What Universities Can Learn from YouTube, from the Perspective of User Experience (UX)

Thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

Institute for Sustainable Industries & Liveable Cities (ISILC),

Victoria University

Yue Shen

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Abstract

Although YouTube, the world's second most popular website, is mainly an entertainment provider, it is also the most frequently used educational resource provider in many areas of university study. Since YouTube videos in general are not considered very reliable for university education, this thesis argues that it is YouTube' User Experience (UX) that largely accounts for its popularity among university students and educators. The aim of this study is to find out what educational platforms such as LMS (Learning Management System) and MOOCs (Massive Open Online Courses) can learn from YouTube on the UX level. This project's data collection includes observation of five participants' use of YouTube, LMS and MOOCs and semi-structured interviews with the participants. This is a low-risk human research project whose ethics has been cleared by the University Human Research Ethics Committee. The ethics approval number is HRE18-179. It is argued that in order to improve UX, universities should integrate in their design of LMS and MOOCs a Recommender System (RS) and a user-friendly Search Engine (SE), elements that can be borrowed from the design of YouTube. The design follows three principles: interactive, motivating and standard. The research outcome is presented by an exegesis and a creative demonstration of LMS/MOOCs interface design through flowcharts and wireframes (See Illustration 1- 6, Page 129- 135). As this is a PhD by creative project, the exegesis accounts for 70% of the project and the creative piece weighs 30%. This project has brought the study of UX into educational technology, an area where researchers have called for more adoption of UX. This thesis provides guiding principles and practical suggestions for university learning designers and educational platform designers. Such suggestions can improve the digital experience for university students.

Keywords: UX, LMS, MOOCs, SE, RS

Doctor of Philosophy Declaration

"I, Yue Shen, declare that the PhD thesis entitled 'What Universities Can Learn from YouTube, from the Perspective of User Experience (UX)' is no more than 80,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work".

"I have conducted my research in alignment with the Australian Code for the Responsible Conduct of Research and Victoria University's Higher Degree by Research Policy and Procedures.

Signature: Yue Shen Date: 5th, March 2021

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List of Abbreviations

Collaborative Filtering (CF)

Exploratory Search (ES)

Human-Computer Interaction (HCI)

Learning Management System (LMS)

Massive Open Online Courses (MOOCs)

Recommendation System or Recommender System (RS)

Search Engine (SE)

Search Engine Results Pages (SERPs)

Thematic Analysis (TA)

User Experience (UX)

User Interface (UI)

Chapter 1 Introduction

Video-sharing platform YouTube is not only the world's second most popular website (alexa.com, 2017), but also a very frequently-used educational resource provider in many areas of university study (Barry et al., 2016; Rapp et al., 2016; Almobarraz, 2018; Tackett et al., 2018; Rudenkin, and Grushevskaya, 2019). YouTube videos, in general, are not considered very reliable for university education (Wittenberg-Lyles et al. 2014). Arguably, it is YouTube' User Experience (UX) that largely accounts for its popularity among university students and educators.

The aim of this study is to find out what universities can learn from YouTube's UX when designing and implementing their own online systems like LMS (Learning Management Systems) and MOOCs (Massive Open Online Courses). As a Human-centred, User Experience research, this project collects its data using industry tools such as user shadowing and interviews with users. This thesis is composed of a written document and a practical prototype. The prototype further explores the ideas discussed in the document through iterative design.

It is argued in this thesis that in order to improve UX, universities should integrate in their design of LMS and MOOCs a form of a Recommender System (RS) and a user-friendly Search Engine (SE), elements I argue make YouTube a success. The design should follow three principles: interactive, motivating and standard. The research outcome is presented by an exegesis and a creative demonstration of LMS/MOOCs interface design through flowcharts and wireframes. This project applies the study of UX to educational technology, it provides suggestions for university learning designers and educational platform designers. Such suggestions can improve the digital experience for university students.

1.1 Background

Video-sharing website YouTube is the world's second most popular website in terms of online traffic (alexa.com, 2017). Despite the fact that YouTube has removed Education as an entry on its recommended channel list and that YouTube is being predominately regarded as an entertainment website, YouTube is still a popular destination for university students and lecturers when they search for video resources (Barry et al., 2016; Rapp et al., 2016; Almobarraz, 2018; Tackett et al., 2018; Rudenkin, and Grushevskaya, 2019).

