data validity (Thurmond, 2001) and avoid bias Maxwell (2008) states that triangulation can reduce the risk of bias even though the data gathered was from a wide range of users that had nothing in common other than they were Lecturers or Academics. Another reason for doing the second data collection is to reduce the risk of doing a single method of data collection that could potentially lead to a less-than-accurate analysis (Cohen, et al., 2007).

The observation test was performed using the video conferencing software, Zoom (Zoom.us). The reason for selecting this out of all others available was because Zoom has a comprehensive set of functions that were needed to perform the observation test. In particular, the annotation tools are not only useful but are well integrated into the platform. These tools allow users to use an input device (mouse or digital pen) to “draw” on the screen. The aforementioned is quite handy should the sound fail due to connection issues or if something needs to be explained with visual input. The free version of the tool was used, so the time limit of the session used to conduct the test was limited to 50 minutes each (two participants). The participants were informed before beginning the session that the test would be conducted in a “how-to” manner whereby the researcher would ask the participant to perform a task in the LMS environment. For the sake of validity, the participant was not allowed to ask the researcher for help, consult the help section of the platform or use a search engine to find the answer. To gauge the effort with which the task

was completed, each task was timed to compare the two participants. The session would be recorded (with consent) for analysis purposes. Four tasks were asked to be completed and based on the researcher's own lived experience with the LMS, the tasks could be classified as easy, intermediate and hard.

The user test was conducted to improve the quality of data gathered as video is an excellent source for analysis because it captures complexity (Ruhleder and Jordan, 1997). The test was also performed to assist in potentially validating the data, which seeks to answer the main research question of how visual literacy and user experience influence LMS usage and adoption. The aforementioned was done to provide a more holistic view of factors that can influence LMS usage and adoption.

3.5 Sampling

Data was gathered from the population using non-probability sampling. Purposive sampling was used for the pilot survey, primary survey and user observation test because the selection of the sample was intentional (Creswell, 2014). Since this sampling method has a high risk of bias (McCombes, 2022), it is important that more than one method of data collection be used to attempt to try and offset the potential bias.

For the primary survey, Lecturers and Academics were needed based on their expertise and familiarity with the LMS (Blackboard) at the Private Academic provider. These participants were chosen because they belong to different faculties and teach various subjects so the data gathered would be varied and not limited in its scope.

According to Jackson (2014) and supported by McCombes (2022), participants do not have an equal chance of being included because this type of sampling is based on criteria such as convenience and is non-random in nature. This is useful to gauge how this demographic uses and interacts with the LMS based on the constructs of the TAM theoretical framework on which the instruments used were designed from.
This was believed to be what was needed to fulfil the aims and objectives of this research.

3.5.1 Characteristics of Participants

The choice of participants for this study was mainly chosen for their engagement with the LMS at the private, higher education provider. It is understood that because usage of the system is mandatory to facilitate their duties, the Lecturers and Academics chosen would have some form of digital or information technology (IT) literacy. The understanding is supported by the fact that upon entering the post of Lecturer and/or Academics, basic training is undergone at the institution to acclimatise the person to the systems of the education provider. This study seeks to explore the influence of elements such as visual literacy and user experience, which, has links to aesthetics. The participant's digital or IT skills could affect their performance while engaging with the aesthetics of the LMS, such as the UI (Granić and Ćukušić, 2011) and this, therefore, coincides with what this study seeks to explore. These were some of the considerations considered when choosing participants for the survey. As stated in Section 3.4.2 of this chapter, the participants in the observational study were selected from the same population sample that did the survey and, in the survey, questions were asked that measured the participant's self-reported visual literacy and LMS training level. The levels for visual literacy and LMS training will be discussed in Chapter 4.

For the pilot study, six (6) participants were approached to complete the online survey. The main criteria were that they needed to have extensive Blackboard usage, and were either Lecturers and/or Academics.
For the main survey, a total of 40 online surveys were distributed and 28 usable responses were received. The aforementioned represents a 70% response rate. This rate is still indicative of participant representation and provides a knowledgeable baseline for an understanding of the criteria from the survey and can therefore still broadly be applied to the population (Patton, 1990).

For the observation study, the participants were chosen from the same population sample as the survey, but two additional criteria needed to be considered for them to be representative of the population. These two criteria were Blackboard training and visual literacy level. For the user

study, one participant needed a high level of Blackboard training and a perceived low level of visual literacy.
The other participant needed a low level of Blackboard training and a perceived high level of visual literacy.

3.6 Ethics

Due to the nature of the research being undertaken, it is imperative that anonymity be a top-tier consideration for the data collection. This is because, during the course of the data gathering, sensitive information such as identifiers (names, contact data, age, income, etc) may be shared by participants. The approach to keep the data to be collected and analysed confidential then becomes imperative as this protects the interests of those participating (Blanche, et al., 2006).
Data storage is an ethical issue that needs to be considered as noted by Creswell and Poth, (2016). Data storage and analysis will have a cloud-based approach where the data is stored on a virtual, cloud-based drive that is password-protected and backed up to a physical, non-removable storage drive that is housed in a fingerprint-protected laptop.

In this research, A pilot study for an online survey was conducted whereby the only identifying data captured was an email address. It was done after consent was obtained from the participants. The email addresses were obtained for the purposes of feedback on the survey so that any problematic or potential hindering questions, based on the participants' feedback, could be modified or removed. A copy of the consent form can be found in Appendix B.
Data for the main survey was collected from participants at a private academic provider in South Africa and to collect data from stakeholders, ethical clearance needed to be obtained. The researcher sought and obtained clearance from the Academic provider (see Appendix C).

3.7 Data Analysis

The data was analysed using the TAM (Davis, 1989) as a lens and using constructs of the Collis and Verwijs (1995) model to add nuance to TAM because of the subjective nature of aesthetics. The data was coded using the four sections of the survey to establish themes. The data was

categorised within these themes and the general information section which provided demographic data, was used to contextualise everything. Having used the data from the four sections, relationships could be established and presented. The data provided a platform with which to interpret, analyse, and corroborate the data to answer the research questions.
The aforementioned information was coded using software (Maxwell, 2008) that was adequate for the task, such as Microsoft Excel.

3.8 Summary

The focus of this chapter was to provide an insight into how the data gathered for the study was collected, analysed and interpreted through the lens of the TAM theoretical framework. This chapter sought to define the methods used to establish the foundation for analysis for formulating conclusive findings that will attempt to answer the research questions posed in this study.
Utilising the theoretical framework of TAM will be critical as its constructs lay the groundwork for how the methods, consisting of a survey and observational study, would be designed. These methods were used as they provided the best way to gather the qualitative data necessary for analysis. The goal would be then to use the collected data to establish how the elements of visual literacy and user experience influence the usage and adoption of LMSs. No interviews or quantitative methods were used as one of the core foci of this study is visual literacy which can be subjective and interpretive and immune to quantitative methods and the other focus is the user experience which, in this case, is best done through observation rather than discussion.
The next chapter will show the data analysis in-depth as well as provide a brief overview of the findings.

CHAPTER 4
Data Analysis and Findings

4.1 Introduction

This chapter provides details of the analysis of the collected data. It includes a discussion of the findings from data obtained through questionnaires and an observation study. The results are categorised into four sections They are;

- Interaction/ User experience,
- Functionality,
- Visual aesthetics/ Visual literacy
- General information (criteria listed influences perception)

This chapter will attempt to establish connections and in some cases contradictions, that will explain or attempt to answer the main research questions of this study.

Section A of the survey (Interaction/ User experience) describes the participants and builds a profile for the data to be contextualised. Section B of the survey (Functionality) will describe how Participants engaged with LMS through their interactions and User Experience. Section C of the survey (Visual aesthetics/ Visual literacy) will describe how the participants consider the functionality of the LMS and how their usage is affected by this. Section D of the survey (General information) will describe aesthetics and visual literacy and how participants viewed the look and feel of the LMS through visual cues.

All these sections are guided by TAM and its constructs.

The main research question guiding the study is:

- *How do Visual Literacy and User Experience influence the usage and adoption of LMSs at Higher Education Institutions?*

The support or sub-questions that will assist in contextualising the main question are:

- *How does the perception of user interface elements influence user experience?* and
- *How does the perception of aesthetics of a Learning Management System influence user experience and usability?*

Factors that affect visual literacy (VL) and user experience (UX) have already been established in Chapter 2. Through the literature and framework (Davis, 1989), the data analysed in this chapter will seek to answer the main research question.

To contextualise the data collected, the research conducted in this study uses the Technology Acceptance Model (TAM) (Davis, 1989) as the theoretical framework along with constructs from Collis and Verwijs, (1995) to add some nuance to the model. The aforementioned is done as this study will show that the constructs used in the Collis and Verwijs (1995) model speak to usage, which coincides with what Davis (1989) hypothesised in his Doctoral thesis. As the aforementioned constructs are there to enhance the theoretical framework of TAM (Davis, 1989), they could also subsequently be used as the themes to which the collected data can be applied. This approach is feasible as the three constructs of Usefulness, Attractiveness and Makes work easier (Collis and Verwijs, 1995), speak directly to the main constructs located in TAM (Davis, 1989), which influences usage and technology adoption. According to Blandford, et al. (2016) and Lazar, et al. (2017), qualitative studies enable us to comprehend the contexts in which technology is utilised and adopted.

Data from the main survey are presented in tables for the purpose of readability, (Designing With the Mind in Mind, n.d.) and will be explained to contextualise it (the data).
The data collected from the observation study will be analysed using correlation to link data to pre-determined coding categories.
In the analysis that follows, deductive reasoning was applied to the data and the data is discussed following the presentation of the data sets. To achieve the goals of this study, as data is analysed, and results are presented accordingly in Chapter 5.

4.2 Demographics

Table 4.2.1: Participants by Gender

Category	Participants	%
Male	14	50%
Female	14	50%

Table 4.2.2: Participants by Age

Category (age range)	Participants	%
19-30	3	10.7%
31-40	9	32.1%
41-50	5	17.9%
51-60	8	28.6%
60+	3	10.7%

Table 4.2.3: Participants by Teaching Experience

Category (Years)	Participants	%
1 - 5 years	12	42.9%
6 - 10 years	8	28.6%
11 - 15 years	2	7.1%
16 - 20 years	1	3.6%
21 - 25 years	1	3.6%
25 - 30 years	2	7.1%
30+ years	2	7.1%

Table 4.2.4: Participant Profile

Participant number	Gender	Lecture experience (in Years)	Age	Visual literacy level (0=low, 4=high)	Experience level with Blackboard LMS	Participant faculty
P1	Female	25 - 30	51-60	2	average	Brand Management
P2	Female	30+	51-60	4	average	Digital Marketing
P3	Male	30+	60+	4	high	Design (graphic design), Photography
P4	Male	1 - 5	60+	3	very high	Brand Management
P5	Male	1 - 5	51-60	2	high	Brand Management
P6	Female	1 - 5	19-30	2	average	Digital Marketing
P7	Male	1 - 5	19-30	3	high	IT (development)
P8	Male	6 - 10	31-40	4	very high	Design (web & mobile development), Design (graphic design), IT (development), Game Design
P9	Female	1 - 5	31-40	0	average	Research
P10	Male	6 - 10	31-40	3	average	Photography
P11	Male	1 - 5	31-40	1	high	Economics
P12	Male	1 - 5	19-30	4	average	Design (graphic design), Brand Management
P13	Female	6 - 10	41-50	4	low	Culture design
P14	Female	6 - 10	51-60	0	high	Brand Management
P15	Female	21 - 25	51-60	3	very high	Brand Management
P16	Female	1 - 5	31-40	4	high	Design (graphic design), Digital Marketing, Photography
P17	Female	11 - 15	51-60	4	very high	Design (web & mobile development)
P18	Female	16 - 20	60+	3	average	Accounting
P19	Male	1 - 5	31-40	1	very low	Digital Marketing
P20	Male	25 - 30	31-40	2	very high	Design (web & mobile development), IT (development)

P21	Male	11 - 15	31-40	4	high	Design (web & mobile development)
P22	Female	6 - 10	41-50	2	high	Digital Marketing, Business Management Entrepreneurs hip
P23	Male	1 - 5	41-50	3	low	IT (development)
P24	Female	6 - 10		4	very high	Interior Design
P25	Male	6 - 10	41-50	2	average	Digital Marketing, Brand Management
P26	Female	1 - 5	31-40	3	low	Design (web & mobile development), IT (development)
P27	Female	1 - 5	31-40	2	average	Design (graphic design)
P28	Male	6 - 10	41-50	2	low	Digital Marketing

The Participant profile (Table 4.2.4) contextualises the demographic information for each participant and allows for a greater degree of analysis. The experience that the participants had with the Blackboard LMS was of particular use for gaining insights during analysis as it can speak to the themes used in this analysis. The information provides context for the observational study because one of the main factors, that part of the data deals with, is the level of Blackboard experience/training. It should be noted that all participants received some form of Blackboard training from the Private Academic Provider therefore no participant has an experience level of “none”.

Table 4.2.5: Participants by Faculty

Category	Participants	%
IT	3	10.7
Law	0	0
Economics	1	3.6
Accounting	1	3.6
Graphic Design	3	10.7
Web & Mobile Design	4	14.3
Photography	2	7.14
Game Design	1	3.6
Digital Marketing	5	17.9
Brand Management	5	17.9
Interior Design	1	3.6
Research	1	3.6
Culture Design	1	3.6

Table 4.2.5 illustrates the participants by Faculty. The variation in faculty among the participants was needed and valuable as it provided the study with differentiating input data.

What we can gauge from this is the number of participants that fall into a field that has some link to content that is of a visual nature. While the levels of the visual elements that each faculty need will be different both in their usage and complexity, their user experience is tied to the fact that they have received training in the LMS and can therefore understand certain visual cues pertaining to the functionality and navigation of the LMS. The visual literacy level was tested in the survey. The assessment of the visual literacy level can be found in Section 4.4.4. Table 4.4.4.4 (Aesthetic awareness level) in this section illustrates the data that deals with the participants' visual literacy level. Therefore, an assumption can be made that the participants have visual literacy that is average or above. Those that fall into visually adjacent fields, meaning that elements of their field do deal with visuals or aesthetics in some form but not as intensive or as direct as those from fields that are assumed to be predominantly visual based. Lastly, we have participants that fall into the faculties that are assumed to be far removed from a predominantly visually driven syllabus. The assumption here is that they have a low or reduced sense of visual literacy. Participants had the option to select more than one faculty, and as subject matter experts, it doesn't mean that they are confined to one area of expertise.

In Table 4.2.4 (Participants Profile) it is shown that those that selected more than one faculty are mainly from what is considered creative fields. Six participants were from design (Graphic, Web, etc.) and two participants outside of this field were from Brand Management and/or Digital Marketing but also considered as from a creative field (Rosario and Cruz, 2019; Gunawan and Sulaeman, 2020). It should be pointed out however that the two participants from the faculty of Brand Management and/or Digital marketing also have a grounding in linear and logic-based subject matter. This showcases that they can be considered to have both creative and analytical reasoning skill sets. It is therefore plausible to be able to group participants into types of thinkers; namely Creative and Critical Thinkers.

Emanuel and Challons-Lipton (2013) state that the aforementioned type of thinkers is essential to being able to live in a media-rich world.

Table 4.2.6: Participants by Critical and Creative Thinkers

Category	Participants	Participants Profile number	%
Critical thinkers (IT, Law, Economics, Accounting)	5	P7, P11, P18, P23, P26	17.8
Creative thinkers (Graphic Design, Web & Mobile Design, Photography, Game Design, Culture Design)	10	P3, P8, P10, P12, P13, P16, P17, P20, P21, P27	35.7
Critical & Creative thinkers (Digital Marketing, Brand Management, Interior Design, Research)	13	P1, P2, P4, P5, P6, P9, P14, P15, P19, P22, P24, P25, P28	46.4

Another way is to subdivide the faculty data is into a binary selection of creative thinkers and critical thinkers, as shown in Table 4.2.6.

Critical thinkers in an Information Technology (IT) environment as stated by Van Laar, et al. (2017) and supported by Noruzi, et al. (2011), when users make informed decisions based on facts while using additional evidence to support their choices. Creative thinkers in an IT environment generate new ideas from existing ones or develop new ways of doing things (Hinrichsen and Coombs, 2013; Resnick, et al., 2005).

Based on the statements about what critical and creative thinkers are, the participants have been organised into groups illustrated by Table 4.2.6. Because of the nature of the type of thinking, and taking into account the advantages and disadvantages of each, it is safe to assume that we can use this binary categorisation to explain how the participants deal with elements in the LMS that cause cognitive load or difficulty. The heavy load or difficulty can illustrate how the participants deal with the adversity that they might encounter when engaging with the LMS's functionality which is either text-based or visually presented items or both. It also allows us to shed light on why and how users might do things, as will be illustrated by the User observation study.

4.3 Interaction and User Experience

This section of the survey deals with Interaction and User Experience (UX) and aims to understand how participants perceived the UX while interacting with the LMS. This section deals with one of the core constructs of TAM (Davis, 1989) which is Perceived Ease of Use (PEoU) and one of the constructs of the Collis and Verwijs model (1995) model (Makes work easier) which was used to support the theoretical framework by way of Human-Computer Interaction (HCI) considerations.

4.3.1 Interaction User Experience: Content upload

Table 4.3.1.1: Table showing content upload engagement by participants

Category:	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
Interaction rating: Content Upload	3.6 %	3.6 %	25 %	35.7 %	32.1 %

Table 4.3.1.2: Table showing difficulty experienced for content upload by participants

Category:	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
Frustration rating: Navigation for Content Upload	32.1 %	25 %	32.1 %	3.6 %	7.1 %

Table 4.3.1.3: Table showing how participants perceive the user experience of the LMS interface

Category: Interface User Experience	Participants	%
Positive	12	42.9 %
Negative	13	46.4 %
Doesn't matter	3	10.7 %

One of the main uses of an LMS is its ability to act as a repository for content (Schoonenboom, 2014). Whether it be for the students or lecturers, having the ability to access information at any time can be useful or vital criteria for usage. However, to access the content, there needs to be content. As covered in the literature in Chapter 2, there are various factors which influence the user experience for engagement. The perception of the tools to facilitate the uploading of content can have a huge influence on the frequency of the engagement (Coleman and Mtshazi, 2017), whether mandatory or not.

Table 4.3.1.1 illustrates that the majority of users have a favourable experience when interacting with the content upload tools. The percentages for high or very high ratings overshadow the low and very low ratings.