In recent years, universities around the world have acknowledged the need to operate online education systems, usually in the form of Online Learning Management Systems (LMS). Massive Open Online Courses (MOOCs) are a type of online course delivery, where free university courses are available to the public (with certification for a fee).

Despite its great entertainment value, YouTube is still a popular online destination for educational purposes. However, universities still prefer to develop their own formal educational platforms instead of encouraging the use of YouTube. This thesis will unpack some of the reasons why, and outline some of the learnings universities could take from the success of YouTube.

There are many reasons why universities may not utilise YouTube more than they do. For instance, it is not difficult to see why universities do not 'trust' YouTube. With 'broadcast yourself' as the ethos, YouTube presents great amounts of User Generated Content (UGC) that does not pass through much of a review process. Information on YouTube can be superficial, misleading or incomplete (Garrett 2016). The quality of information sources varies; the knowledge background of users who participate in comments varies. Also, recommended entertainment videos divert YouTube users' attention easily. In contrast, universities spend time and effort in developing their own online platforms, in a much more formal and focused approach.

On the other hand, universities' mistrust in YouTube does not erase YouTube's

appeal among university students. The amount of educational videos being uploaded and watched on YouTube is still impressive: the top three educational channels on YouTube all have billions of video views (socialbakers.com, 2018). Compared to universities' formal video courses, UGCs on YouTube can be more trustworthy, engaging and memorable (Gotter, tintup.com, 2016). YouTube's smart phone application and mobile version also adapt well to university students' inclination to using mobile devices. Moreover, YouTube is not only a video provider, but also an established social network. It is a place where users can easily connect and interact with each other. For the above reasons, it is arguable that universities can learn from YouTube's popularity while developing their own online platforms.

1.2 Aims

This project studies university students' User Experience when using YouTube as an educational content provider. It plans to extract the attractive elements of YouTube's UX. Then, I will make suggestions on how universities can apply them to the design of their own digital learning platforms. The aim of this thesis is to understand what elements contribute to good User Experience in the higher educational context and provide a set of recommendations on how university digital learning platforms can improve their User Experience.

1.3 Research Questions

The main research question of this project is: as an educational video resource provider, what perspectives can YouTube provide to University E-Learning Projects (From the User Experience aspect). Sub-questions include:

1. What elements of the YouTube experience are relevant to university e-learning projects?
2. What role does User Experience play in university students' learning activity?
3. What are the principles I follow as a UX designer?

1.4 Contribution to Knowledge and Statement of Significance

Digital technology is used in more and more areas. The global COVID-19 crisis has forced many higher educational institutes to turn to distance education and universities' digital presence is assuming importance like never before. There are many opportunities. Providing good UX is a way university can support their students and faculty when teaching, learning and undertaking student administration work. Universities also face many new challenges from disruptive technology like YouTube who offers cheaper and easier service than the more traditional ones and new technological giant-like companies like Zoom. It is time to make some visible changes to LMS and MOOCs to actually improve its UX.

This research is useful for university learning designers, educational platform designers and future university students. As technology is more and more integrated into higher education, universities are spending more and more time and effort into cultivating their online space. Designers need to grasp students' idea of user-friendly platforms. Formal educational institutions need to understand the mechanics behind informal learning platforms like YouTube. This project learns the features that make informal learning platforms so sought after and makes suggestions about how formal learning platforms can co-opt these features. Findings from this project provide insights on how to make digital education platforms more interactive, motivating and fulfilling users' expectation.

This thesis studies the new area of UX in the context of e-learning platforms, scholars like Brabazon (2017) calls for more study in this field. Some researchers are applying UX to study educational experiences. For example, Ahn (2018)'s Learning Experience (LX), gamification and Park and Lim (2018)'s Emotional Affordance (EA). I develop these ideas further and in this thesis, I develop a tri-fold design guiding principle: the interactive principle, the motivating principle and the standard principle. My project provides new easy-to-follow principles of UX design and extends the UX frameworks' flexibility and creativity.

Following these principles, two functions were designed to improve the UX of LMS and MOOCs. With these principles, e-learning designers can design or improve other digital functions other than Search Engine and Recommendation System. The interactive, motivating and standard principles are also applicable to other institutional platforms whose UX demands improvement, such as those of banking and medical services.