This data is further enhanced by the fact that users experienced a predominantly low amount of frustration when navigating the content upload tools (Table 4.3.1.2). This bodes well for these functions, user experience and aesthetic value of the LMS as users need to feel comfortable using the tools for such an important task. There also seems to be a correlation, albeit one with a narrow one, between how participants viewed the overall navigation of the LMS and the navigation of the specifics of the content upload function. Nearly half of the participants (42.9%) viewed the overall navigation in a positive light, which coincides with the number of participants who viewed the Content upload navigation positively or with low frustration (57.1%). This data analysis speaks to one of the main constructs (PEoU) of the TAM framework on which this study is based.

4.3.2 Interaction: Tools usage and frequency of use

As with many LMSs, the tools it provides, are at the core of its systems and whether the usage of them is frequent or not, they remain fundamental to tasks being done and completed (Schoonenboom, 2014). The tools and their usage, as well as their frequency of use, could be an indicator of the Perceived Ease of Use (PEoU) of the system's environment. This construct (PEoU) has a direct link to usage and adoption (Davis, 1989; Venkatesh and Davis, 1996; Yousafzai, et al. 2007). This in turn speaks to the theoretical framework on which this study is based.

As lecturers are the key focus of this study, it stands to reason that one of the core tools that this demographic would engage with would be the grading tool of the LMS. In Blackboard this is referred to as Grade Centre. The tables below will help to illustrate how using this tool can address PEoU.

Table 4.3.2.1: Table showing Grade Centre usage

Category: Grading tool use	**Participants**	**%**
Use	27	96.4 %
Don't use	1	3.6 %

Table 4.3.2.2: Table showing how participants perceived their interaction with Grade Centre

Category:	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
Favourability rating of interaction with Grade Centre	3.6 %	7.1 %	14.3 %	39.3 %	35.7%

Table 4.3.2.3: Table showing the skill level of participants using the LMS

Category:	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
Skill Level of Participants using LMS	3.6 %	14.3 %	32.1 %	28.6 %	21.4 %

The resultant data in Table 4.3.2.1 paints an overwhelming picture of the usage of this specific tool. All participants with the exception of one (Participant designation: P2) used the tool. The data that supports this usage is shown in Table 4.3.2.2 where the majority of participants display a positive interaction with the tool. This speaks to the PEoU construct of TAM which leads to system (LMS) usage as its conclusion.
Table 4.3.2.3 displays the skill level of all the participants and P2 (the participant that didn't use Grade Centre) ranked their skill level of working in the LMS as Average. The aforementioned indicates that the input from the user of not using the tool must be connected to a factor that is external to the scope of this study, which mainly deals with the influence of visual literacy and user experience. The conclusion can therefore be made that the two data sets together corroborate the fact that user experience does influence the usage of the LMS.

4.3.3 Interaction: Navigation

The HCI design of a system is most often done for User Experience (UX) engagement with particular emphasis normally put on navigation. This function mainly facilitates how users get to interact with almost every aspect of the LMS. If the user encounters an issue with navigation, progression might be stalled (Kim and Hirtle, 1995) which could illicit a negative perception or reaction towards the usability (Buchanan, 2001), UX and LMS, thereby decreasing usage.

The data analysed here will speak to the experiences that users faced and the Perceived level of frustration, which in turn addresses Perceived Ease of Use PEoU, with the LMS.

Table 4.3.3.1: Participants' rating frustration and level of frustration with LMS navigation

Category:	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
Rating: **If** frustration occurs with the navigation of LMS	7.1%	21.4%	35.7%	28.6%	7.1%
Rating: **How much** frustration occurred with the navigation of LMS	14.3%	25%	28.6%	25%	7.1%

Table 4.3.3.2: Participants' frequency of frustration with the LMS navigation

Category:	Every log in %	Sometimes %	Rarely %
Frequency (how often) frustration occurs	21.4%	53.6%	25%

Table 4.3.3.3: Participants' frequency of overall LMS use

Category:	Everyday %	When needed %	Other %
Frequency (how often) do you use the LMS	64.3%	35.6%	0%

Table 4.3.3.1 shows that an above-average number of participants did indeed experience frustrations with the navigation interaction of the LMS. If you take into consideration the "Average" and "High" percentages, then it is safe to assume that the majority of users consider there to be some form of HCI issue with the Navigation implementation of the LMS. The other data in Table 4.3.3.1 of the level of frustration that occurs appears to be high, leading the analysis to assume that the issue is not a simple one but quite substantial.

Table 4.3.3.2 highlights the frequency for this level of frustration with the navigation only occurs "sometimes". Table 4.3.3.3 shows that a majority of participants use the LMS every day. When considering the two data sets together, the assumption can be made that although PEoU is sometimes called into question, the Perceived Usefulness (PU) is not low. It can therefore be assumed that while the is some negative contribution towards PEoU, the majority of participants still regarded the navigation as useful. This is evident by the frequent use of the LMS, and that continued usage would be ongoing regardless of the shortcomings of the navigation. The aforementioned shows that even though there was a mix of results concerning PEoU, PU was substantial enough to influence the usage of the LMS.

4.3.4 Interaction: Student Communication

Meenakumari, et al. (2013) state that the learning process is continual; therefore communication with students should also be continual. The LMS

has a variety of tools and functions that facilitate this communication (Black, Beck, Dawson, Jinks, & DiPietro, 2007) and the data collected showcases two methods that Blackboard does it through, namely; email and announcements. This interaction criterion was measured because it considers how participants perceived the Ease of Use (PEoU) of this relevant function which affects the usage of the system (Davis, 1989).

Table 4.3.4.1: Table showing communication tools usage

Category: Communication with students	**Participants**	**%**
Use	23	82.1%
Don't use	5	17.9%

Table 4.3.4.2: Table showing Participants' value rating with communication tools

Category:	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
Rating: interaction value with Announcements tool	7.1%	10.7%	28.6%	28.6%	25%
Rating: Interaction value with Email tool	3.6%	14.3%	32.1%	25%	25%

It is clear from the data in Table 4.3.4.1 that the majority of Participants communicate with students through the LMS. One of the perceived advantages of using the LMS for communication purposes is that the sender can be sure that the recipient will receive the communication as using the LMS is mandatory in the Higher Education Institution (HEI). Another useful part about using these communication tools is that communication can be sent en masse, especially if the student count for a particular subject is relatively high. The reason for combining the data of email and announcements is that they can work in tandem with each other.

An example of this is with an email, a communication that is quite lengthy in terms of content, can be sent and with an announcement, should it be needed, amendments to the initial communication can be made or summarised content could be communicated should a lengthy email not be needed.

Table 4.3.4.2: reveals that there is generally a positive perception towards the interaction and usage of communication tools regardless of whether it was an email or announcement. This high rating among participants can be perceived as them finding the tools relatively easy to use or interact with. The aforementioned, therefore, speaks to the perception that the technology is effective (Bingimlas, 2005) in its purpose which drives Perceived Usefulness (PU) and because it is used frequently and has a high usability rating, speaks to Perceived Ease of Use (PEoU). As these two constructs fall on the positive for these tools, it can therefore be assumed that the positive user experience influenced the usage of the LMS.

4.4 Aesthetics and Visual Literacy

This section of the survey deals with aesthetics and Visual Literacy and aims to understand how participants perceived the visual nature of the LMS through its representation of elements and functions. This section deals, at times, indirectly with one of the core constructs of TAM (Davis, 1989) which is Perceived Ease of Use (PEoU) and one of the constructs of the Collis and Verwijs model (1995) model (Attractiveness) which was used to support the theoretical framework by way of aesthetics and Visual Literacy considerations. The TAM construct of PEoU can be taken into account by the data portrayed in this section because icons function as a representation of functions that the user can do inside the LMS. If the representation is skewered or incorrect it could affect how the user functions or navigates the LMS which could influence the usage and adoption of the LMS.

4.4.1 Visual customisation (Aesthetic value)

Table 4.4.1.1: Importance of Participants' visual customisation of the entire LMS

Category: Importance of visual customisation of the entire LMS	Yes %	No %
	71.4%	28.6%

Table 4.4.1.2: Importance of Participants' visual customisation of their LMS workspace

Category: Importance of visual customisation of workspace	Yes %	No %	Other (Somewhat) %
	64.3%	32.1%	3.6%

Table 4.4.1.3: Participants' ranking of available customisation features

Category: Ranking LMS customisation features	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
	7.1%	39.31%	32.1%	14.3%	7.1%

Tractinsky, et al. (2000) state that aesthetic features are perceived as independent from function. Table 4.4.1.1 which references Question C13 of the survey, asks how important is visual customisation of the LMS. A majority (71.4%) of participants indicated that customisation of the visuals of the LMS, which can be regarded as an aesthetic feature, is important. The aforementioned can affect the usage rate as the responses to question C7 (represented by Table 4.4.1.3) indicate that most users perceive the LMS to have low, very low or average customisation features (78.5%). To support this, the participants were asked if customisation of their specific workspaces inside the LMS was important, and most participants said yes (64.3%). This data shows that aesthetic customisation of the LMS in a micro (their workspaces) or Macro (the entire LMS) is important to users.

It, therefore, stands to reason that should a more visually appealing LMS be presented to the users, they might adopt this alternate offering as poorly designed technology (McCarthy and Wright, 2004) takes users away from it. Regardless of functionality, the data proves aesthetics are important to users for usage.

4.4.2 Icon representation (Primary Navigation)

Table 4.4.2.1: Participants' ranking of need for icons in primary navigation

Category: Need for icons in primary navigation	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
	0%	17.9 %	28.6 %	39.3 %	14.3 %

Table 4.4.2.1 Represents data that shows that a majority of the participants indicated that there needs to be some form of icon representation in the primary navigation. This is indicated by 39.3% representing a high need, and a lower 14.3% representing a very high need for the primary navigation needing icons.
Petersen, et al. (2004) believe that aesthetics for the value of interaction can be beneficial when designing systems. The data in Table 4.4.2.1 seems to support the aforementioned statement.

4.4.3 Mobile usage and visual perception

Dickey (2004) states that technology has advanced that when we access information, it can be from anywhere as location no longer plays a part in knowledge accumulation. This is supported by Dahlstrom, et al. (2014) that say that mobile technology can make information from a digital environment available anywhere. They (Dahlstrom, et al., 2014) also state that for this to be facilitated the mobile device functionality needs to be user-friendly (in aesthetics and structure) and optimised (in functionality). The aforementioned speaks to elements which form part of the UX, HCI principles and visual literacy.

Table 4.4.3.1: Participants' accessing the LMS by device

Category: Access of LMS	Desktop	Laptop	Mobile (Phone/Tablet)
	71.4%	28.6%	0%

The data presented in Table 4.4.3.1 shows that participants prefer to access the LMS from a device that is perhaps larger in size or has a screen that is larger in size. The aforementioned can be attributed to the fact that an LMS is a digital environment and can consist of, at times, complex interactions, large amounts of content, etc. As data from Table 4.4.3.1 suggests, the actuality is that the LMS in this study is accessed from devices that can perhaps handle the aforementioned in a manner that does not increase cognitive load as it (the device) might be more optimised about HCI principles and user experience.

Table 4.4.3.2: Participants' preference for accessing the LMS by device

Category: Preference of device used for LMS access	Desktop	Laptop	Mobile (Phone/Tablet)
	50.6%	45.8%	3.6%

The data from Table 4.4.3.2 shows that a minority (3.6%) prefer to use a mobile version of the LMS. This can be considered an outlier as the could speak to a choice that is made taking personal desirability into account. The desirability and the data in Table 4.4.3.2 illustrates more a preference of usage concerning the type of device (small scale or large scale) rather than the LMS version (desktop or mobile).

Table 4.4.3.3: Participants' rating of importance for a mobile version of the LMS

Category: Importance of having a mobile version	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
	14.3%	10.7%	21.4%	21.4%	32.1%

4.4.3.4: Participants' opinion of the visual appeal of the LMS mobile version

Category: Mobile version visual appeal	Yes %	No %
	50.6%	45.8%

4.4.3.5: Participants' rating of the visual appeal of the LMS mobile version

Category: Visual appeal rating of mobile LMS	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
	28.6%	28.6%	28.6%	10.7%	3.6%

This is in contrast to the data that Table 4.4.3.3 alludes to. From the data, it can be deduced that users want a mobile version. The data can also assume that the reason for wanting a mobile version is that either the participants are not aware that one exists or, as the data in Tables 4.4.3.4 and 4.4.3.5 will reveal that they have had experience with the current mobile version and found it wanting in all visual areas, particularly the aesthetics of the mobile LMS version. It can therefore be surmised that considering the data in Table 4.4.3.1 and taking into context the data from Table 4.4.3.4, perception has been mostly negative and therefore the adoption of the LMS or at least the mobile version was affected by the visual nature (or its literacy) and UX of the LMS.

4.4.4 Aesthetic importance

Our understanding of aesthetic value can be derived from a variety of sources in the real world. These determinants are varied enough that not any singular source can claim dominance as they are not mutually exclusive (Jacobsen, 2010) as the subjectivity of the determinants as well as exposure to them (Leder, et al., 2003) also plays a role in our perception.

Table 4.4.4.1: Participants' rating of Aesthetic Importance

Category: Importance of Aesthetics	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
	10.7%	7.1%	17.9%	35.7%	28.6%

Table 4.4.4.2: Participants' rating of the default colour scheme of the LMS

Category: Rating of default colour scheme appeal	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
	25%	14.3%	39.3%	17.9%	3.6%

Table 4.4.4.3: Participants' opinion if the visual nature of LMS feels outdated

Category: Overall visual is outdated?	Yes %	No %
	67.9%	32.1%

Table 4.4.4.4: Participants' rating of their Aesthetics awareness

Category: Aesthetics awareness level	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
	7.1%	7.1%	28.6%	25%	32.1%

The data represented in Table 4.4.4.1 shows that the majority of participants (Average to Very High) valued the aesthetics of the LMS. The data in Tables Table 4.4.4.2 and Table 4.4.4.3 are presented alongside Table 4.4.4.1 as support to correlate the users' perception of the importance of aesthetics. From the analysis of the support tables, the assumption can be made aesthetic value is important for users when engaging with the LMS. This is because a high percentage of the participants regarded the visual nature of the LMS to be outdated. As pointed out in section 4.4.1 of this chapter, participants value the concept of customisation and that is supported by the fact that a majority of the participants (Very low to Average) do not think that the default colour scheme is appealing. The aforementioned could have major implications for current usage and future adoption because if technology is perceived to be outdated from a certain aspect, the assumption can be made that it

could be an inferior system. Messaris (1993) points out that we draw our perceptions from reality and since the data in Table 4.4.4.4 shows that the majority of participants believe that they have a high aesthetics awareness so, therefore, their perception that the visuals of the LMS are outdated rings true to them. Therefore, as stated before the participants could consider the LMS outdated and thereby affect future usage and adoption.

4.4.5 Icon implementation: Styling and Complexity

User experience (UX) plays a vital role in how users can and will interact with any given system based on their perception (Garrido-Morgado et al., 2016; Lemon & Nowlis, 2002) of the complexity of how to go about completing tasks. Icon design for functionality can form part of that complexity and based on our abilities to perceive the information the icon represents, can either make task completion or interaction with the system easier or harder. In this part of the analysis, questions were posed to the participants as to how much they value the design of the icon based on whether it is simple or complex in form.

Table 4.4.5.1: Participants' rating of their value for simple icon design

Category: Rating: value of simple icon design	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
	3.6%	7.1%	17.9%	14.3%	57.1%

Table 4.4.5.2: Participants' rating of their value for complex icon design

Category: Rating: value of complex icon design	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
	42.9%	25%	14.3%	10.7%	7.1%

The data analysis shows that a majority (57.1%) of the participants value simple icon design quite highly and the opposite is true in that a majority (42.9%) has a low sense of value for complex icon design as illustrated by Tables 4.4.5.1 (simple icon design) and 4.4.5.2 (complex icon design).

This does show as well that there is an equilibrium for the perception of icon design because although the percentages vary slightly, it shows that if a user values simple design they almost always do not value complex design. This bodes well for usability as it appears that there is no conflict in participants knowing what they want from an aesthetic viewpoint so when they encounter a system that caters to their needs, their Perceived Ease of Use would shift to the positive. The same can be said for the reverse in that if they encounter systems that don't cater to their visual needs, they might use it less or seek out a system that does. The icon implementation and the visual complexity therefore directly influence usage or adoption.

4.4.6 Icon implementation: Design styling of icons

Table 4.4.6.1: Participants' selection of icon styling

Category: Complexity of icon design				
	Outline	**Detailed**	**Flat**	**Filled**
%	42.9%	25%	14.3%	10.7%

This section will be viewed as support for the analysis made in 4.4.5. It was stated that the participants valued either a simple style icon design or a complex style icon design but rarely both simultaneously. The data presented in Table 4.4.6.1 will attempt to enhance the aforementioned analysis further. There are generally four main styling aesthetics for icons and they belong to categories of design styling (Shahid, et al., 2016) referred to as flat (simple) or skeuomorphic (complex).
Participants could choose more than one styling and based on the data received, only 25% chose more than one styling. While that is not a large margin, what was interesting was the fact that of those who selected more than one option, the outline icon (representing simple design) and the detailed icon (representing complex design) were never selected together. This correlated with the information deduced in section 4.4.5 which states

that participants never value simple and complex icon design together and it is either one or the other.

4.4.7 Icon implementation: LMS Icon Perception

To test the data from sections 4.4.5 and 4.4.6 as it pertains to the Blackboard LMS, Participants were asked to select an icon styling from either a simple or detailed icon that they think best represents the function. The icon chosen for these questions was deliberate as it pertains to elements that would be of interest to the population sample (Lecturers). The icons were the “calendar” and “create lesson plan”.

Table 4.4.7.1: Participants' selection of best icon representation

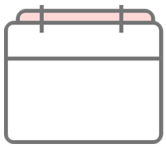
Category: **Best representation of Icon:** **Calender**		
	Simple	**Detailed**
%	57.1%	42.9%

Table 4.4.7.2: Participants' selection of best icon representation

Category: **Best representation of Icon:** **Calender**		
	Simple	**Detailed**
%	75%	25%

This data speaks to the analysis in section 4.4.5 which shows that a majority of participants prefer simple over detailed (complex). The data that was interesting to note was that the Participants that selected their preferred styling of the icon as detailed in section 4.4.6.1 were also part of

the participants that chose detailed (complex) as their preferred representation of the icon represented in this section and illustrated by tables 4.4.7.1 and 4.4.7.2.