Moreover, a great many previous works use the UX framework as an evaluation criterion (Zaharias and Pappas, 2016; Santos et al., 2016; Nakamura, Oliveira and Conte, 2017; Pettersson et al., 2018). They aim at developing lists of entries that can be used to assess UX. Those entries can include aesthetics, instant support, usability and so on. They give little attention to actually improve the UX of their evaluated platforms. Plus, different projects list different criterion. It is difficult to select one evaluation list to follow. In this thesis, the UX framework is used more as a construction method than an evaluation method. It aims at constructing specific solutions and guiding principles at actually improving UX. Instead of giving a list of suggestions and guiding ideas, it centres on only two solutions and three principles. In this way, each suggestion and principle is given in depth discussion and easy to follow.

Two Practical Suggestions

Following the conceptual framework, two practical suggestions are made to improve the UX of LMS and MOOCs. The first is to implement a Recommendation System. The second one is to have a Search Engine. Although RS and SE are common features of many of today's leading commercial platforms like Google, YouTube and Amazon, they are not yet common for LMS and MOOCs. A few LMS and MOOCs already have either a SE or a SE, but what they have are far from being user-friendly. This thesis not only proposes to incorporate a RS and a SE into LMS and MOOCs, but also proves these two features are what the users actually want by analysing the collected data. This project also directly links these two features with positive UX, so that future researchers can also consider these two functions for the task of UX improvement.

In addition, the two suggestions are demonstrated practically. As discussed before, many previous studies treat UX as an evaluation criterion (Zaharias and Pappas, 2016; Santos et al., 2016; Nakamura, Oliveira and Conte, 2017; Pettersson et al., 2018). This leaves the question of how to improve UX often answered very theoretically, vaguely, or with little practical impact. This project gives two very specific recommendations. These two suggestions are given detailed explanation on how they are different from similar projects, both the user interface and the working mechanism, possible design issues and solutions, detailed design elements and the theoretical and practical support for them. The detailed analysis also validates the design of the two functions. Plus, flow charts and wireframes are drawn to visually demonstrate the design of the two functions. In general, the two practical suggestions are given very detailed explanation, validation and visualization. They can be used easily to make real changes towards the design of e-learning platforms.

To conclude, this project is in a relatively new area that studies specific guiding principles and practical solutions for improving e-learning platforms' UX. This research is useful for university learning designers, educational platform designers and future university students. A new conceptual framework is developed for future researchers' and e-learning designers' reference. Practical solutions are given to improve the UX of LMS and MOOCs users. Theoretically, the new guiding principle of UX design is to pursue interactivity, motivation and standardization. Practically, Search Engine and Recommendation System are important functions for providing good UX. With the proliferation of digital technology and global crisis like the COVID-19, it is time that universities gave more attention to the UX of their digital systems to sustain competitive power and deliver support for their students and faculty.

1.5 UX Prototype

This PhD project is consisted of an exegesis and creative work. The creative work is presented by two flowcharts and three wireframes (See Illustration 1 – 6, Page 129-135). The main finding of this project is that in order to improve the UX

of formal educational systems like LMS and MOOCs, a Recommendation System (RS) and a Search Engine (SE) are to be added to them. The finding is presented by the creative work as an interface and process design of an LMS/MOOCs based digital system with a SE and a RS. Methods used to demonstrate this system were flow charts and wireframes. In UX design, wireframes and flowchart are two commonly-used tools (Laubheimer, nngroup.com, 2016). Wireframes are mainly responsible for showing the design of the user interface by showing different webpages of a system. Flow charts used to communicate the process behind the user interface. Using them together can demonstrate a both a system's the webpage layout and its functioning mechanism. Flow charts and wireframes are frequently considered as 'responsibilities and tasks of UX designers identified by literature' (Bruun et al., 2018: 353).

Two flowcharts are drawn: one for the RS and the other for the SE. The wireframes are constituted of three frames. The first one was a system homepage for the users. The homepage showcases a search bar and a recommended content area. The next two wireframes are the Search Results Display Pages (SERPs) of the designed system. Apart from a search bar and recommended content that are consistent on every page, the SERPs design demonstrates my design principle that is integrative, motivating and standard.