This proves that there is at least some correlation and consistency between the aesthetic preferences and choices that users make as far as the visuals of a system (LMS) are concerned. This data is useful from a useability aspect as designers of these systems can use data such as this to update their systems to suit what their user base requires to positively influence the perception and user experience of the systems and thereby increase the usage and adoption of the LMSs.

4.4.8 Icon implementation: LMS Icon Interpretation

The participants were given an open-ended question where they had an icon to identify. This question tests the validity of the participants' perceived visual literacy as well as the visual elements that the LMS has chosen to implement as a representation of a function. The participants were asked to attempt to identify the icon from either their acquired, lived experience or experience with the LMS. The data is presented in Table 4.4.8.2 with the icon that was used in the study's survey that was distributed, its actual meaning and the percentage of participants that identified it correctly. The images in Table 4.4.8.1 are the correct representation of the functions in the Blackboard LMS.

Table 4.4.8.1: LMS icon visual definitions

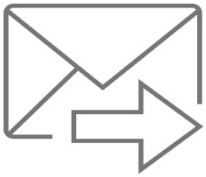
Icon visual representation used by Blackboard LMS		
	Message	**Email**

Table 4.4.8.2: LMS icon identification

Category: LMS Icon identification		% of Participants identified correctly:	% of Participants identified incorrectly:
	Icon representation: Message	**35.7%**	**64.2%**

The interesting part of the analysis for this data is that the participants who identified the icon incorrectly, all identified the icon as one that represents; email.

This can be understood because the icon that the LMS uses for "message" is typically, as a general consensus, used to signify email. What this analysis then points are two things:

- The participants that identified the icon correctly have used the function considerably and,
- The participants that identified the icon incorrectly have either high or low visual literacy or have not used the function a lot.

The assumption based on the analysis of the individual responses points to average to high visual literacy and average to high LMS usage.
It is therefore assumed that the issue lies with the representation of the icon by the LMS and because of this it might create confusion and according to the data, it has. This speaks to a usability issue that can directly affect the user experience. If this is indeed the case then this issue, if not addressed could cause the function to not be used for fear of using it incorrectly which therefore influences the usage and adoption of the LMS.

4.5 Functionality

This section of the survey deals with functionality and aims to understand how participants used and engaged with the core functions of the LMS. This section deals with one of the core constructs of TAM (Davis, 1989) which is Perceived Usefulness (PU) and one of the constructs of the Collis and Verwijs model (1995) model (Usefulness) which was used to support the theoretical framework by way of its link to User Experience (UX) considerations. The TAM construct of PU can be used in this section because of the core functions taken into account and portrayed by the data. If the functionality is found to be ineffective or confusing it could affect how the user interacts with it, creating a negative perception of the LMS, which could influence the usage and adoption of the LMS.
Table 4.5 provides an overview of how the participants perceived their operating knowledge of the LMS and a rating of how much they perceived the LMS assists with their ability to teach.

Table 4.5: Participants' LMS operating knowledge and LMS teaching assistance

Category:	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
Knowledge in operating the LMS	3.6%	10.7%	32.1%	39.3%	14.3%
Rating: how much the LMS assists lecturing	7.1%	21.4%	14.3%	39.3%	17.9%

What we can gauge from the data in Table 4.5 is that the majority of participants deemed themselves to have an average to very high LMS operating knowledge. As for how the participants perceived how much the LMS assisted with their ability to teach is more evenly allocated among them with perhaps the exception of the very low category which accounts for 7.1% or two (2) participants. This data forms a relevant base from which to proceed with the analysis.

4.5.1 Accessibility

Accessibility has become a popular catch-all phrase for inclusivity. Most designs of everyday things (Norman, 2013) have an element of accessibility available or at the very least, an accessible version of that everyday thing. When it comes to technology and systems design, users with accessible needs are finding that at times they do not need to venture too far from the technology that users who have no accessible needs engage with. This is a positive element and can only increase the Perceived Usefulness (PU) of the system thereby positively influencing its usage and adoption. The issue arises when these functionalities are not used because either the users are not aware of them, they find no use for them or they have little to no idea how to use these accessibility features. The data below will attempt to analyse which it is.

Table 4.5.1.1: Participants' knowledge of the LMS accessibility features

Category: Preference of device used for LMS access	Yes	No	Not sure
	14.3%	32.1%	53.6%

Table 4.5.1.2: Participants' usage of the LMS accessibility features

Category: Usage of accessibility features	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
	39.3%	21.4%	32.1%	3.6%	3.6%

Table 4.5.1.3: Participants' rating of two LMS accessibility features

Category: Rating of accessibility features	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
High contrast settings	35.7%	17.9%	42.9%	3.6%	3.6%
Alternate text and captioning	32.1%	17.9%	35.7%	14.3%	0%

Table 4.5.1.1 shows that a majority (53.6%) of participants are not aware of the accessibility features offered by the LMS. Another considered negative from the perspective of the LMS is that a smaller but still substantial number of participants viewed the LMS as having bad accessibility features. The data representing the participants that answered as the LMS having bad accessibility features can be echoed in Table 4.5.1.2 by the low usage of the accessibility features (a combined 60.7%). It can be therefore assumed that the data displayed in Table 4.5.1.3 is reflective of the low usage (from Table 4.5.1.2) because if you are unaware or have low usage, how are you able to allocate a high rating to certain accessibility features? It can be considered that the low or unclear knowledge of the LMSs accessibility features can be addressed through training however if training is not available and users need to interact with the accessibility features, it might prove difficult and this can therefore influence the usage of the LMS. It could also influence the

adoption, as users might flock to an LMS that is better geared at representing the functionality of its accessibility features better.

4.5.2 Social Media Integration

Social media has become synonymous with how users interact and receive information. Social media tends to transcend an age demographic as there is almost always something available for different target markets. It would there be assumed that integration of social media functionality into an LMS would make sense. In this section, the data explores how aware the participants are of any social media integration within the LMS.

Table 4.5.2.1: Participants' awareness of social media functionality of the LMS

Category: Is social media functionality available in the LMS	**Yes**	**No**	**Not sure**
	7.1%	25%	67.9%

As with the previous section which covered accessibility features, there seems to be a trend developing with regard to the functional elements of the LMS. Again, a resounding majority (67.9%) was not aware of the functionality and a lesser majority perceived there to be no social media functionality (as displayed in Table 4.5.2.1). For two perceived common functional elements that could be argued is present in an everyday technology-filled environment, there is a perceived negative outcome with regard to them (the accessibility and social media functions). It can therefore be argued that if such fundamental or core functionality is missing from the LMS, it stands to reason that users would seek a system that caters to their needs. This would not only influence usage but adoption of this LMS in a major way.

4.5.3 Online Learning

The concept of online learning has contributed to numerous studies and has been the focus of much literature that deals with the usage and adoption of the LMS environment. While online learning does feature in this study it is not a core driver for examining usage or adoption but it is used as an element that speaks to functionality. This functionality addresses one of the key components of the framework for this study which is Perceived Usefulness (PU).

The data will investigate how participants view the online learning feature (known as Collaborate) and its functionality to address PU to determine the influence the feature has on the usage and adoption of the LMS.

Table 4.5.3.1: Participants' view of the Collaborate feature

Category: Is the Collaborate feature good for online learning?	**Yes**	**No**
	89.3%	10.7%

Table 4.5.3.2: Participants' rating of the Collaborate feature

Category: Effectiveness of the Collaborate feature	**Very low %**	**Low %**	**Average %**	**High %**	**Very high %**
	(0)	**(1)**	**(2)**	**(3)**	**(4)**
	0%	7.1%	35.7%	53.6%	3.6%

Table 4.5.3.3: Participants' view of the Collaborate features requirement

Category: Does Collaborate need more functions for online learning?	**Yes**	**No**
	75%	25%

Table 4.5.3.4: Participants' need for more Collaborate features

Category:	Very low %	Low %	Average %	High %	Very high %
	(0)	(1)	(2)	(3)	(4)
Rating: how strongly do you believe more functions are needed?	0%	14.3%	25%	35.7%	25%

An overwhelming majority of Participants believe that the online learning feature of the Blackboard LMS, Collaborate, is a worthwhile function (89.3%), however in the same breath, that same majority believe that Collaborate does require more features (75%) to enhance the function. From the data in Table 4.5.3.2, participants believe quite strongly that while the Collaborate feature is effective, they also believe equally strongly, that more features are needed to enhance the functionality. While it can be useful to measure the Collaborate function against other live-learning functions, it needs to be reiterated or pointed out that this feature is a core function and not the main function of the LMS. It could be argued that some improvements to the existing functionality could perhaps increase the perception of the online-learning functionality, but it may or may not increase the overall perception of the LMS. There is however a strong positive perception of the feature, regardless of the wanting for more functions. It can therefore be argued that because of this positive reception of the function, it directly influences PU and by way of that assumption, influences the usage and adoption of the LMS.

4.6 Observational User Study

The study was undertaken to determine the users' experiences and their ability to adapt their innate IT knowledge to an instruction to initiate a process (Harrison, et al., 2013) inside the LMS. Another determinant was to establish the time taken and the implementation strategy that the User chose to undertake to complete the assigned task. This is a viable way of analysing the user's ability to navigate the LMS (using HCI and visual literacy) because as Goldman and McDermott (2014) state; "video

becomes data when the researcher selects video and uses them for specific analytic purposes."

This would be used to interpret the users' actions into how well-developed their visual literacy is and how it influences their ability to interact/use the LMS and its functions/tools. This observational study looks at the user's experience as well to establish how well they intuitively apply HCI principles to complete a task in the LMS. This will assist in answering the question of how visual literacy and user experience influence LMS usage. To negate the variance that an external factor such as bandwidth could cause, the test was conducted at the same premises. This would therefore add stability to any interaction process that was governed by bandwidth such as the system's response to Call to action button interactions and upload speeds. The participants each ran a default layout of the LMS to ensure fairness without any addition visual assistance. This meant that no participant had an advantage regardless of how their personal account for the LMS was altered. All links and their locations are in their default placement as to ensure that the time variances observed were accurate for both participants.

This section is divided into the four tasks the participants needed to perform. They are in descending level of difficulty:

- Create a link containing a PDF to initiate a class task worth 100 marks that needs marking in the grade centre (Task level: Hard).
- Upload a PowerPoint document with a description (Task level: Intermediate).
- Create a Blog post (Task level: Intermediate).
- Change the rubric score of the first task (Task 1) to 50 (Task level: Easy).

4.6.1 TASK 1

The participants were tasked with using the LMS to upload a PDF that would serve as a formal brief for a class exercise. They then needed to check if the task was done correctly by navigating to the Grade Book (Figure 4.6.1.1.1) screen to check if the task had been allocated a marking column. To let the participants be guided by their existing knowledge and digital competencies (Ferrari, 2012) and not influenced by the researcher,

the instruction was given with the word “task” instead of “assignment”. The reasoning for this was that some users within the Blackboard environment, especially novice users, have trouble locating the appropriate function inside the Blackboard system (Tella, 2011). This term was used to allude to something that needed to be done with the potential for evaluation to test the user’s ability to rationalise an instruction and choose the appropriate option with the LMS.
Therefore, no specifics were given but the instruction was clear enough to elicit a response once given.

Table 4.6.1.1: Participants' need for more Collaborate features

User	Task 1	Task level	Time taken	Variance in time
Lola (User 1)	Create a link to a class with a PDF task that needs grading	Hard	1 minute and 20 seconds	**47 seconds**
Peter (User 2)			33 seconds	

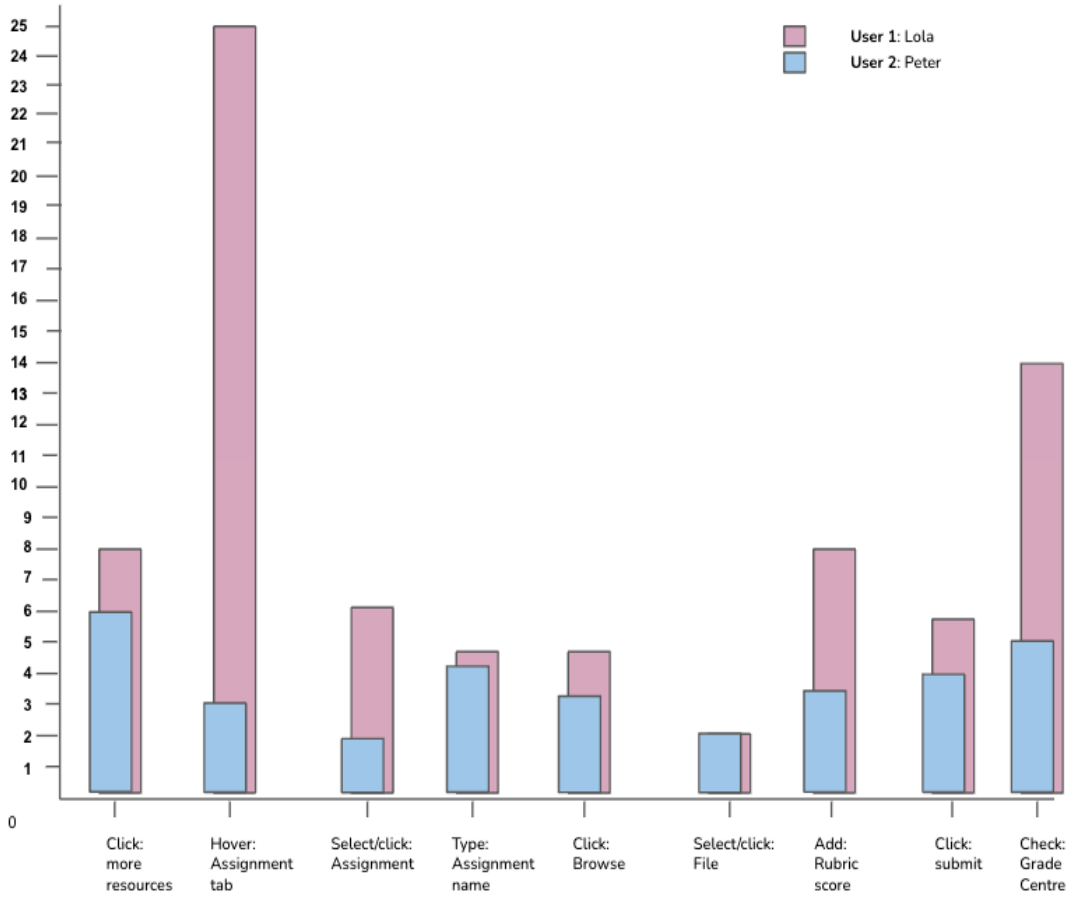


Fig 4.6.1.1: Task 1 time taken by Users per step.

Results

Table 4.6.1.1 gives us a summarised overview of the time taken to complete the task. According to the time taken by each participant, there is a time completion difference of 47 seconds between the two participants. There are very slight variations in the paths users can take to achieve an objective inside a system (Garrett, 2003). Because of the consistent form or organisational structure of items (Hallnäs, 2011), it is a system based on logical construction, therefore the steps can be quite linear. This is proven by the path taken by both participants when doing the first task, regardless of their Blackboard training level.

The graph in Fig 4.6.1.1 illustrates these steps and displays the time taken (in seconds) for each step. User 1 took longer to perform each step than User 2, except for the selecting of the file (step 6).

By far the longest time taken was step 2 (second from the left); "Hover: Assessments".

ACTIVITY 3.1.2: AUDIT AND EVALUATE YOUR CREATIVE WORK	PROJECT 1 - PROGRESS SUBMISSION	PROJECT 1 - PROJECT SUBMISSION	PROJECT 1	PROJECT 2	SUMMATIVE PROJECT	ICE 01 - NOSCE TE IPSUM / TEMET NOSCE (KNOW THYSELF)	ICE03 TASK - CO-DESIGN	EXERCISE - LOGO REDESIGN - VEGA	PEER REVIEW - STUDENT WORK UPLOAD - 8 AUGUST
--	0.00	51.00	51.00%	60.00%	72.00%	100.00	100.00	100.00	100.00
--	--	--	0.00%	22.00%	0.00%	100.00	100.00	0.00	0.00
	14.125	51.00	65.125%	58.00%	50.375%	100.00	0.00	100.00	0.00
--	14.125	62.00	76.125%	77.00%	75.00%	100.00	100.00	100.00	100.00
--	14.125	51.00	65.125%	70.00%	73.00%	100.00	100.00	100.00	100.00
--	14.125	59.00	73.125%	79.00%	80.00%	100.00	0.00	0.00	100.00
--	14.125	62.00	76.125%	80.00%	76.00%	100.00	100.00	100.00	100.00
--	14.125	72.00	86.125%	77.00%	70.00%	100.00	100.00	100.00	100.00
--	14.125	55.00	69.125%	55.00%	63.00%	100.00	100.00	100.00	100.00

Fig 4.6.1.1.1: Example of the grade book.

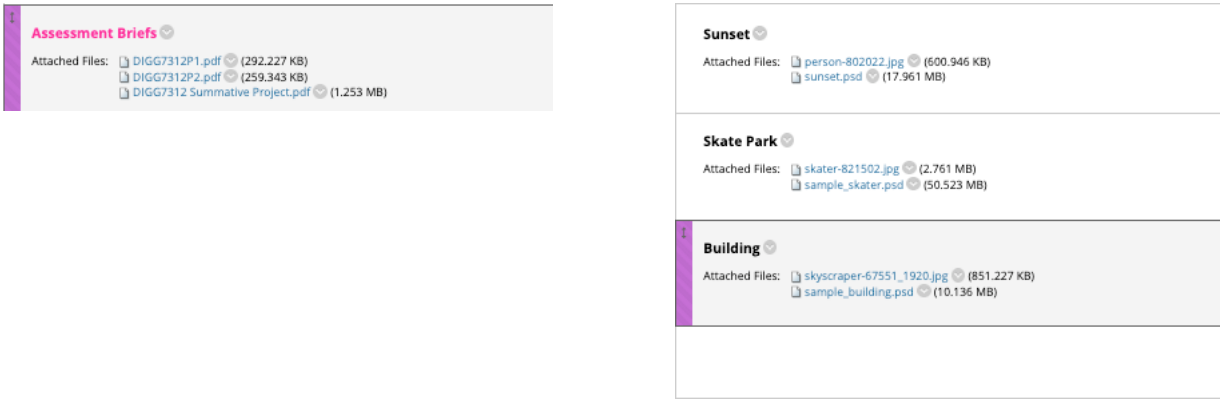


Fig 4.6.1.1.2: Example of PDF loaded documents

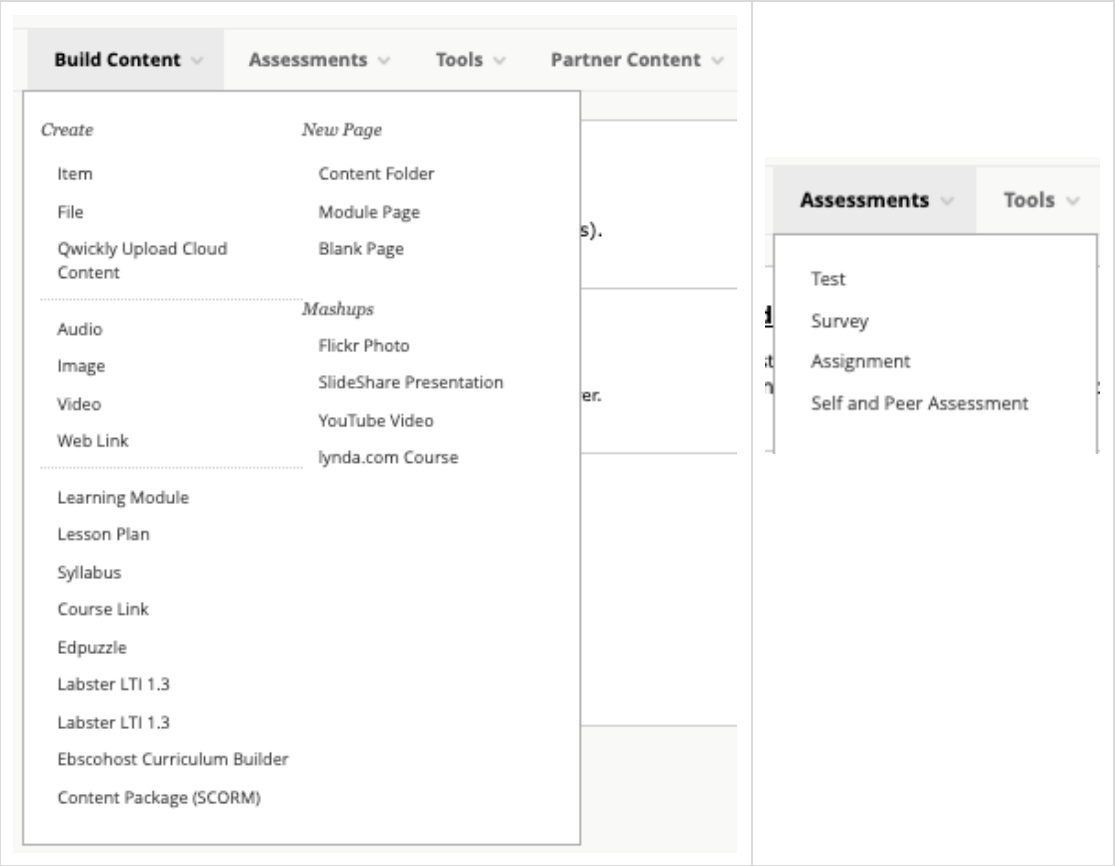


Fig 4.6.1.2: Blackboard “hover” feedback

Blackboard has a variety of feedback options (Fig 4.6.1.2) that displays various states of a function (Alaofi, 2016). In this case, before choosing a function, the User has to “hover” on one of a row of primary functions to display further options. These primary functions are not always clear as some systems do not display a proper hierarchy with regard to the importance or relevance of functionality (Dumais and Chen, 2000). This has been discussed in the literature from chapter 2.

Fig 4.6.1.2 also illustrates the functionality for the various kinds of upload types that the user can engage with.

This lack of possible hierarchy is made more difficult if the User is not sure of which function to use (Johnson, 2010), as was the case here. From observation of the User’s eye movement and their input device (displayed as a cursor on the screen), it was clear that indecision was taking place (Luckin, et al., 2013). User 1’s eyes (and their cursor) darted back and forth between two options namely; Build content and Assessment. The former option was first and as an HCI principle, we as a western culture,

place emphasis on the leftmost option because of scanning strategy (Molnar, 1981).

User 1 did not find the appropriate function on any of the pop-up menus and therefore proceeded to the next, in row of functions, namely; Assessment. Still, caution was exercised and after careful consideration (six seconds) of the presented options, chose the assignment option. The data result (Fig 4.6.1.1) shows that after this prolonged time, there were still slight variances in time to complete the remaining steps. It can be inferred that because this indecision happened very early in the process and because of the low level of Blackboard training, User 1 proceeded with caution. This caution translated into the extra time taken to make sure that they did the correct process to complete the task. The final step in the process involved the User going to another section of the LMS that deals with Grades and Marking, called the Grade Centre. User 1 took extra time because it can be assumed that because this last step involved a process that was external to the one just completed, their cognitive load increased because they had another decision to make that is based on the LMS's functionality. Hollender, et al. (2010) states that HCI and cognitive load are linked and therefore this supports the extra time taken in the final step. This task and the variance in time taken on certain steps shows that because of the nature of the functions and their lack of visual hierarchy, which is an element of visual literacy (Johnson, 2010), influenced the way User 1 used the LMS. This influence translated to increased time to perform a task and this prolonged usage could cause an undesirable effect on the user and negatively influence their perception of the LMS. This could, as a knock-on effect cause usage of the LMS, to decrease.

4.6.2 TASK 2

The participants were tasked with uploading a pre-made PowerPoint presentation and adding a brief description to accompany the file upload. The participants had to use the built-in authoring tools to insert a short paragraph describing the content of the PowerPoint. The hardness level of this task is ranked as intermediate as there are functions involved in the task that can confuse the user if they are not sure of which options in the LMS to select to complete the task. Although the PowerPoint can be uploaded to the system using the "Build Content" function

(Fig 4.6.2.2), only one of the presented options listed enables the user to add a description. The interface option utilised in this task has minimal visual presence and the context for the user is entirely driven by text-based options and functionality.

Table 4.6.2.1: Task 2 time taken by users

User	Task 1	Task level	Time taken	Variance in time
Lola (User 1)	Upload PowerPoint with description	Intermediate	1 minute and 1 second	**37 seconds**
Peter (User 2)			24 seconds	

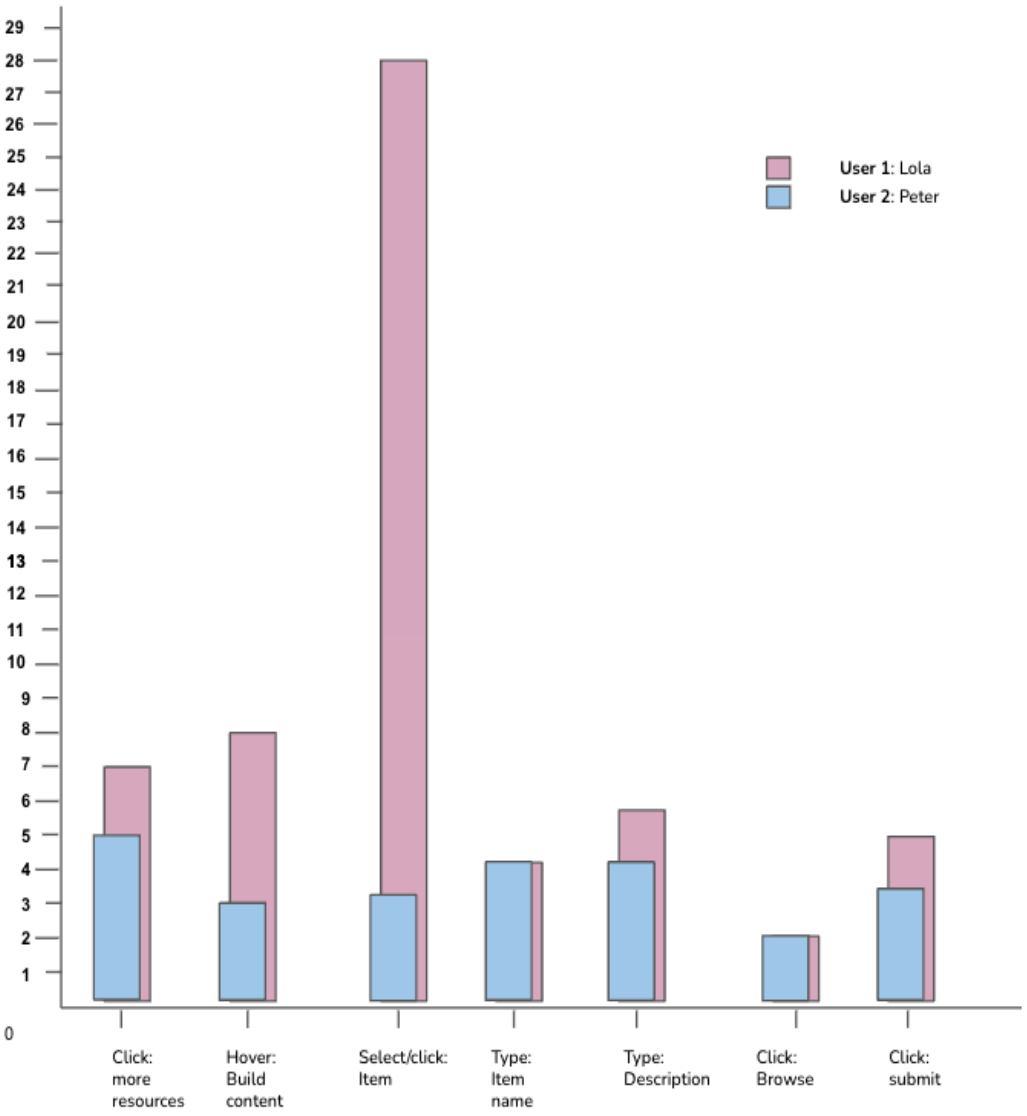


Fig 4.6.2.1: Task 2 time taken by users per step.

Results

The time variance to complete the task between User 1 (Low-level Blackboard training, High visual literacy) and User 2 (High-level Blackboard training, Low visual literacy) was 37 seconds. The data in Fig 4.6.2.1 illustrates that the time taken for each step of the task was relatively the same with the exception of the first three steps (from left to right). The initial two-second delay is perhaps in response to User 2 taking the time to consider the path that needs to be taken to complete the task or because of the low level of Blackboard training, needed to assess the user interface (UI) (Yuan, et al., 2013) in order to proceed. This can be particularly daunting for a user that has low training levels for Blackboard as there isn't constant feedback (Andersen, 2015) from the system to assist the user in navigating the LMS.

Step 3 was where there was a substantial discrepancy in the time taken. As with Task 1, User 1 needed to internally evaluate the options presented before committing to a choice. Convention dictates that the process although different in context from task 1 (file upload versus assignment creation) should have less time as the users had already engaged with the system to perform the previous task. This perhaps would have been the case, however, User 1 selected the incorrect option for uploading the file and adding a description. This resulted in User 1 having to backtrack and select the correct option.

It can be assumed that this mistake was done not just because the user had low-level Blackboard training but because the system presented the user with an incorrectly or badly labelled option which skewed the context of what needed to be done. What in all likelihood compounded the situation was the lack of visual or icon representation?

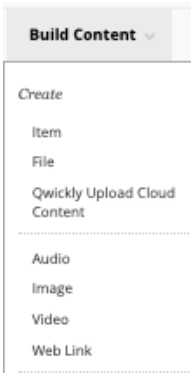


Fig 4.6.2.2: The “Build Content” dropdown

User 1 selected “file” instead of “item” the first time, which made sense as this was a file that needed to be uploaded. The word “item” is vague terminology. This vagueness can affect usability (Hartson, 1998) as it does not adhere to certain principles of HCI design.

To support this observation, the analysis of how users perceive the UX of content uploading in Table 4.3.1.1 And Table 4.3.1.2 (in section 4.3.1: Interaction User Experience: Content upload) illustrates that although a majority of users do not experience difficulty when uploading content, Table 4.3.1.3 (in section 4.3.1: Interaction User Experience: Content upload) shows that more users find interaction with the LMS’s interface to be a negative experience. It can be assumed that although the task is not cognitively taxing for most users, they probably perform it to complete a necessary or mandatory task but don’t necessarily enjoy doing so.

4.6.3 TASK 3

In this task the users were asked to set up a blog. The hardness level of this task is ranked as intermediate as there are different ways to go about setup up the blog. It can be done via (a) the main menu (in Course Tools) where the user has a much more straightforward way of setting up the blog or (b) the user can set up the blog via a specific section of the existing content. This content could be anything from lecturing material, assignments, class tasks, etc.

The second way is more involved as the user would need to navigate the LMS more and this could lead to the user encountering issues, especially if their Blackboard training is considered to be low. The caveat for (a) however is that if the user does not know where the option is to create a blog (via the main menu), then the assigned task becomes more difficult. The reason for this is that the user needs to toggle down the correct menu from the list in order for the blog option to be revealed as shown below in Fig 4.6.3.1

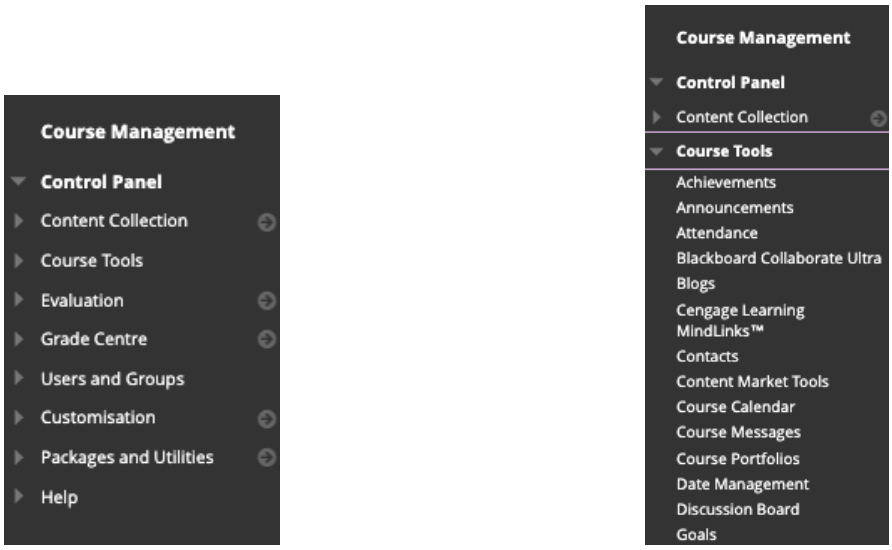


Fig 4.6.3.1: Creating a Blog via the main menu: Toggled up (left) and Toggled down (right)

Table 4.6.3.1: Task 3 time taken by users

User	Task 1	Task level	Time taken	Variance in time
Lola (User 1)	Create a Blog post	Intermediate	52 seconds	**34 seconds**
Peter (User 2)			18 seconds	

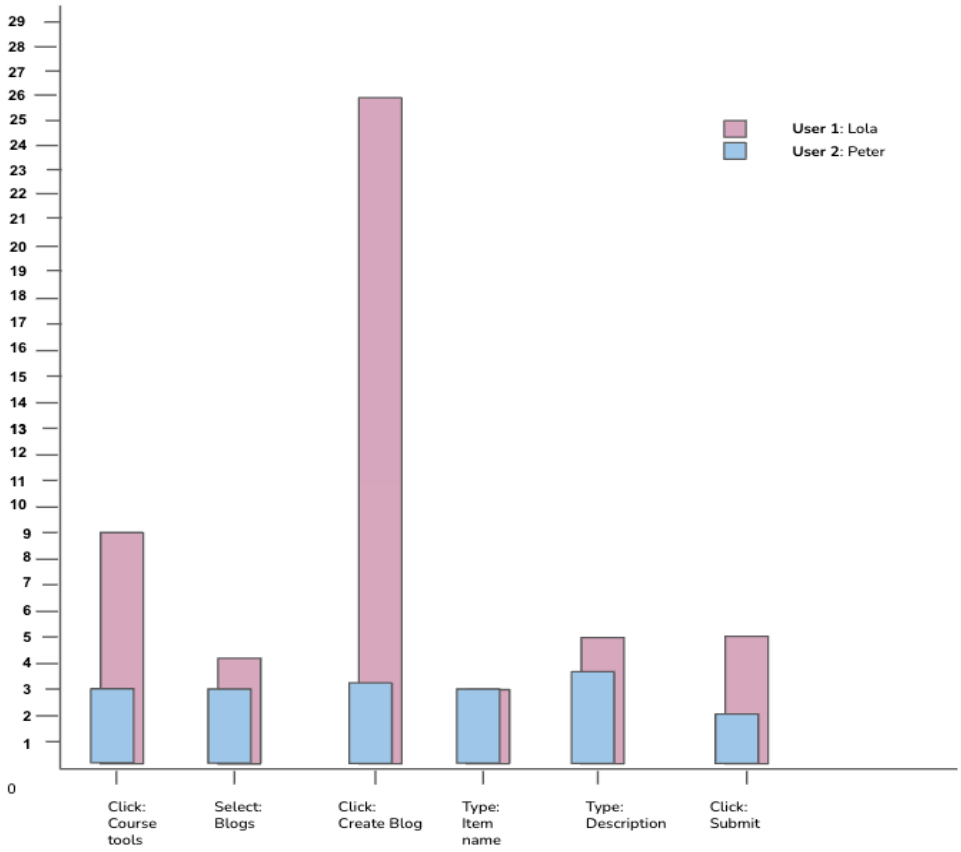


Fig 4.6.3.2: Task 3 time taken by users per step

Results

To complete the task, User 1 opted to go via the main menu. The time variation between User 1 and User 2 was accounted for by the caveat that was mentioned in the introduction of this task. User 1 knew where to go, however, it was unknown to User 1 how to proceed once the initial decision was made to approach the task using the main menu. The haphazard movement of the User's eyes and the cursor on the screen indicated that User 1 was indecisive about which option to choose as Luckin, et al. (2013) state that when an action is performed, it is from cognitive thought.

It took an additional six seconds for User 1 to make a decision. The next major variation in time compared to User 2 was in step 3 which was to create that actual blog post. A whopping 23 seconds was the difference between the users. This difference can be directly attributed to the rather vague visual literacy and user experience of the LMS inside this function.