To conclude, in the introduction I describe how the Video-sharing platform YouTube is not only the world's second most popular website, but also a very frequently used educational resource provider in many areas of university study. The aim of this study is to find out what universities can learn from YouTube' UX when designing their own online systems like LMS (Learning Management Systems) and MOOCs (Massive Open Online Courses). As a Human-centred, User Experience research, this project collects its data using industry tools including user shadowing and interviews with users. It is argued that in order to improve UX, universities should integrate in their design of LMS and MOOCs a Recommender System (RS) and a Search Engine (SE). The designing principle for these two functions are interactive, motivating and standard. The research outcome is presented by this written exegesis and creative demonstrations by

flowcharts and wireframes. This project applies the study of UX to educational technology, it provides suggestions for university learning designers and educational platform designers. Such suggestions can improve the digital experience for university students.

Chapter 2 Literature Review

The literature review includes three areas: the background of the research, User Experience (UX) as the conceptual framework and this project's a trifold designing principle for universities' digital learning platforms like LMS and MOOCs: interactive, motivating and standard. The background of this research is: YouTube is popular among university users because of its positive UX, not necessarily because it provides high quality educational videos. Consequently, it is helpful for universities to understand what they can extract from YouTube on the UX level. UX studies 'a person's perceptions and responses (ISO, 2009)' from the use of a certain technology. UX is a widely used conceptual framework in the Human-Computer Interaction (HCI) community (Lindblom and Andreasson, 2016; Hassenzahl, 2009). However, a great many studies use UX as an evaluation framework (Zaharias and Pappas, 2016; Santos et al., 2016; Nakamura, Oliveira and Conte, 2017; Pettersson et al., 2018) instead of a construction framework. To fill in this gap, this thesis uses three guiding principles to direct the improvement of LMS and MOOCs' UX.

The first part of the literature focuses on the background of this study. YouTube's popularity does not necessarily come from its video quality. Secondly, with the help of technology, we are witnessing an increasing level of convergence and competition between formal educational institutes such as universities and informal educational content providers like YouTube. It is helpful for universities to understand what they can extract from YouTube. This part justifies why UX is the study focus and the argument that universities should learn from YouTube on the technological aspect.

The second part of the literature review explains User Experience (UX) as a conceptual framework. User Experience (UX) refers to 'a person's perceptions and responses that result from the use or anticipated use of a product, system or service' (ISO, 2009). The third part of the literature reviews how previous researchers apply the UX framework to the educational domain and develop different perspective or guiding principles, then it outlines the guiding principles

of this project. This project develops a trifold designing principle for universities' digital learning platforms like LMS and MOOCs: interactive, motivating and standard. The interactive principle means good UX design should have more user-friendly interactive features. The motivating principles requires the system to motivate users to learn from both the intrinsic and extrinsic aspect. The standard principle advocates for common interface design that follows the example of popular commercial platforms such as YouTube an Google. UX is a flexible framework that has been used in many different ways and still calls for new theoretical contribution. The interactive, motivating and standard principle not only provides guidance for the proposed design of this project, but also adds new theoretical contribution to UX as a conceptual framework. I now describe the methodology used to explore my question.

2.1 The Background of the Study

The background of this study mainly centres on two aspects. Firstly, YouTube' popularity does not necessarily come from its video quality. Secondly, with the help of technology, we are witnessing an increasing level of convergence and competition between formal educational institutes such as universities and informal educational content providers like YouTube. Consequently, it is helpful for universities to understand what they can extract from YouTube on the UX level. This part justifies why UX, instead of digital content quality, is the study focus and the argument that universities should learn from YouTube on the UX aspect.

YouTube, LMS and MOOCs: Similarities and Differences

YouTube, LMS and MOOCs are compared in this thesis because they have similarities and differences, and they all provide valuable lessons for UX designers in the educational context. similarities and difference. In terms of similarities, these three are all major online study destinations for university students (Aldallal, Yates and Ajrash, 2019; Gamage, Perera and Fernando, 2020; Al-Sharhan et al., 2020:15-16). They combine educational content with digital

systems and offer students new possibilities and convenience in accessing and sharing information. As educational content providers, they all face challenges such as how to motivate students, how to integrate other technological advancement such as interactive functions, Search Engines (SE) and recommendation systems (RS)and how to grow the field of educational technology.