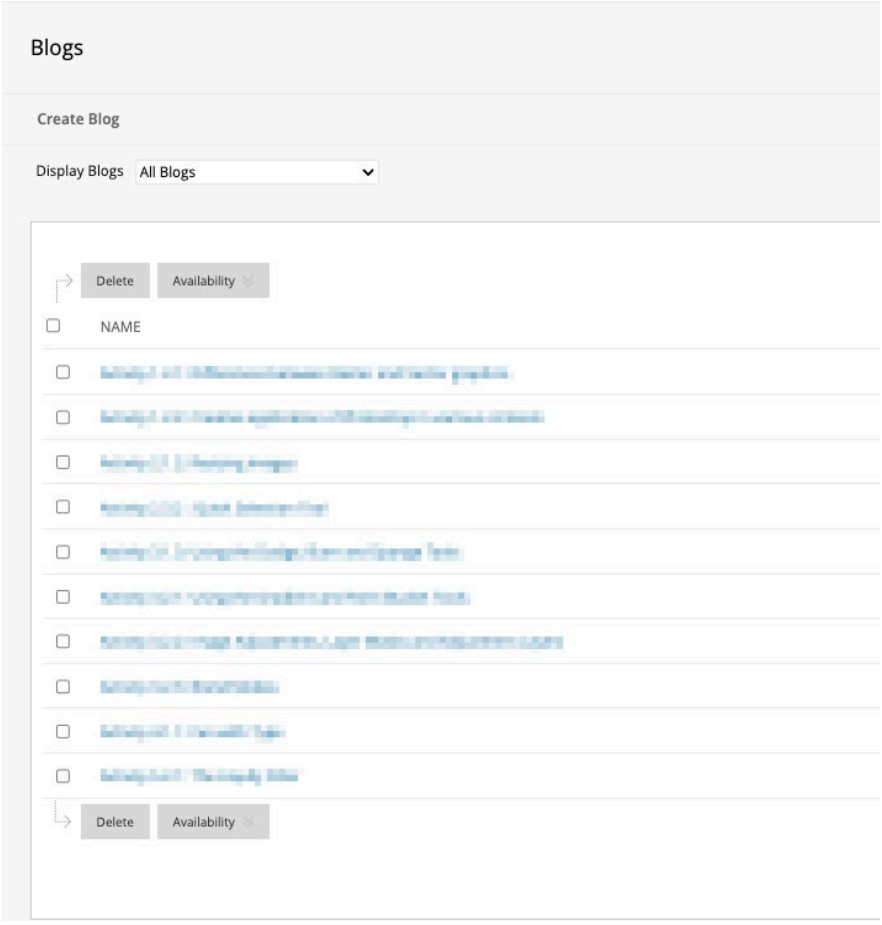


Fig 4.6.3.3: Blog setup screen

In the blog setup screen (Fig 4.6.3.3), substantial visual cues could assist (Haramundanis, 1996) with completing the task.
There is however a misleading visual element that does account for the increase in time taken by User 1. Design principles dictate that our eyes follow “leading lines” (Mochizuki, et al., 2018). This could be anything from a line, to an arrow, and in this case, a combination of the two as shown in Fig 4.6.3.3. When engaging in this screen, User 1’s cursor went directly to the boxes (labelled: Delete and Availability) next to the arrow/line. The main issue with the UX of this screen is that there is a lack of visual hierarchy and guiding feedback. Fig 4.6.3.3 illustrates this issue.

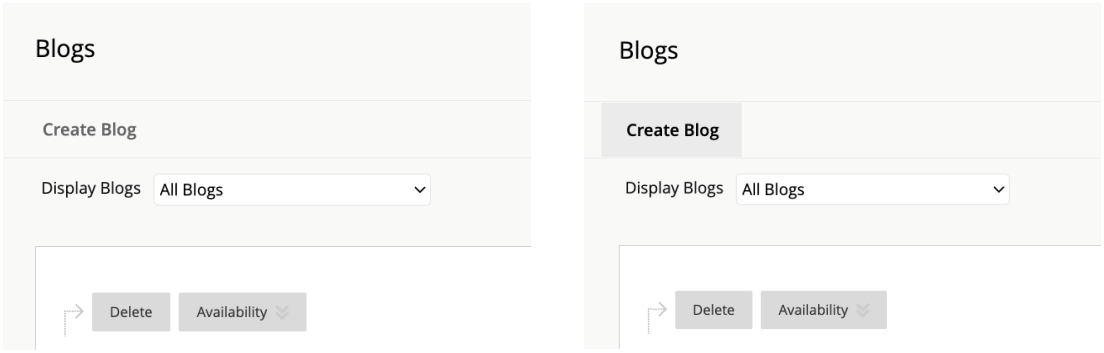


Fig 4.6.3.4: Visual feedback on Blog setup screen

In Fig 4.6.3.4, the image on the left shows a “Create Blog” button. This is not as apparent as is in the image on the right. That is because the image on the right has the feedback activated only when an input device hovers over the word “Create Blog”. Before this input is done by the user, the wording looks to be a heading or subheading. The lack of signifiers which could identify this as an interactive button is one of the issues discussed in the literature concerning interaction design and HCI principles. It, therefore, stands to reason that the variation in time is well founded because even though User 1 had a high level of visual literacy, the lack of visual cues (Nadin, 1988) of the LMS hindered the usage because of the increase in time taken to perform the task. The lack of visual literacy, therefore, influenced the user experience and the usage of the LMS.

4.6.4 TASK 4

For this task, the users were asked to change/edit an existing element from Task 1. The level of difficulty of this task is ranked as easy because the user has already engaged with the task and recall of what was done is the main factor facing both users. This task will showcase how the User Experience and to a very small extent, the visual literacy, is engaged with inside the LMS.

Table 4.6.4.1: Task 4 time taken by users

User	Task 1	Task level	Time taken	Variance in time
Lola (User 1)	Change rubric score of Task 1 to 50	Easy	18 seconds	**5 seconds**
Peter (User 2)			13 seconds	

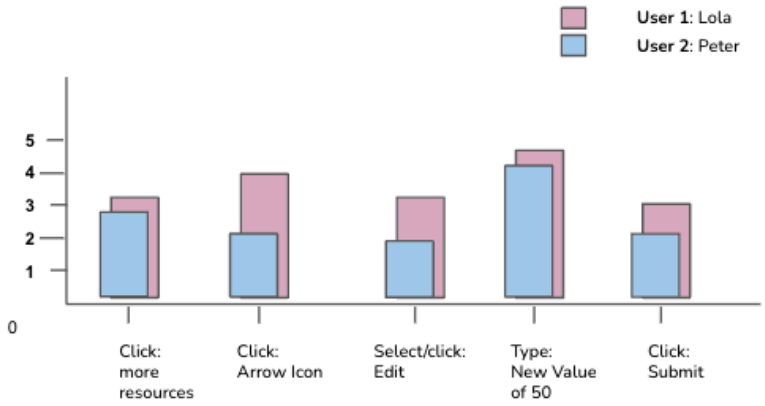


Fig 4.6.4.1: Task 4 time taken by users per step

Results

The data shows that there was a minor difference in the time taken to complete between the users. Although this task was classified as easy, the users still needed to be guided by the User Experience to complete the task. The data in Fig 4.6.4.1 shows that both users were on par with each other through all the necessary steps taken. The most time taken (two seconds) was for step 2 (Click: Arrow Icon) shown in Fig. 4.6.4.2.
The data shows in Fig. 4.6.4.2, that because of the arrow icon, which is a visual literacy device, User 1 was able to navigate successfully to the edit option by clicking it. The extra time taken (in step 2) as observed by the

research accounted for User 1 doing a brief scan to make sure that no other visual or text cues were visible before clicking on the arrow to bring out the options popup box.

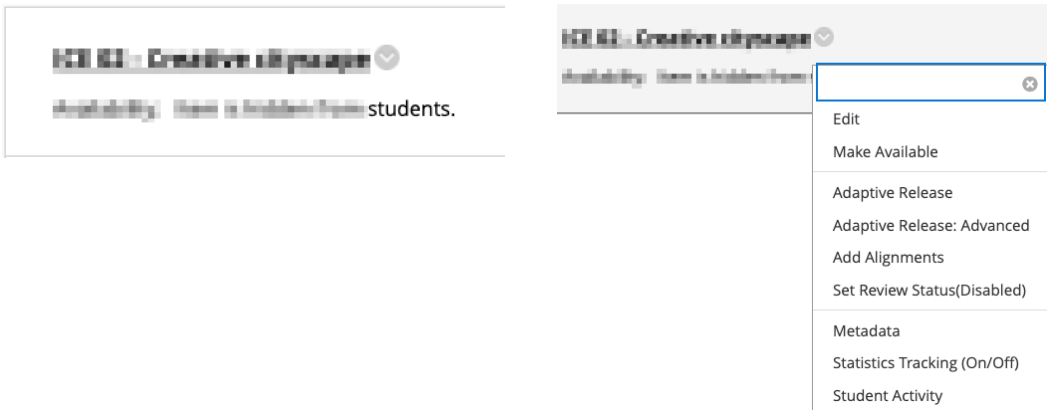


Fig 4.6.4.2: Activating the edit function

In the third step, the variance of one (1) second can be explained by User 1 taking their time to scan all the options in the popup box before selecting the topmost one, namely; Edit. This slight hesitation is probably because of their low level of Blackboard training. Every other step was almost a dead heat. What the data of this task illustrates is that a visual cue can perhaps cause a user to act more definitively when doing tasks regardless of Blackboard skill level.

4.6.5 Summary of Observation Test

This study found that there is a steep learning curve for those with low Blackboard training regardless of the level of visual literacy (VL) skill. Affordances did assist in helping the participants identify what and how they needed to proceed however it is clear by the time variances with certain tasks that the properties of certain LMS visual elements were not overwhelmingly apparent. Having visual literacy knowledge does indeed help, however, if the visual literacy functionality of the LMS itself is lacking, then the users need to rely on the user experience (UX) and the concept of affordance to facilitate usage. For certain processes, Blackboard does not have an overtly substantial icon or symbol presence to assist the user so they would have to rely on previously gained IT and user experience knowledge to complete an intermediate or hard-level task. This is

supported by the difference in time taken by User 1 (Lola) who has low Blackboard training versus User 2 (Peter) who has high Blackboard training. The inclusion of this measurement is inserted for comparison and to avoid any potential bias (Cuschieri, 2019).

Another indicator is the movement of the input device of the different users. Where User 2 was more decisive with a more linear and straightforward input device movement as displayed by the cursor on the screen, User 1 had a more haphazard and irregular input device movement, with many pauses to indicate that decision-making was taking place mid-task. This indecisiveness could have something to do with the fact that Human-computer interactions (HCI) and affordance, which are connected to the user experience, can be subjective (Bertelsen and Pold, 2004) even though the user might be competent in their interpretation of the User Interface (UI).

All tasks assigned in the observation test had a connection to visual literacy and user experience. Whether these constructs (VL and UX) were seen from the user's side or the LMS side, the constructs were shown to be important to be able to complete tasks within the LMS. The differences in time taken to complete certain steps were more apparent when the user had little to no cues, other than text-based ones (Haramundanis, 1996), to assist in navigating the LMS and doing tasks. It showed as well (in task 3: Blog creation) that even when visual literacy elements were included, the user still had difficulty completing the tasks. This is mainly due to VL elements not being used correctly or the LMS not following UX and HCI guidelines. Because these factors were not being implemented to a level that adequately facilitated the completion of tasks, the user's engagement and usage were affected. This in turn leads to the conclusion that VL and UX can influence the usage of an LMS and if the user is a representation of the population, this could lead to reduced adoption because of the challenges faced when engaging with the LMS.

4.7 Conclusion

The main objective of this chapter was to analyse the data collected from the survey and observational user study. From the analysis, it is clear that the LMS has core issues that need addressing regardless of some of the perceived successes and failures of the Blackboard LMS.

There are outright clear positives that have been identified however some contradictions do arise that shape the usage of the LMS in the context of this research. When using TAM and elements of the Collis and Verwijs model as the framework, the analysed data was able to establish motivators and de-motivators which can both attribute to the influence on the usage and adoption of the Blackboard LMS. Through the findings, this study established that the LMS needs to make changes to all three sections that were analysed, namely; interaction and user experience, aesthetics and visual literacy, and functionality. This would be done to increase perception to a more positive leaning of the LMS.

The next section provides a conclusion and suggests recommendations that are based on the findings as to how to improve visual literacy and user experience and by way of the recommendation, have a greater influence on the usage and adoption of the LMS.

CHAPTER 5
Discussions and Recommendations

5.1 Discussion

The outcomes of this research have provided insight into how visual literacy (VL) and user experience (UX) influence the usage and adoption of an LMS. The LMS used for the purposes of this study was Blackboard. The results can be interpreted with optimism as it is believed that value was added to the existing albeit limited existing research. There are still however limitations to this study that should be considered when viewing the research in the context of the overarching literature. Here, a reflection of the research process, the results interpretation and its limitations are discussed. The conclusion of this chapter will put forth recommendations for future research.

This study sought to explore the problem driving this research, in that we did not know how visual literacy (VL) and user experience (UX) influenced the usage and adoption of an LMS at Higher Education Institutions (HEIs). This problem was minimally covered by the existing literature when it came to factors that influenced LMS usage and adoption. The main research question driving this study was;

- "*How do visual literacy and user experience influence the usage and adoption of LMSs in Higher Education Institutions?"*

The results were consolidated from two qualitative data-gathering instruments. The main instrument was an online distributed survey instrument to Lecturers and focused on Interaction (UX), Aesthetics (VL), and Functionality (HCI). The secondary instrument used was an online observational study which focused on VL and UX considerations. The two were done to avoid bias and to provide a stronger correlation between the results. The study demonstrates a correlation between VL and UX and their influence on how users interact with a digital system. The analysis does indeed support the constructs of the TAM framework however the results indicate that the two main foci of this study (VL and UX) do influence the usage of the LMS by showing that usage difficulty ensues when these foci are not fully accommodated by the LMS and its

functionality. The data suggests that the varied population had varying successes in using the LMS, even though their level of VL skills differed. Having VL knowledge did provide some assistance but the VL and aesthetic implementation of the LMS itself was lacking and therefore the usage and adoption were impeded.

What stood out was the clear distinction of usage between users in the observational study with high VL and low Blackboard training and those with low VL and high Blackboard training. The analysis (bar graphs) of the various tasks in the observational study showed the time variances when the users attempted the tasks. The interaction was similar but the quality of the interaction varied greatly, especially when there needed to be some interpretation of the UI. This is relevant because it influences the user experience. Taking a long time to accomplish a task because the interpretation causes a degree of frustration for the user, therefore they (the user) might ascribe a negative perception to the whole LMS engagement and further influence the usage. This supports a claim by McDougall, et al. (2001) that states constructive and positive interaction takes place when the user can navigate the digital environment.
In line with the suggestion that VL and UX have a connection, the analysis shows that when visual cues in the form of icons are present, the user has a much more enriched user experience. This enrichment takes the form of less cognitive load when performing tasks simply because there was a “road map” (Kare, 2011; Lange, 2018) in the form of icons (visual cues). The visual literacy of both the user and the system was therefore highlighted and shown that when it is available, it influences not only the user experience but the usage of the LMS as well.

When the subject of customisation of the LMS was addressed in the findings which is not only an aesthetic function but a consideration of VL. The analysis showed that users needed some form of customisation to have a positive perception of the LMS, which also speaks to their experience as a user. This finding was supported by the fact that the results showed that there was a low ranking of the enabled customisation feature of the Blackboard LMS. This result contradicts the claims of Tractinsky, et al. (2000) that states that aesthetic features are perceived

as independent of function and show that it is not only important for the user from a visual standpoint but from a functional aspect as well.

A section of the analysis that was unanticipated was the users' perception of social media integration. The analysis found that an overwhelming majority were unaware of social media tools/ functions within the LMS. Coming in a distant second was that more users did not use available social media tools. This is quite surprising seeing as how social media is such a prevalent part of users' lives (Amedie, 2015).
The results suggest that users were mainly unaware of the social media tools. However, based on the findings of a study by Braun, et al. (2019), a more feasible explanation is that email was found to be a more common and highly rated tool.

These results build on the existing literature of the TAM (Davis, 1989) theoretical framework by showing that considerations of interaction and UX representing the Perceived Ease of Use (PEoU) construct, are viable and supportive. The finding also shows that the analysed results of the functionality aspects of the study contribute to the construct of TAM that deals with Perceived Usefulness (PU). The study provides new insight into the relationship between how aesthetics and VL can influence UX thereby directly influencing the perceived ease of use of the Blackboard LMS. Park (2009) and Tang and Chen (2011) iterate that this framework is a reliable indicator for predicting the usage of a system, and as the results influence both constructs of TAM, the findings should be considered a viable contribution to the literature.

5.2 Limitations

Although the TAM framework is a useful, reliable and proven indicator of technology usage it is not proficient in taking visual subjectiveness such as aesthetics and VL into consideration. The dimensionality of the model, therefore, needs to be expanded to accommodate these considerations. This was attempted by utilising constructs of the Collis and Verwijs to add nuance to TAM but to be fully integrated, a recommendation of a full theoretical reconstruction of TAM is perhaps needed.

Another issue related to the study was the gathering of data, especially for the observational study. While the two categorical variables of VL and training were used, they were utilised in a limited manner. The study utilised two participants who had high VL but low Blackboard training and low VL but high Blackboard training respectively. A wider dissection of the two variables would have increased the validity of the data captured. If two more participants were added that represented high VL with high Blackboard training and low VL with low Blackboard training respectively, the data gathered would have perhaps provided a larger scope of analysis.

The methodological choice of qualitative was perhaps a constraint in gaining more data on usage. Perhaps if a degree of statistical data was gathered alongside the empirical data and using a mixed method of analysis, the analysis could be strengthened in this regard. The Blackboard LMS has its own statistical reports that can be generated to show, for example, log-in data and interaction data within certain regions of the LMS. This could have assisted with enhancing the validity of the results even further.

5.3 Recommendations for Future Research

I acknowledge that the research is limited to the static visual aesthetic of user interfaces, icons and symbols. A suggestion for future research can therefore explore the multimodality of the user interface. If the design and functionality incorporated higher-level interactive aspects such as animations, that could add depth to the concept of the visual literacy influence from both the user and the LMS. This could also increase the recognition of the visual contained within the LMS as it pertains to the concept of affordances. This affordance concept could also be more thoroughly tested as a gauge to establish how much the UX concept actually impacts the interaction.

A second suggestion is if the research can be repeated with a much larger sample population from different Higher Education Institutions. Although the sample used was enough for the purposes of this study, the broader research would be better served if different Lecturers from different

institutions were sampled. The population included Lecturers from a private academic provider to broaden the scope of the influence of the research problem, a demographic from a more public-orientated academic provider could provide more in-depth data and results.

A third suggestion is that another LMS, other than Blackboard could be tested. Blackboard is a proprietary LMS so therefore if an open-source LMS such as Moodle could be tested, then the data would be more varied. If the research was to be replicated in an open-source LMS, the parameters would be more and comparative analysis could also be done.