As for the differences, YouTube, LMS and MOOCs provide different content and User Experience (UX). YouTube is a commercial platform who is generally considered as a User-Generated Content (UGC) and entertainment provider. Still, it is one of the most popular educational platforms for university users (Barry et al., 2016; Rapp et al., 2016; Almobarraz, 2018; Tackett et al., 2018; Rudenkin, and Grushevskaya, 2019). Students frequently use YouTube's Search Engine and Recommendation System to access educational videos, this contributes to YouTube's leading status as the worlds' second most popular search engine (Davies, searchenginejournal.com, 2018). However, YouTube's focus on UGC and entertainment prompts scholars to question its information quality when it delivers educational content.

Universities have their own preferred learning platforms, among which LMS and MOOCs are the two main ones. LMS' target users are each university's own enrolled students. This system fascinates learning and administration tasks (De Bra et al., 2010). LMS are usually called a 'repository of learning materials' (De Bra et al., 2010: 3029). There, students can find formal learning materials like their lecture slides, recordings, assessment requirements and reading lists. LMS also help students with a great number of administration tasks such as course enrolment, subject selection and paying for tuition fees.

As the name suggests, MOOCs are open courses for all: students, professionals or anyone who wants to study. There are many MOOCs providers available now, for instance, Coursera, EdX and Khan Academy. Some MOOCs publish full-length course videos of a whole subject, such as Harvard University's Free Online Courses. Others offer the option to watch short clips of smaller topics

and certain skills, such as LinkedInLearning.com. Some MOOCs now issue certificates for students who finish their courses. In short, MOOCs offer a wide range of learning materials and UX to cater for its broad target population.

The UX of YouTube, LMS and MOOCs in the University Context

As discussed before, university users prefer to use YouTube because of its good UX. YouTube is a video sharing platform, which means its main way of dispensing information is through video. YouTube videos are usually a dynamic combination of texts, sounds and illustrations. Videos, compared to texts, sounds or illustrations alone, are more attractive to users. Compared to reading texts or listening to recordings, watching videos are the easier and more fun way to study and thus provides more motivation for students (Iwantara, Sadia and Suma, 2014；Lee, Osop, Goh and Kelni，2017).

Moreover, YouTube has other design features favoured by users, such as its Search Engine (SE), Recommendation System (RS), social network and User-Generated Content (UGC). YouTube's SE does not only offer simple keyword-matching lookup search, but it also provides the more complex Exploratory Search (ES). Exploratory Search (ES) happens when users search for open-ended questions, or when users do not know how to describe the search query in the most accurate way, or when users are using the SE to discover how a system works (Marchionini, 2006). ES is particularly useful to university-level users because unlike primary or secondary students, their study involves more open-ended questions and complex topics. Plus, some system's simple lookup search presents zero or very limited or useless search results. With ES, it is more likely for the system to retrieve a decent number of useful results. ES will be discussed more in depth in Chapter 6.

In the university context, YouTube is frequently used by higher education institutes, faculty members and students. Institutes use it to publish open resources (Schicchi,

Marino and Taibi, 2021). Lecturers use it to provide additional contexts (Almobarraz, 2017) and video resources to students. There are many literatures on assessing the effectiveness of using YouTube as a teaching tool (Kim et al., 2014; Zhou et al., 2017; Lee, Osop , Goh and Kelni , 2017).

A lot of students frequently use YouTube to study (Aldallal, Yates and Ajrash, 2019). Their main goal is to find additional resources to complement their university study, which include 'latest development in the discipline, news and documentary videos on the practical aspects of the discipline, information on assignments and research, and information to complement class notes' (Tella, Bode-Obanla and Age, 2020: 94). Under circumstances not required by their educators, students are intrinsically motivated to watch YouTube's educational videos (Lee, Osop , Goh and Kelni , 2017: 618). Search (Tella, Bode-Obanla and Age, 2020) and recommendation (Schicchi, Marino and Taibi, 2021) play critical roles in students' learning activity.

University students' use of MOOCs presents two major issues: the lack of interaction and motivation. On MOOCs, students can participate in a great variety of learning activities such as video watching, quiz taking and forum discussions. Gamage, Perera and Fernando (2020) find that university users mostly use MOOC for video watching, followed by assignments and quizzes. The least used features are discussion forum and online meeting. This means that users do not usually use the social functions of MOOCs. Consequently, the interaction between users is limited. The interaction between users and the system is limited as well since users predominately use MOOCs to only watch videos. Besides interaction, motivation is another issue of MOOCs. Study shows that motivation to study through MOOCs is usually high at the beginning, and then significantly drops over time (Gamage, Perera and Fernando, 2020: 173; Reparaz, Aznarez-Sanado and Mendoza, 2020).

LMS is a platform for the formal university learning context. 'LMS provides variety of functions and communication tools that agreed to support teaching and learning such

as assignments, announcement, quizzes, discussion forum, chat, resources, and others' (Al-Sharhan et al., 2020:15-16). These tools can be used either synchronous or asynchronous. Comparing to YouTube, the advantage of LMS is that the information content is of high quality (Daghan and Akkoyunlu, 2016). Unlike YouTube with information quality issue (Aldallal, Yates and Ajrash, 2019), LMS' learning materials are selected by university's faculty members. Study shows that user satisfaction is high for basic LMS features like downloading lectures slides and recordings (Dahlstrom et al., 2014). However, users are not satisfied with LMS' more advanced features such as those for fostering collaboration and interaction (Dahlstrom et al., 2014).

Students' use of MOOCs is similar to their use of LMS. They simply use LMS and MOOCs to access learning materials and complete learning tasks that must be completed through these platforms. They are less interested in other features these platforms provide, such as social network and forums. We need to look at how to increase students' motivation to use these e-learning platforms and how to increase interaction between users and between users and the platform.

Quality Vs. Popularity

One of the interesting findings about YouTube is that there is a paradoxical nexus between video quality and popularity. YouTube carries a great amount of User-Generated video content. As a result, it is common for YouTube videos to have low information quality and low production value. However, a video's quality does not necessarily hinder its popularity.

YouTube's User-Generated videos usually have low quality in terms of both the information and the production. Information quality means the correctness and usefulness of information, while production quality refers to a video's audio-visual technics and media aesthetics. Due to reasons such as unverified origins, unprofessional referencing and dubious accountability, the quality of online information is generally low. Researchers like Staunton et al. (2015) even argue that YouTube's information quality is lower than other websites. Moreover, YouTube has its own technological structure and mechanism, where compressed

videos upload and stream fast and in the meantime more easily reach the audience. Compression leads to distortion of image and sound, which decreases video quality.

Interestingly, low quality does not stop YouTube from flourishing and its videos from reaching millions of views. Media scholars like Bruns (2008), Cubitt (2008) and Pesce (2006) argue that YouTube videos with lower production value tend to enjoy more popularity. It is usually the entertainment value and ability to attract attention that determines a video's popularity (Bruns, 2008). 'When placed head-to-head, can a professional production of modest salience stand up against an amateur production of great salience? Absolutely not. The audience will always select the production which speaks to them most directly. Media is a form of language, and we always favor our mother tongue' (Pesce, 2006). To sum up, the overall low video quality does not stop YouTube from being popular and quality videos are not necessarily popular.

A Content Provider with Limitations

YouTube has attracted the attention of scholars in the teaching and learning of disciplines that require a large number of audio-visual sources, such as medical studies. For instance, Wittenberg-Lyles et al (2014) studied YouTube as a pain management tool for informal cancer caregivers. Staunton et al (2015) analysed the quality of scoliosis videos on YouTube. Barry et al (2016) conducted a survey among medical students to examine the use of YouTube for anatomy education.

Researchers believe that YouTube has both advantages and disadvantages.

Wittenberg-Lyles et al. (2014) argues that YouTube videos help to increase users' knowledge, but the 'video instruction was primarily talk without any onscreen action (65%), user-generated amateur video (79%), and had poor quality sources of information' (Wittenberg-Lyles et al. 2014: 1200). Barry et al believe that YouTube's advantages include that 'it is of considerable value in bringing topics and concepts alive, offering instant information on an anatomical concept at no cost to the student and is not location dependent' (Barry et al.,

2015: 94). However, YouTube provides relatively adequate information on some areas and inadequate information on others. YouTube also has problems with copyright (Barry et al, 2015). Staunton et al. (2015) argue that since YouTube's published content 'does not pass through a traditional editorial process' (2015:1859), its origins and accountability are dubious. In general, YouTube has been studied as a popular and convenient content provider with many limitations.