A final suggestion is that another demographic other than Lecturers be added to the population sample. As an LMS is not solely for the Lecturers, adding students could prove useful as there would be perhaps a more distinct variation in visual literacy level. Another variation that could be taken into consideration, if students were added is that of user experience. An assumption can be made that if lecturers get training on an institution's LMS before teaching, it stands to reason that the Students would get training as well. It also stands to reason that because Lecturers need the LMS to “do more”, they would be exposed to a higher level of training than the Students. This would already influence both constructs of the TAM model and provide another opportunity for comparative analysis.

Technology is constantly evolving and our ability to continue to interact at the highest possible level is reliant on our ability as users to evolve with it.

REFERENCES

ACRL Visual Literacy Competency Standards for Higher Education. (2022, April 14). Association of College & Research Libraries (ACRL). https://www.ala.org/acrl/standards/visualliteracy

Adikari, S., McDonald, C. and Campbell, J., 2016. Quantitative analysis of desirability in user experience. *arXiv preprint arXiv:1606.03544*.

Alenezi, A., 2018. Barriers to participation in learning management systems in Saudi Arabian universities. *Education Research International*, *2018*(1), p.9085914.

Alhazmi, A.K. and Rahman, A.A., 2012, October. Why LMS failed to support student learning in higher education institutions. In *2012 IEEE symposium on e-learning, e-management and e-services* (pp. 1-5). IEEE.

Al-Samarraie, H., Teo, T. and Abbas, M., 2013. Can structured representation enhance students' thinking skills for better understanding of E-learning content? Computers & Education, 69, pp.463-473.

Al-Aulamie, A., 2013. Enhanced technology acceptance model to explain and predict learners' behavioural intentions in learning management systems.

Ahuja, M.K. and Thatcher, J.B., 2005. Moving beyond intentions and toward the theory of trying: Effects of work environment and gender on post-adoption information technology use. MIS quarterly, pp.427-459.

Ajzen, I., 1991. The theory of planned behavior. Organizational behavior and human decision processes, 50(2), pp.179-211.

Alaofi, S., 2016. How do teachers and students perceive the utility of Blackboard as a distance learning platform? (case study from Taibah University, Saudi Arabia).

Alturki, U. and Aldraiweesh, A., 2021. Application of Learning Management System (LMS) during the covid-19 pandemic: a sustainable acceptance model of the expansion technology approach. Sustainability, 13(19), p.10991.

Altekruse, M.K. and Brew, L., 2000. Using the Web for Distance Learning.

Amedie, J., 2015. The impact of social media on society.
Amedie, J., 2015. The Impact of Social Media on Society. Advanced Writing: Pop Culture Intersections. 2. http://scholarcommons.scu.edu/engl_176/2

Andersen, M., 2015. Evaluating and improving the user-interface of existing GIS-applications by the use of HCI evaluation techniques.

Andersen, P.B., 1997. A theory of computer semiotics: Semiotic approaches to construction and assessment of computer systems (No. 3). Cambridge University Press.

Arts, J.W., Frambach, R.T. and Bijmolt, T.H., 2011. Generalizations on consumer innovation adoption: A meta-analysis on drivers of intention and behavior. *International Journal of Research in Marketing*, *28*(2), pp.134-144.

Association of College & Research Libraries (ACRL). (2011). ACRL visual literacy competency
standards for higher education. Retrieved from
http://www.ala.org/acrl/standards/visualliteracy

Avgerinou, M. and Ericson, J., 1997. A review of the concept of visual literacy. *British journal of educational technology*, *28*(4), pp.280-291.

Avgerinou, M.D. and Pettersson, R., 2011. Toward a cohesive theory of visual literacy. *Journal of visual literacy*, *30*(2), pp.1-19.

Back, D.A., Behringer, F., Haberstroh, N., Ehlers, J.P., Sostmann, K. and Peters, H., 2016. Learning management system and e-learning tools: an experience of medical students' usage and expectations. International journal of medical education, 7, p.267.

Beasley, R.E. and Waugh, M.L., 1995. Cognitive mapping architectures and hypermedia disorientation: An empirical study. *Journal of Educational Multimedia and Hypermedia*, *4*, pp.239-55.

Bebortta, Sujit & Das, Saneev Kumar & Kandpal, Meenakshi & Barik, Dr. Rabindra & Dubey, Harishchandra. (2020). Geospatial Serverless Computing: Architectures, Tools and Future Directions. ISPRS International Journal of Geo-Information. 9. 311. 10.3390/ijgi9050311.

Black, E.W., Beck, D., Dawson, K., Jinks, S. and DiPietro, M., 2007. Considering implementation and use in the adoption of an LMS in online and blended learning environments. *TechTrends*, *51*(2), pp.35-53.

Beatty, N.A., 2013. Cognitive visual literacy: From theories and competencies to pedagogy. *Art Documentation: Journal of the Art Libraries Society of North America*, *32*(1), pp.33-42.

Bingimlas, K.A., 2009. Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, science and technology education*, *5*(3), pp.235-245.

Brill, J.M., Kim, D., & Branch, R.M. (2007). Visual literacy defined-the results of a delphi study: Can IVLA (operationally) define visual literacy. Journal of Visual Literacy, 27, 47–60. doi: 10.1080/23796529.2007.11674645

Bradent, R.A. and Hortinf, J.A., 1982. Identifying the theoretical foundations of visual literacy. *Journal of Visual Verbal Languaging*, *2*(2), pp.37-42.

Bradley, V.M., 2021. Learning Management System (LMS) use with online instruction. International Journal of Technology in Education (IJTE), 4(1), pp.68-92.

Birt, J. (2021, January 22). *15 Types of Questions (With Definitions and Examples)*. indeed.com. https://www.indeed.com/career-advice/career-development/types-of-questions
[Accessed 14 October 2022].

Bouhnik, D. and Marcus, T., 2006. Interaction in distance-learning courses. Journal of the American society for Information Science and technology, 57(3), pp.299-305.

Barreto, D., Rottmann, A, & Rabidoux, S (2020). Types of LMS Deployment & Common Features. In D. Barreto, A Rottmann, & S Rabidoux (Eds.), Learning Management Systems.
EdTech Books. Retrieved from https://edtechbooks.org/learning_management_systems/types_of_lms_deployment
[Accessed 10 September 2022].

Berghoff, B., Cousin, P.T. and Martens, P., 1998. Inquiry about learning and learners: Multiple sign systems and reading. *The Reading Teacher*, *51*(6), pp.520-523.

Bertelsen, O.W. and Pold, S., 2004, October. Criticism as an approach to interface aesthetics. In *Proceedings of the third Nordic conference on Human-computer interaction* (pp. 23-32).

Blanche, M.T., Blanche, M.J.T., Durrheim, K. and Painter, D. eds., 2006. *Research in practice: Applied methods for the social sciences*. Juta and Company Ltd.

Brown, C. & Czerniewicz, L., 2009. Intermediaries and Infrastructure as Agents: The
Mediation of E-learning Policy and use by Institutional Culture. In: Transforming Higher Education Through Technology-enhanced learning. York: The Higher Education Academy, pp. 107-121.

Blackboard Announces "New Learning Experience Platform" to Integrate Services. (2018, December 27). EdSurge. https://www.edsurge.com/news/2016-04-05-blackboard-announces-new-learning-experience-platform-to-integrate-services [Accessed 5 September 2022].

Bol, N., van Weert, J.C., de Haes, H.C., Loos, E.F., de Heer, S., Sikkel, D. and Smets, E.M., 2014. Using cognitive and affective illustrations to enhance older adults' website satisfaction and recall of online cancer-related information. Health communication, 29(7), pp.678-688.

Blandford, A., Furniss, D. and Makri, S., 2016. Qualitative HCI research: Going behind the scenes. Synthesis lectures on human-centered informatics, 9(1), pp.1-115.

Blackboard Learn LMS Review. (2017b, July 13). PCMAG. https://www.pcmag.com/reviews/blackboard-learn-lms [Accessed 24 September 2022].

Bleed, R., 2005. Visual literacy in higher education. Educause Learning Initiative, 1(1), pp.1-11.

Bradley, J. 1993. Methodological issues and practices in qualitative research. The Library Quarterly, 63(4):431-449.

Braun, S., Hernandez Bark, A., Kirchner, A., Stegmann, S. and Van Dick, R., 2019. Emails from the boss—Curse or blessing? Relations between communication channels, leader evaluation, and employees' attitudes. *International Journal of Business Communication*, *56*(1), pp.50-81.

Calp, M.H. and Akcayol, M.A., 2019. The importance of human computer interaction in the development process of software projects. *arXiv preprint arXiv:1902.02757*.

Cantoni, V., Cellario, M. and Porta, M., 2004. Perspectives and challenges in e-learning: towards natural interaction paradigms. *Journal of Visual Languages & Computing*, *15*(5), pp.333-345.

Chamorro Koc, M., Popovic, V. and Emmison, M., 2005. Visual representation of concepts: exploring users' and designers' concepts of everyday products. In *New Design Paradigms: Proceedings of International Design Congress 2005* (pp. 1-10). Organizing Committee of 2005 International Design Congress.

Chesebro, J.W. and Borisoff, D.J., 2007. What makes qualitative research qualitative? Qualitative Research Reports in Communication, 8(1):3-14.

Coates, H., 2007. A model of online and general campus-based student engagement. *Assessment & Evaluation in Higher Education*, *32*(2), pp.121-141.

Cohen, L., Manion, L. and Morrison, K., 2002. *Research methods in education*. Routledge.

Chandler, P. and Sweller, J., 1991. Cognitive load theory and the format of instruction. *Cognition and instruction*, *8*(4), pp.293-332.

Chung, C.H., Pasquini, L.A. and Koh, C.E., 2013. Web-based learning management system considerations for higher education. *Learning and Performance Quarterly*, *1*(4), pp.24-37.

Collis, B. and Verwijs, C., 1995. Evaluating Electronic Performance Support Systems: A Methodology Focused on Future Use-In-Practice. *Innovations in Education and Training International*, *32*(1), pp.23-30.

Coleman, E. and Mtshazi, S., 2017. Factors affecting the use and non-use of Learning Management Systems (LMS) by academic staff. *South African Computer Journal*, *29*(3), pp.31-63.

Considine, D.M., 1986. Visual Literacy and Children's Books: An Integrated Approach. *School Library Journal*, *33*(1), pp.38-42.

Corporate, Government, Healthcare, and Higher Education (pp. 2576-2583). Association for the Advancement of Computing in Education (AACE).

Cowan, K., Spielmann, N., Horn, E. and Griffart, C., 2021. Perception is reality… How digital retail environments influence brand perceptions through presence. *Journal of Business Research*, *123*, pp.86-96.

Creswell, J.W., 2014. Qualitative, quantitative and mixed methods approaches.

Creswell, J.W. and Poth, C.N., 2016. *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.

Cuschieri, S., 2019. The STROBE guidelines. *Saudi journal of anaesthesia*, *13*(Suppl 1), p.S31.

Dahlstrom, E., Brooks, D.C. and Bichsel, J., 2014. The current ecosystem of learning management systems in higher education: Student, faculty, and IT perspectives.

Dake, D.M., 2007. A natural visual mind: The art and science of visual literacy. Journal of Visual Literacy, 27(1), pp.7-28.

Davis, F. D. 1989. “Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology.” MIS Quarterly 13(3): 319–340. doi: 10.1155/2013/591796

DeNeui, D.L. and Dodge, T.L., 2006. Asynchronous learning networks and student outcomes: The utility of online learning components in hybrid courses. *Journal of Instructional Psychology*, *33*(4).

Deng, S., Fang, Y., Liu, Y. and Li, H., 2015. Understanding the Factors Influencing User Experience of Social Question and Answer Services. *Information Research: An International Electronic Journal*, *20*(4), p.n4.

De Saussure, F., 2011. *Course in general linguistics*. Columbia University Press.

De Saussure, F., 1916. Nature of the linguistic sign. *Course in general linguistics*, *1*, pp.65-70.

De Souza, C.S., 2005. The semiotic engineering of human-computer interaction. MIT press.

Derboven, J., De Roeck, D. and Verstraete, M., 2012. Semiotic analysis of multi-touch interface design: The MuTable case study. *International Journal of Human-Computer Studies*, *70*(10), pp.714-728.

Designing with the Mind in Mind. (n.d.). UXmatters. https://www.uxmatters.com/mt/archives/2010/04/designing-with-the-mind-in-mind.php
[Accessed 14 September 2022].

Dickey, M., 2004. The impact of web-logs (blogs) on student perceptions of isolation and alienation in a web-based distance-learning environment. Open Learning: The Journal of Open, Distance and e-Learning, 19(3), pp.279-291.

Doyle, P., 2000. Value-based marketing. Journal of Strategic Marketing, 8(4), pp.299-311.

Duffy, M., 2000. The Internet as a research and dissemination resource. Health promotion international, 15(4), pp.349-353.
Dumais, S. and Chen, H., 2000, July. Hierarchical classification of web content. In *Proceedings of the 23rd annual international ACM SIGIR conference on Research and development in information retrieval* (pp. 256-263).

Dung, P.Q. and Florea, A.M., 2012, May. An approach for detecting learning styles in learning management systems based on learners' behaviours. In International Conference on Education and Management Innovation (Vol. 30, pp. 171-177).

Dutt, A. and Ismail, M.A., 2019, June. Can we predict student learning performance from LMS data? A classification approach. In *3rd International Conference on Current Issues in Education (ICCIE 2018)* (pp. 24-29). Atlantis Press.

Eco, U., 1979. *A theory of semiotics* (Vol. 217). Indiana University Press.

Elliott, R. and Timulak, L., 2005. Descriptive and interpretive approaches to qualitative research. *A handbook of research methods for clinical and health psychology*, *1*(7), pp.147-159.
Ercan, S.A., Hendriks, C.M. and Boswell, J., 2017. Studying public deliberation after the systemic turn: The crucial role for interpretive research. Policy & Politics, 45(2), pp.195-212.

Emanuel, R. and Challons-Lipton, S., 2013. Visual literacy and the digital native: Another look. *Journal of Visual Literacy*, *32*(1), pp.7-26.

Engelbart, D.C., 1962. Augmenting human intellect: A conceptual framework. *Menlo Park, CA*, p.21.

Ervine, M.D., 2016. Visual literacy in instructional design programs. Journal of Visual Literacy, 35(2), pp.104-113.

Evans, J.R. and Mathur, A., 2005. The value of online surveys. *Internet research*.

Fardoun, H.M., Alghazzawi, D.M., López, S.R. and Gallud, J.A., 2012. Proposed model for social and collaborative social network of positive reinforcement. Information Technology: New Generations, ITNG, pp.16-18.

Falvo, D.A. and Johnson, B.F., 2007. The use of learning management systems in the United States. *TechTrends*, *51*(2), p.40.

Felder, R.M. and Silverman, L.K., 1988. Learning and teaching styles in engineering education. Engineering education, 78(7), pp.674-681.

Felten, P., 2008. Visual literacy. *Change: The magazine of higher learning*, *40*(6), pp.60-64.

Fehnert, B. and Kosagowsky, A., 2008, September. Measuring user experience: complementing qualitative and quantitative assessment. In *Proceedings of the 10th international conference on Human computer interaction with mobile devices and services* (pp. 383-386).

Ferrari, A., 2012. Digital competence in practice: An analysis of frameworks. *Sevilla: JRC IPTS*, *10*, p.82116.

Fishbein, M. and Ajzen, I., 1977. Belief, attitude, intention, and behavior: An introduction to theory and research. Philosophy and Rhetoric, 10(2).

Ganotra, K. 2020. https://uxdesign.cc/ui-ux-case-study-apple-music-redesign-46ff1f433363 [Accessed:11 September 2022].

Garrido-Morgado, Á., González-Benito, Ó. and Martos-Partal, M., 2016. Influence of customer quality perception on the effectiveness of commercial stimuli for electronic products. Frontiers in Psychology, 7, p.336.

Garrett, J.J., 2011. The elements of user experience: user-centered design for the web and beyond (voices that matter). *New riders*, *2*.

Gee, J.P., 1991. What is literacy. *Rewriting literacy: Culture and the discourse of the other*, pp.3-11.

Gnambs, T. and Kaspar, K., 2015. Disclosure of sensitive behaviors across self-administered survey modes: a meta-analysis. *Behavior research methods*, *47*(4), pp.1237-1259.

Goldman, S. and McDermott, R., 2014. Staying the course with video analysis. In *Video research in the learning sciences* (pp. 115-128). Routledge.

Graf, S., Viola, S.R., Leo, T. and Kinshuk, 2007. In-depth analysis of the Felder-Silverman learning style dimensions. Journal of Research on Technology in Education, 40(1), pp.79-93.

Graf, S. and Kinshuk, K., 2007, October. Providing adaptive courses in learning management systems with respect to learning styles. In E-Learn: World Conference on E-Learning in

Graf, S., 2007. Adaptivity in learning management systems focussing on learning styles (Doctoral dissertation).

Gatsou, C., Politis, A. and Zevgolis, D., 2011, September. From icons perception to mobile interaction. In *2011 Federated Conference on Computer Science and Information Systems (FedCSIS)* (pp. 705-710). IEEE.

Granić, A. and Ćukušić, M., 2011. Usability testing and expert inspections complemented by educational evaluation: A case study of an e-learning platform. *Journal of Educational Technology & Society*, *14*(2), pp.107-123.

Griffiths, C., 2020. All about the LMS. *Learning Management Systems*.

Gunasinghe, A., Abd Hamid, J., Khatibi, A. and Azam, S.F., 2019. Academicians' acceptance of online learning environments: A review of information system theories and models. *Global Journal of Computer Science and Technology*.

Gunawan, G. and Sulaeman, M., 2020. Determining Factors in the Use of Digital Marketing and Its Effect on Marketing Performance in the Creative Industries in Tasikmalaya. *Budapest International Research and Critics Institute-Journal (BIRCI-Journal)*, *3*(3), pp.2543-2550.

Hallnäs, L., 2011. On the foundations of interaction design aesthetics: Revisiting the notions of form and expression. *International Journal of design*, *5*(1), pp.73-84.

Haramundanis, K., 1996. Why icons cannot stand alone. *ACM SIGDOC Asterisk Journal of Computer Documentation*, *20*(2), pp.1-8.

Harley, A., 2014. Icon usability. *Nielsen Norman Group*.

Harrison, M.B., Graham, I.D., Van Den Hoek, J., Dogherty, E.J., Carley, M.E. and Angus, V., 2013. Guideline adaptation and implementation planning: a prospective observational study. *Implementation science*, *8*(1), pp.1-14.

Hattwig, D., Bussert, K., Medaille, A. and Burgess, J., 2013. Visual literacy standards in higher education: New opportunities for libraries and student learning. *portal: Libraries and the Academy*, *13*(1), pp.61-89.

Hemlin, S. and Gustafsson, M., 1996. Research production in the arts and humanities: A questionnaire study of factors influencing research performance. Scientometrics, 37(3):417-432

Henke, H., 1997. Evaluating web-based instruction design. Retrieved October, 16, p.2002.

Hill, J.R., 2000. Web-Based Instruction: Prospects and Challenges. Educational media and technology yearbook, 25, pp.141-55.

Hinrichsen, J. and Coombs, A., 2013. The five resources of critical digital literacy: a framework for curriculum integration. *Research in Learning Technology*, *21*.

Hoehe, M.R. and Thibaut, F., 2022. Going digital: how technology use may influence human brains and behavior. *Dialogues in Clinical Neuroscience*.

Hollender, N., Hofmann, C., Deneke, M. and Schmitz, B., 2010. Integrating cognitive load theory and concepts of human–computer interaction. *Computers in human behavior*, *26*(6), pp.1278-1288.

Horton, W., 1993. Figures of image: Aristotle and the design of icons and hypermedia. *Technical Communication*, *40*(3), pp.495-500.

Horton, W.K., 1994. The icon book: Visual symbols for computer systems and documentation. John Wiley & Sons, Inc.

Hotrum, M., 2005. 44. Breaking down the LMS walls. International Review of Research in Open and Distributed Learning, 6(1), pp.1-6.

Huang, T., 2014. HCI Evaluation Methods. University of Tasmania.

Hummels, C.C.M., Ross, P.R. and Overbeeke, C.J., 2003, September. In search of resonant human computer interaction: Building and testing aesthetic installations. In Proceedings of the 9th IFIP Conference on Human-Computer Interaction (pp. 399-406).

Ibrahim, R., Leng, N.S., Yusoff, R.C.M., Samy, G.N., Masrom, S. and Rizman, Z.I., 2017. E-learning acceptance based on technology acceptance model (TAM). Journal of Fundamental and Applied Sciences, 9(4S), pp.871-889.

Ioannou, A. and Hannafin, R.D., 2008. Time for users to get what they need. TechTrends, 52(1), p.47.

Is Language Now Meaningless? A Ruling in the Matter of Scalia v. SCOTUScare. (2015, June 25). SlateMagazine.https://slate.com/human-interest/2015/06/scalia-says-words-have-no-meaning-slate-s-supreme-court-of-the-american-lexicon-weighs-in.html
[Accessed 2 October 2022].

International Visual Literacy Association. (n.d.). Retrieved from https://ivla.org/about-us/visual-literacy-defined/ [Accessed 19 September 2022].

Jacoby, J.M., 2017. The impact of an aesthetic online course design template on the learner user experience: a thesis presented in partial fulfilment of the requirements for the degree of

Jacobsen, T., 2010. Beauty and the brain: culture, history and individual differences in aesthetic appreciation. Journal of anatomy, 216(2), pp.184-191.

Jackson, S.L., 2014. Research methods: A modular approach. Cengage Learning.

Jaiswal, P., 2020. Integrating educational technologies to augment learners' academic achievements. International Journal of Emerging Technologies in Learning (IJET), 15(2), pp.145-159.

Johnson, J. (2010, April 5). *Designing with the Mind in Mind*. UXmatters. https://www.uxmatters.com/mt/archives/2010/04/designing-with-the-mind-in-mind.php
[Accessed 17 August 2022].

Jong, D., 2009, December. The acceptance and use of the learning management system. In 2009 Fourth International Conference on Innovative Computing, Information and Control (ICICIC) (pp. 34-37). IEEE.

Kalmyk, I. (2019, September 19). *How does UX design depend on user perception?* uxdesign.cc. https://uxdesign.cc/how-does-ux-design-depend-on-user-perception-2ae6dc60d251
[Accessed 10 August 2022].

Kember, D., McNaught, C., Chong, F.C., Lam, P. and Cheng, K.F., 2010. Understanding the ways in which design features of educational websites impact upon student learning outcomes in blended learning environments. *Computers & Education*, *55*(3), pp.1183-1192.

Kędra, J. and Žakevičiūtė, R., 2019. Visual literacy practices in higher education: what, why and how? *Journal of Visual Literacy*, *38*(1-2), pp.1-7.

Kedrova, G. and Potemkin, S., 2015, October. New trends in implementation of ICT in higher education. In *2015 9th International Conference on Application of Information and Communication Technologies (AICT)* (pp. 531-535). IEEE.

Keefe, E.B. and Copeland, S.R., 2011. What is literacy? The power of a definition. *Research and practice for persons with severe disabilities*, *36*(3-4), pp.92-99.

Kellogg, W.A., 1989. The dimensions of consistency. *Coordinating user interfaces for consistency*, pp.9-20.

Kim, H. and Hirtle, S.C., 1995. Spatial metaphors and disorientation in hypertext browsing. *Behaviour & information technology*, *14*(4), pp.239-250.

Koehler, M.J. and Mishra, P., 2005. What happens when teachers design educational technology? The development of technological pedagogical content knowledge. Journal of educational computing research, 32(2), pp.131-152.

Kasim, N.N.M. and Khalid, F., 2016. Choosing the right learning management system (LMS) for the higher education institution context: A systematic review. International Journal of Emerging Technologies in Learning, 11(6).

Kohl, A.T. (2010). The pedagogical and research value of images and locally managed image collections: Library, visual resources, and faculty perspectives. Visual Resources Association Bulletin,
37, 51–57.

Koul, S. and Eydgahi, A., 2017. A systematic review of technology adoption frameworks and their applications. *Journal of technology management & innovation*, *12*(4), pp.106-113.

Khor, E.T., 2014. An analysis of ODL student perception and adoption behavior using the technology acceptance model. International Review of Research in Open and Distributed Learning, 15(6), pp.275-288.

Kolko, J. (2020, May 27). *Introducing the Blackboard Learn Ultra experience*. Blackboard Blog. https://blog.blackboard.com/introducing-the-learn-ultra-experience-2/ [Accessed 10 September 2022].

Kulshrestha T, Kant AR. Benefits of learning management system (LMS) in Indian education. International Journal of Computer Science & Engineering Technology (IJCSET). 2013 Aug;4(8):1153-4.

Ken Research. 2019. South Africa E-Learning Market Outlook to 2023 - By Content (OpenCourseware, Customized Multimedia, Simulation Content and Online Test), By Technology (Learning Management System, Smart Classes, Smart Authoring Tools) By Sector (Corporate, Higher Education, K-12 and Vocational training) and By End users (Corporate Enterprise, Home users, Non-profit Organizations and Government). [online] Available at: https://www.kenresearch.com/education-and-recruitment/education/south-africa-elearning-market/195626-99.html [Accessed 24 September 2022].

Kiel, J. M. 1999. Reshaping Maslow's Hierarchy of Needs to Reflect Today's Educational and Managerial Philosophies. Journal of Instructional Psychology. 26(3): 167-185, 1999.

Ko, S. and Rossen, S., 2017. Teaching online: A practical guide. Routledge.

Justas (2016) 'Best stormtrooper icons and illustrations,' Icon Utopia, 11 June. https://iconutopia.com/best-stormtrooper-icons-and-illustrations/

Labib, A.E., Canós, J.H. and Penadés, M.C., 2017. On the way to learning style models integration: a Learner's Characteristics Ontology. Computers in Human Behavior, 73, pp.433-445.

Lange, A. (2018, April 19). The Woman Who Gave the Macintosh a Smile. The New Yorker. https://www.newyorker.com/culture/cultural-comment/the-woman-who-gave-the-macintosh-a-smile

Lavie, T. and Tractinsky, N., 2004. Assessing dimensions of perceived visual aesthetics of web sites. *International journal of human-computer studies*, *60*(3), pp.269-298.

Lazar, J., Feng, J.H. and Hochheiser, H., 2017. Research methods in human-computer interaction. Morgan Kaufmann.

learning management system (LMS). (2019, December 30). SearchCIO. https://www.techtarget.com/searchcio/definition/learning-management-system

Lemon, K.N. and Nowlis, S.M., 2002. Developing synergies between promotions and brands in different price-quality tiers. Journal of Marketing Research, 39(2), pp.171-185.

Leder, H., Belke, B., Oeberst, A. and Augustin, D., 2004. A model of aesthetic appreciation and aesthetic judgments. *British journal of psychology*, *95*(4), pp.489-508.

Levialdi, S., Mussio, P., Protti, M. and Tosoni, L., 1993, August. Reflections on icons. In *Proceedings 1993 IEEE Symposium on Visual Languages* (pp. 249-254). IEEE.

Li, Y.B. and Perkins, A., 2007. The impact of technological developments on the daily life of the elderly. *Technology in society*, *29*(3), pp.361-368.

Liaw, S.S., 2008. Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system. Computers & education, 51(2), pp.864-873.

Lidwell, W., Holden, K. and Butler, J., 2010. *Universal principles of design, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design*. Rockport Pub.

Lin, R., 1994. A study of visual features for icon design. *Design studies*, *15*(2), pp.185-197.

Lonn, S. and Teasley, S.D., 2009. Saving time or innovating practice: Investigating perceptions and uses of Learning Management Systems. *Computers & education*, *53*(3), pp.686-694.

Luckin, R., Puntambekar, S., Goodyear, P., Grabowski, B.L., Underwood, J. and Winters, N., 2013. Insight into Teaching and Learning: The Complex Face of Video Research. In *Handbook of Design in Educational Technology* (pp. 451-459). Routledge.

Maclean, R., Jagannathan, S. and Sarvi, J. eds., 2012. Skills development for inclusive and sustainable growth in developing Asia-Pacific. Springer

McDougall, S.J., Curry, M.B. and De Bruijn, O., 2001. The effects of visual information on users' mental models: An evaluation of Pathfinder analysis as a measure of icon usability. *International journal of cognitive ergonomics*, *5*(1), pp.59-84.

Martin, A.J., Nejad, H.G., Colmar, S. and Liem, G.A.D., 2013. Adaptability: How students' responses to uncertainty and novelty predict their academic and non-academic outcomes. Journal of Educational Psychology, 105(3), p.728.

Malikowski, S.R., Thompson, M.E. and Theis, J.G., 2007. A model for research into course management systems: Bridging technology and learning theory. *Journal of educational computing research*, *36*(2), pp.149-173.

Malone, T.W., 1982, March. Heuristics for designing enjoyable user interfaces: Lessons from computer games. In *Proceedings of the 1982 conference on Human factors in computing systems* (pp. 63-68).

Maggiori, C., Johnston, C.S., Krings, F., Massoudi, K. and Rossier, J., 2013. The role of career adaptability and work conditions on general and professional well-being. Journal of Vocational Behavior, 83(3), pp.437-449.

Marcelo, C., Yot, C. and Mayor, C., 2015. Teaching with digital technologies at the University= University Teaching with Digital Technologies. *Teaching with digital technologies at the University= University Teaching with Digital Technologies* , pp.117-132.

Messaris, P., 1996. Visual “Literacy”: Image, Minds, and Reality.

Messaris, P., 1993. Visual “literacy”: A theoretical synthesis. *Communication Theory*, *3*(4), pp.277-294.

Mashhadi, V.Z. and Kargozari, M.R., 2011. Influences of digital classrooms on education. Procedia Computer Science, 3, pp.1178-1183.

Master of Education at Massey University, Manawatu, New Zealand (Doctoral dissertation, Massey University).

Matusiak, K.K., Heinbach, C., Harper, A. and Bovee, M., 2019. Visual literacy in practice: Use of images in students’ academic work. *College & Research Libraries*, *80*(1), p.123.

Maxwell, J.A., 2008. *Designing a qualitative study* (Vol. 2, pp. 214-253). The SAGE handbook of applied social research methods.

McArthur, D., Parker, A. and Giersch, S., 2003. Why plan for e-learning? Planning for Higher Education, 31(4), pp.20-28.

McCarthy, J. and Wright, P., 2004. Technology as experience. *interactions*, *11*(5), pp.42-43.

McCombes, S. (2022, October 10). *Sampling Methods | Types, Techniques & Examples*. Scribbr. https://www.scribbr.com/methodology/sampling-methods/

McManus, T., 1995. Special considerations for designing Internet based instruction. In Society for Information Technology & Teacher Education International Conference (pp. 715-718). Association for the Advancement of Computing in Education (AACE).

Meenakumari J, Boby Antony, Vinay M, Measuring the Usage of LMS in Higher Education Institutions: An Analysis, International Journal of Advanced Computational Engineering and Networking, Vol-1, Issue-2, 2013.

Metros, S.E. and Woolsey, K., 2006. Visual literacy: An institutional imperative. *Educause review*, *41*(3), pp.80-81.

Mercader, C. and Gairín, J., 2020. University teachers' perception of barriers to the use of digital technologies: the importance of the academic discipline. *International Journal of Educational Technology in Higher Education*, *17*(1), pp.1-14.

Mercader, C. and Sallán, J.G., 2017. ¿ Cómo utiliza el profesorado universitario las tecnologías digitales en sus aulas? *REDU. Revista de Docencia Universitaria*, *15*(2), pp.257-274.

Mlitwa, N., 2006. e-Learning and learning management systems (LMS) in a changing higher education environment. In 36th Annual Conference of the Southern African Computer Lecturers Association: Electronic Conference Proceedings on CD-ROM.

Mirnig, A.G., Meschtscherjakov, A., Wurhofer, D., Meneweger, T. and Tscheligi, M., 2015, April. A formal analysis of the ISO 9241-210 definition of user experience. In *Proceedings of the 33rd annual ACM conference extended abstracts on human factors in computing systems* (pp. 437-450).

Mochizuki, I., Toyoura, M. and Mao, X., 2018. Visual attention prediction for images with leading line structure. *The Visual Computer*, *34*(6), pp.1031-1041.

Molnar, F., 1981. About the role of visual exploration in aesthetics. In *Advances in intrinsic motivation and aesthetics* (pp. 385-413). Springer, Boston, MA.

Moshagen, M. and Thielsch, M.T., 2010. Facets of visual aesthetics. *International journal of human-computer studies*, *68*(10), pp.689-709.

Mutuku, M.K., 2020. A Meta-Analysis of User Perception and Use of Online Digital Platforms in Kenya: Evidence from E-citizen Platform, Kenya. *INTERNATIONAL JOURNAL OF MANAGEMENT &Amp*, pp.35-42.

Mun, Y.Y., Jackson, J.D., Park, J.S. and Probst, J.C., 2006. Understanding information technology acceptance by individual professionals: Toward an integrative view. *Information & management*, *43*(3), pp.350-363.

Muraven, M. and Baumeister, R.F., 2000. Self-regulation and depletion of limited resources: Does self-control resemble a muscle? Psychological bulletin, 126(2), p.247.

Nadin, M., 1988. Interface design: A semiotic paradigm.

Nurakun Kyzy, Z., Ismailova, R. and Dündar, H., 2018. Learning management system implementation: a case study in the Kyrgyz Republic. Interactive Learning Environments, 26(8), pp.1010-1022.

Niess, M.L., 2005. Preparing teachers to teach science and mathematics with technology: Developing a technology pedagogical content knowledge. Teaching and teacher education, 21(5), pp.509-523.

Noruzi, M.R. and Hernandez, J.G.V., 2011. Critical thinking in the workplace: characteristics, and some assessment tests. *International Proceedings of Economics Development and Research*, *12*, pp.19-20.

Norman, D.A., 2013. The Design of Everyday Things, revised and expanded edition ed. *BB (AZ)*.

Olson, J.C., 1978. Inferential belief formation in the cue utilization process. ACR North American Advances.

O'Neill, S., 2008. *Interactive media: The semiotics of embodied interaction*. Springer Science & Business Media.

Orbell, S., Hodgkins, S. and Sheeran, P., 1997. Implementation intentions and the theory of planned behavior. *Personality and social psychology bulletin*, *23*(9), pp.945-954.

Queirós, R., Leal, J.P. and Paiva, J.C., 2016. Integrating rich learning applications in LMS. In *State-of-the-art and future directions of smart learning* (pp. 381-386). Springer, Singapore.

Park, S.Y., 2009. An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. Journal of Educational Technology & Society, 12(3), pp.150-162.

Patil, M.S., Desai, P., Vijayalakshmi, M., Raikar, M.M., Battur, S., Parikshit, H. and Joshi, G.H., 2016, December. UX design to promote undergraduate projects to products: case study. In 2016 IEEE 4th International Conference on MOOCs, Innovation and Technology in Education (MITE) (pp. 302-307). IEEE.

Paul, S. and Lal, K., 2018. Adoption of digital technologies in tertiary education: Evidence from India. Journal of Educational Technology Systems, 47(1), pp.128-147.

Perry, K.H., 2012. What Is Literacy? A Critical Overview of Sociocultural Perspectives. *Journal of Language and Literacy Education*, *8*(1), pp.50-71.

Popescu, E., 2009. Diagnosing students' learning style in an educational hypermedia system. Cognitive and emotional processes in Web-based education: Integrating human factors and personalization, pp.187-208.

Patton, M.Q., 1990. *Qualitative evaluation and research methods*. SAGE Publications, inc.

Pettersson, R. (2007). Visual literacy in message design. Journal of Visual Literacy, 27, 61–90. doi:10.1080/23796529.2007.11674646

Petersen, M.G., Iversen, O.S., Krogh, P.G. and Ludvigsen, M., 2004, August. Aesthetic interaction: a pragmatist's aesthetics of interactive systems. In *Proceedings of the 5th conference on Designing interactive systems: processes, practices, methods, and techniques* (pp. 269-276).

Reimer, J., 2005. A History of the GUI. *Ars Technica*, *5*, pp.1-17.

Resnick, M., 2002. Rethinking learning in the digital age.

Resnick, M., Myers, B., Nakakoji, K., Shneiderman, B., Pausch, R., Selker, T. and Eisenberg, M., 2005. Design principles for tools to support creative thinking.

Ritchie, D.C. and Hoffman, B., 1996. Using instructional design principles to amplify learning on the World Wide Web. In Society for Information Technology & Teacher Education International Conference (pp. 845-847). Association for the Advancement of Computing in Education (AACE).

Rogers, Y., HCI Theory: Classical, Modern, and Contemporary (Synthesis Lectures on Human-Centered Informatics). *Morgan & Claypool Publishers*, *1*.

Rodden, T., Cheverst, K., Davies, K. and Dix, A., 1998, May. Exploiting context in HCI design for mobile systems. In *Workshop on human computer interaction with mobile devices* (Vol. 12).