Formal and Informal Education Impacted by Technology

In recent years, the formal educational context is experiencing several trends and technology is playing a crucial role. According to Kamenetz (2010, cited in Batchelor, 2011), the four trends of higher education now are 'an increase in more non-traditional and minority students choosing non-selective institutions', 'the unbundling of services', the 'combination of traditional classes and technology' and 'reaching the dropouts and finding alternate learning avenues through developing personal learning networks and paths for students to direct their own learning'. Brabazon (2017) argues that in the past twenty years, the three most influential factors for higher education are economy, technology and the increased mobility speed of 'people, goods, money and ideas' (174). Technology is in itself a more and more important factor when it comes to change in higher education and it also has paved way for other trends such as the increasing mobility of people and ideas and the rise of non- traditional online institutes.

While providing more opportunities and possibilities for both formal and informal education, technology is also blurring the dividing line between formal and informal education. Although formal and informal education have been seen as rivaling forces, students in formal educational contexts are integrating more and more tools, technologies and ideas from informal education (Trinder et al., 2008: 4). Formal educational institutes facilitate MOOCS, but their target users are not limited to university students. They actually provide an opportunity for the general public to access university courses. In this sense, MOOCS' target users are informal. Dominated by User-Generated Content (UGC), YouTube is supposed to be an informal source of information.

There are scholars arguing for the need to change formal higher education by 'deformalization'. Scholars like Batchelor (2011) believe that the Internet can reduce the power of higher education institutions. In order to maintain prestige and develop, universities need to change. Many scholars recommend universities to embrace technology more (Kamenetz, 2010; Batchelor, 2011; Rotar, 2014 and Jenkins, 2017), and here technology is to be used in a deformalized way. Kamenetz (2010) calls this deformalized use of technology in the formal educational setting ''deschooling', which means transforming universities as 'technologically enabled, largely self-directed, free, and open exchange of information' (2010: 112). By embracing technology in a deformalized way, universities can let information and knowledge be transmitted to and exchanged between more people, especially the more technology-enabled younger generation. By doing do, universities are empowering itself.

Interestingly, when it comes to increasing the impact of informal education, suggestions are usually coming from the aspect of formalization. Brabazon (2017) analyses the case of MOOCs and argues that their inability to engage more learners does not lie in the content. Researchers like Brabazon (2017) find that many MOOCs' users did not finish their MOOC course. Brabazon (2017) thinks that this is not because of MOOCs' course content. Instead, she argues that MOOCs' issue is due to the lack of 'motivation, modeling, mentoring and achievement' (Brabazon, 2017:186), resulted from the absence of 'community and connection' (Brabazon, 2017:186). Although MOOCs offer courses from excellent universities and an opportunity for users to acquire knowledge, it fails to build solid communities among users and connection between teachers and learners, as well as between fellow learners. Another disadvantage of informal learning is the lack of recognition of learning, such as leaners' certificates, qualifications and degrees. Zagar and kelava (2014) argues that the current educational environment is neoliberal, which means the current educational goal is more about providing job training, rather than individual development. Consequently, qualification is highly valued and sought after by learners. 'Motivation, modeling, mentoring and achievement' mentioned by Brabazon (2017) and 'recognition of learning' mentioned by (Zagar and Kelava, 2014) both are key factors of formal education.

While technology is providing more and more informal educational opportunities for the general public, the attraction of formal university education is still there. Globally speaking, the number of registered students at universities is still rising (Kamenetz, 2010). Getting a university degree is still seen by many as essential for their career development. Kamenetz (2010) argues that two factors that determine students' choices regarding institutions are 'exclusivity' and 'quality of experience'. Universities, especially the top ones, are still highly selective in their student admissions process. This does not stop students' passion for study as they long for the quality experience at good universities. Informal learning cannot replace universities, not in the near future.