Rosario, A.M.F.T. and Cruz, R.N., 2019. Determinants of innovation in digital marketing. *Journal of Reviews on Global Economics*, *8*(1), pp.1722-1731.

Ruhleder, K. and Jordan, B., 1997. Capturing complex, distributed activities: Video-based interaction analysis as a component of workplace ethnography. In *Information systems and qualitative research* (pp. 246-275). Springer, Boston, MA.

Sarkar, S., 2012. The role of information and communication technology (ICT) in higher education for the 21st century. Science, 1(1), pp.30-41.

Sampson, H., 2004. Navigating the waves: the usefulness of a pilot in qualitative research. *Qualitative research*, *4*(3), pp.383-402.

Sayre, S., 2001. *Qualitative methods for marketplace research* (Vol. 84). Thousand Oaks, CA: Sage.

Schoen, M.J., 2014. Teaching visual literacy skills in a one-shot session. *Visual Resources Association Bulletin*, *41*(1).

Schoonenboom, J., 2014. Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Computers & Education*, *71*, pp.247-256.

Sclater, N., 2008. Web 2.0, personal learning environments, and the future of learning management systems. *Research bulletin*, *13*(13), pp.1-13.

Siddiqui, A.T. and Masud, M., 2012. An e-learning system for quality education. International Journal of Computer Science Issues (IJCSI), 9(4), p.375.

Silvennoinen, J.M. and Jokinen, J.P., 2016, May. Aesthetic appeal and visual usability in four icon design eras. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 4390-4400).

Shahid, S., ter Voort, J., Somers, M. and Mansour, I., 2016, September. Skeuomorphic, flat or material design: requirements for designing mobile planning applications for students with autism spectrum disorder. In *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct* (pp. 738-745).

Shin, W.S. and Kang, M., 2015. The use of a mobile learning management system at an online university and its effect on learning satisfaction and achievement. International Review of Research in Open and Distributed Learning, 16(3), pp.110-130.

Spalter, A.M. and Van Dam, A., 2008. Digital visual literacy. *Theory into practice*, *47*(2), pp.93-101.

Sparks, P. and Shepherd, R., 1992. Self-identity and the theory of planned behavior: Assesing the role of identification with" green consumerism". *Social psychology quarterly*, pp.388-399.

Stappers, PJ & Giaccardi, E 2017, Research through Design. in M Soegaard & R Friis-Dam (eds), The Encyclopedia of Human-Computer Interaction. 2nd edn, The Interaction Design Foundation, pp. 1-94.

Straub, E.T., 2009. Understanding technology adoption: Theory and future directions for informal learning. *Review of educational research*, *79*(2), pp.625-649.

Streefkerk, R. (2022, October 10). *Inductive vs. Deductive Research Approach (with Examples)*. Scribbr. https://www.scribbr.com/methodology/inductive-deductive-reasoning/

Tang, D. and Chen, L., 2011. A review of the evolution of research on information Technology
Acceptance Model. In 2011 International Conference on Business Management and Electronic
Information (BMEI). Guangzhou, China 13-15 May 2011, 588-591. Washington DC: IEEE
Computer Society.

Taylor, S. and Todd, P., 1995. Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intentions. *International journal of research in marketing*, *12*(2), pp.137-155.

Tella, A., 2011. Reliability and factor analysis of a blackboard course management system
success: A scale development and validation in an educational context. *Journal of Information Technology Education: Research*, *10*(1), pp.55-80.

Teo, T., 2009. Modelling technology acceptance in education: A study of pre-service teachers. Computers & Education, 52(2), pp.302-312.

Teo, T. and Noyes, J., 2011. An assessment of the influence of perceived enjoyment and attitude on the intention to use technology among pre-service teachers: A structural equation modeling approach. *Computers & education*, *57*(2), pp.1645-1653.

Thurmond, V.A., 2001. The point of triangulation. *Journal of nursing scholarship*, *33*(3), pp.253-258.

Tillmann, A., 2012. What we see and why it matters: How competency in visual literacy can enhance student learning.

Ting, J., Jing, Y. and Jianbo, X., 2018, June. The Application of Multi-perception User Experience in Emotional Design Characteristic Parameter Models. In 2018 International Conference on Smart Grid and Electrical Automation (ICSGEA) (pp. 424-427). IEEE.

The Four Types of Digital users. (2018b, December 3). CallVU. https://callvu.com/blog/four-types-digital-users/

The 7 Factors that Influence User Experience. (2021, January 12). The Interaction Design Foundation. https://www.interaction-design.org/literature/article/the-7-factors-that-influence-user-experience

Tractinsky, N., Katz, A.S. and Ikar, D., 2000. What is beautiful is usable. *Interacting with computers*, *13*(2), pp.127-145.

Tseng, A.H. and Hsia, J.W., 2008, September. The impact of internal locus of control on perceived usefulness and perceived ease of use in e-learning: An extension of the technology acceptance model. In *2008 International Conference on Cyberworlds* (pp. 815-819). IEEE.

Turnbull, D., Chugh, R. and Luck, J., 2021. Issues in learning management systems implementation: A comparison of research perspectives between Australia and China. *Education and Information Technologies*, *26*(4), pp.3789-3810.

Van Laar, E., Van Deursen, A.J., Van Dijk, J.A. and De Haan, J., 2017. The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in human behavior*, *72*, pp.577-588.

Van Merrienboer, J.J. and Sweller, J., 2005. Cognitive load theory and complex learning: Recent developments and future directions. *Educational psychology review*, *17*(2), pp.147-177.

Venkatesh, V. and Davis, F.D., 1996. A model of the antecedents of perceived ease of use: Development and test. Decision sciences, 27(3), pp.451-481.

Venter, P., van Rensburg, M.J. and Davis, A., 2012. Drivers of learning management system use in a South African open and distance learning institution. *Australasian Journal of Educational Technology*, *28*(2).

Volery, T., 2001. Online education: An exploratory study into success factors. Journal of educational computing research, 24(1), pp.77-92.

Vovides, Y., Sanchez-Alonso, S., Mitropoulou, V. and Nickmans, G., 2007. The use of e-learning course management systems to support learning strategies and to improve self-regulated learning. Educational Research Review, 2(1), pp.64-74.

Vygotsky, L.S. and Cole, M., 1978. *Mind in society: Development of higher psychological processes*. Harvard university press.

Vrasidas, C., 2004, March. Issues of pedagogy and design in e-learning systems. In Proceedings of the 2004 ACM symposium on Applied computing (pp. 911-915).

Wahdain, E.A., Ahmad, M.N. and Zakaria, N.H., 2014. Using TAM to study the user acceptance of IT in the Yemeni public sector. *International Journal of Computer and Communication Engineering*, *3*(3), pp.160-165.

West, R.E., Waddoups, G. and Graham, C.R., 2007. Understanding the experiences of instructors as they adopt a course management system. *Educational Technology Research and Development*, *55*(1), pp.1-26.

Westerman, B., 2008. How do people really use the iPhone. *Presentation slides published in*.

Winograd, T., 1997. From computing machinery to interaction design. *New York*.

Yousafzai, S.Y., Foxall, G.R. and Pallister, J.G., 2007. Technology acceptance: a meta-analysis of the TAM: Part 2. *Journal of Modelling in Management*.

Yuan, M.J., Finley, G.M., Long, J., Mills, C. and Johnson, R.K., 2013. Evaluation of user interface and workflow design of a bedside nursing clinical decision support system. *Interactive journal of medical research*, *2*(1), p.e2402.

Zimmer, L., 2007. How viable is virtual commerce. Businesses that understand the potential of Second Life are finding real-world commercial opportunities in the virtual space.

Zhou, M. and Lin, W., 2016. Adaptability and life satisfaction: The moderating role of social support. Frontiers in psychology, 7, p.113

APPENDICES

APPENDIX A: Survey (Google Form)

Survey for Masters research

This survey is to gather information on how you as a User, interacts with the LMS. There are 4 sections to the survey:

(A) Interaction/ User experience,
(B) Functionality,
(C) Visual aesthetics/ Visual literacy and
(D) General information

The Ethics of the study was approved by:

1. The Faculty of Business and Management Sciences of CPUT
2. The research and postgraduate studies policy of a Private Academic Provider

SECTION A: Interaction & User Experience

This section focuses on how & when you engage with the LMS

1. How often do you engage with your LMS?

Mark only one oval.

- Everyday
- Only when needed

2. Do you use the institution LMS for:

Check all that apply.

- [ ] Uploading content
- [ ] Grading
- [ ] Communication with students

3. Indicate your level of experience with the LMS: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Level of experience					

4. How would you rate your interaction with the following: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Grade Centre					

5. How would you rate your interaction with the following: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Uploading content					

6. How would you rate your interaction with the following: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Using the retention centre					

7. How would you rate your interaction with the following: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Generating the various reports from the LMS					

8. How would you rate your interaction with the following: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Student communication: Announcements					

9. How would you rate your interaction with the following: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Student communication: Email					

10. Do you access the LMS more on:

Mark only one oval.

- Desktop
- Laptop
- Mobile device (phone/tablet)

11. Do you think training is needed before engaging with the LMS?

Mark only one oval.

- Yes
- No

12. If above answer was yes, where should the training come from?

Mark only one oval.

- Your institution
- LinkedIn
- YouTube

13. Do you ever experience frustrations with navigation functionality of the LMS

Mark only one oval.

- Yes
- No

14. How often do you experience these frustrations?

Mark only one oval.

- Every log in
- Sometimes
- Rarely

15. Rate how much this interaction function frustrates you: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
LMS and course Navigation					

16. Rate how much this interaction function frustrates you: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Grade Centre Navigation					

17. Rate how much this interaction function frustrates you: 0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Content uploading Navigation					

18. Do you feel the LMS has many bugs that need fixing?

Mark only one oval.

- Yes
- No

19. How often should the LMS be reviewed for bugs?

Mark only one oval.

- Weekly
- Monthly

20. Do you consider the LMS's interface to be a good user experience?

Mark only one oval.

- Yes
- No
- Doesn't matter

21. Do you feel the LMS is more beneficial for the Lecturer or Student?

Mark only one oval.

- Lecturer
- Student

SECTION B: Functionality

This section is about how your usage is affected by the functions the LMS provides

22. How would you rate:
0= Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Your knowledge in operating the LMS					

23. Does the LMS assist with your ability to teach?

Mark only one oval.

- Yes
- No

24. How would you therefore rate: 0=
Very Low to 4=Very High

Mark only one oval.

	0	1	2	3	4
Your ability to teach using the LMS					

25. Does the LMS have Social Media functions?

Mark only one oval.

- Yes
- No

26. Which social media platform does the LMS need?

Check all that apply.

- [ ] Instagram
- [ ] Twitter
- [ ] Facebook
- [ ] YouTube
- [ ] Pinterest
- [ ]

27. Do you think the LMS has good authoring tool?

Mark only one oval.

- Yes
- No
- Unsure

28. How would you rate the following:
0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
Graphical and video implementation					

29. How would you rate the following in the LMS: 0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
Assessment creation					

30. How would you rate the following in the LMS: 0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
Gamification usage					

31. Does the LMS have good accessibility features?

Mark only one oval.

- Yes
- No
- Not sure

32. Do you make use of the accessibility features?

Mark only one oval.

- Yes
- No

33. How would you rate the following accessibility features: 0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
High contrast settings					

34. How would you rate the following accessibility features: 0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
Alternate text and Captioning					

35. Is the Live-Learning collaboration feature effective?

Mark only one oval.

- Yes
- No
- Needs more functions

36. Is the LMS effective at communicating when new content is available?

Mark only one oval.

- Yes
- No

37. Have you used different LMSs?

Mark only one oval.

- Yes
- No

38. Are the other LMSs superior to the one you currently use?

Mark only one oval.

- Yes
- No

39. How would you rate the following:
0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
Overall functionality					

40. How would you rate the following:
0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
Online Collaboration					

SECTION C: Visual Aesthetics & Visual Literacy

This section focuses on the look and feel of the LMS

41. How would you rate the importance of following: 0=Very low and 4= Very high

Mark only one oval.

	0	1	2	3	4
Visual Aesthetics					

42. Rate your visual aesthetic awareness
(ie. ability to evaluate the appearance of elements) 0=Very low and 4= Very high

Mark only one oval.

0	1	2	3	4
◯	◯	◯	◯	◯

43. Does the LMS have good visual customisation features

Mark only one oval.

- ◯ Yes
- ◯ No

44. Is the Main navigation positioned well inside the LMS?

Mark only one oval.

- ◯ Yes
- ◯ No

45. Does the Main navigation contain too many or too few link options?

Mark only one oval.

- ◯ Too many
- ◯ Too few
- ◯ Just right

46. Are the icons used in the Main navigation a good representation of the options

Mark only one oval.

- Yes
- No

47. Are icons needed as part of the Main navigation

Mark only one oval.

- Yes
- No

48. Is the default colour scheme nice to look at?

Mark only one oval.

- Yes
- No

49. Is visual customisation important to you?

Mark only one oval.

- Yes
- No

50. Is a mobile version important to you?

Mark only one oval.

- Yes
- No

51. Is the mobile version of the LMS nice to look at?

Mark only one oval.

- Yes
- No

52. Prefer to use: Mobile or desktop version?

Mark only one oval.

- Mobile
- Desktop

53. Does the icon design of the LMS...

Mark only one oval.

- Need refinement
- Redesign
- is good as is

54. Does the LMS need more or less icon usage?

Mark only one oval.

- More
- Less
- Just right

55. Does the navigation items need animation?

Mark only one oval.

- Yes
- No

56. Should the animation be subtle or dazzling?

Mark only one oval.

- Subtle
- Dazzling

57. Is animation important for interactivity?

Mark only one oval.

- Yes
- No

58. Are the LMSs system prompts effective? (system warnings or interaction warnings)

Mark only one oval.

- Yes
- No

59. Do the overall visuals feel outdated

Mark only one oval.

- Yes
- No

SECTION D: Demographic information

This is used to analyse the data provided above in context

60. Gender

Mark only one oval.

- Male
- Female
- Non-binary
- Prefer not to say

61. Age

Mark only one oval.

- 19-30
- 31-40
- 41-50
- 51-60
- 60+

62. Field of lecturing

Mark only one oval.

Design (web & mobile development)

Design (graphic design)

IT (development)

Law

Economics

Accounting

Digital Marketing

Brand Management

Interior Design

Other: _____

63. Teaching experience

Mark only one oval.

1 - 5 years

6 - 10 years

11 - 15 years

16 - 20 years

21 - 25 years

25 - 30 years

30+ years

Thank you for taking the time and effort to complete this survey. It is appreciated.

APPENDIX B: Consent Form

Confirmation / Consent of Participation

This letter is a confirmation that we are willing to participate in Mr Daghlaan Davids's MBIA research project, for which approval has been obtained from the Research Ethics Committee of CPUT and a private Academic Service Provider.

The project involves exploring the impact of User experience (UX) and Visual literacy on Learner Management System (LMS) adoption at higher learning institutions.
We are willing for you to conduct a survey/study.

We understand that our participation is voluntary and that the information obtained will be used anonymously and without identification of our institution.

Signed:

Designation/Title:

Current or previous Academic institution:

Date:

Email address:

For further information please contact Daghlaan Davids:
daghlaandavids1@gmail.com
+27 82 764 6710

APPENDIX C: Ethical clearance documents

Cape Peninsula University of Technology

Faculty's

THE INDEPENDENT INSTITUTE OF EDUCATION

Reference: R.15462
Enquiries: bvanwyk@iie.ac.za
research@iie.ac.za

7 September 2020

Re: Permission to conduct research on IIE staff, students, sites or artefacts with standard conditions

Dear Mr Davids,

The committee considered your request and have granted permission to conduct research on IIE staff, students, sites or artefacts in accordance with your request – on condition that you strictly adhere to the conditions stipulated below. This approval is based on the assumptions that (1) the information you have provided is true and factually correct and that (2) the study will be conducted in an ethical manner.

Initials and surname:	D. Davids
Student number:	199027560
Institution:	Cape Peninsula University of Technology (CPUT)
Qualification:	Master of Business and Information Administration
Research to be conducted in:	2020
Title of study:	Exploring the impact of user experience and visual literacy design on learner management systems adoption at tertiary institutions

Permission is granted to proceed with the above study subject to meeting the conditions listed below. Permission may be withdrawn should any of these conditions not be met.

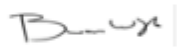
Please note: The panel has not considered the merits, accuracy or ethical soundness of the research. The only merits examined are the use of The IIE as a sample.

Conditions to be met	
1.	A copy of the final paper must be submitted electronically to The IIE's Dean for Research and Postgraduate Studies at research@iie.ac.za no later than 30 days post finalisation.
2.	The researcher(s) is neither permitted to refer to The IIE or any of its educational brands nor to name, logo, brand or any other identifiers of The IIE or any of its educational brands the in any way, including, but not limited to, in questionnaires, surveys, interviews, proposal or research reports. The IIE or educational brand in question must be referred to in a generic manner, for example 'A private provider'.
3.	The researcher(s) will need to obtain informed consent in writing from all of the participants in his/ her sample if the study is not anonymous.
4.	If the Learning Management System (LMS) of The IIE is used, the researcher(s) is not permitted to refer to it by name. Learn needs to be referred to in a generic manner, for example "the Learning Management System of a Higher Education provider."

5. A copy of this letter must be forwarded to the relevant person(s) at the brand or The IIE that would be involved in the study.
6. Research must be conducted in such a way that the normal programme and operations of the site/ offices is not interrupted.
7. The principal/ manager of a site must be consulted about an appropriate time when the researcher(s) may carry out the research at the site.
8. The researcher(s) may only use this data for these research purposes and in no other way.
9. Should the researcher(s) wish to publish this research or in any way make the results public, for example by publishing the results on a social media platform, this committee will need to approve a request to this end first.
10. No names or identifying information of participants may be used within the research and the research must be voluntary.
11. Photographs of human subjects may only be taken if relevant to the research and informed consent from the participants or respondents was obtained, and, even with informed consent, the photographs may not be published.
12. The researcher is responsible for supplying and utilising his/ her own research resources, such as stationery, photocopies, transport, faxes and telephones and should not depend on the goodwill of the institutions or the offices visited for supplying such resources.
13. If any of The IIE reports or policies are used as part of the research, all identifying information needs to be removed.
14. Please make it clear that the information will not be used punitively in any way and participants may in no way be counselled or advised based on this.

All the best with your research.

Yours sincerely,



Dr B. van Wyk
Dean: Research and Postgraduate Studies
The Independent Institute of Education

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BAC