To sum up, technology can play a crucial role in the development of higher education: to bridge the formal and the informal. While it is highly unlikely for informal education to completely replace universities in the near future, formal education institutes need 'deformalisation'. At the same time, informal education needs formalisation. Both 'deformalisation' and 'formalisation' cannot be achieved without the appropriate application of technology. I believe that the future will see more convergence of formal and informal education. Students will have the authority to use a wide range of learning materials from both formal and informal resources (Colley, Hodkinson, and Malcolm, 2003, cited in Greenhow and Lewin, 2016: 10). Formal and informal learning providers will extract positive elements from each other, for their own development. More achievements of technological development will be used to accomplish this convergence.

2.2 User Experience (UX) as the Conceptual Framework

The second part of the literature review explains User Experience (UX) as a conceptual framework. User Experience (UX) refers to 'a person's perceptions and responses that result from the use or anticipated use of a product, system or service' (ISO, 2009). 'Since the inception of the term in the mid-1990s, the notion of UX has been embraced by both practitioners and researchers because it offers a possible alternative to the more traditional and instrumental HCI' (Lindblom and Andreasson, 2016: 4; also, Law et al., 2009). Usability and User Interface (UI) are important

attributes to UX (Norman and Neilson, 2021). UX is also frequently dealt with from two aspects: the pragmatics and the hedonics (Hassenzahl, 2007; Lindblom and Andreasson, 2016). The pragmatics relates to a user's actual use of a system, which can include how effective or efficient a system performs, how easy it is to use and whether a system fulfills users' need. The hedonic aspects are more about how a system makes a user feel, also known as the emotional impact. The review of the literature demonstrates that there should be more research that can go beyond usability studies and UX evaluation.

'Experience or User Experience is not about good industrial design, multi-touch, or fancy interfaces. It is about transcending the material. It is about creating an experience through a device' (Hassenzahl, 2011: 1). In general, UX is a research framework that pays attention to the users' actual experience resulted from the use of 'a product, system or service' (ISO, 2009). By studying UX, we can understand users' behaviours and need and use such knowledge to improve our design of interactive products, so they can better serve the users. Since the term's creation in the mid-1990s (Lindblom and Andreasson, 2016), UX has been widely embraced by professionals and researchers from the Human-Computer Interaction field (Law et al., 2009; Lindblom and Andreasson, 2016).

UX is an umbrella term for 'all aspects of the end-user's interaction with the company, its services, and its products' (Norman and Neilson, nngroup.com, 2021). User Interface (UI) and Usability are important attributes to a positive UX (Norman and Neilson, 2021). Usability means 'the system is easy to learn, efficient to use, pleasant, and so forth' (Neilson, nngroup.com, 2012; cited by Norman and Neilson, nngroup.com, 2021). 'User interfaces are the access points where users interact with designs' (Interation-design.org,2021). This means that the design of UI and Usability are important UX design tasks.

UX is also frequently considered to include the pragmatics and the hedonics (Hassenzahl, 2007). In order to understand the relationship between the pragmatics and the hedonics, Hassenzahl (2007) proposes a 'situation-dependent ranking'. This means that depending on the object of study or the

status quo of the object, researchers can choose to focus more on the pragmatics or the hedonics. Researchers can also decide if the hedonic depends on the pragmatics, or vice versa. In general, the pragmatics and the hedonics are equally important. However, Roinson, Lanius and Weber (2018) find that usability studies, instead of hedonic studies, are the most commonly used methods. This means that studies that can extend beyond usability are required.

UX design, not technological advancement, can actually make the difference between a market-leading product and its followers. Researchers like Norman (1998), Katz (2010), Hassenzahl (2011) and Kim (2015) all notice that popular technological products do not often boast 'new, innovative technological breakthroughs' (Kim, 2015:4), such as 'new algorithms, future materials, or fancy interface concepts' (Hassenzahl, 2011:5). Instead, they demonstrate 'the intimate understanding of certain experiences, feelings, situations, boundary conditions, and how those experiences can be created and shaped through a thing' (Hassenzahl, 2011: 5).

An example to support this opinion is Apple's iPhone. It has the same technological functions as other smart phone devices on the market: making phone calls, sending messages, taking photos, accessing the Internet, running Apps and more. What makes iPhone a market-leading product is not high-tech functions that others do not have. Apple's success comes from its great attention to what can create a positive UX. For example, a system that runs fast, smooth and without saving useless cache can save users' time and reduce negative feelings in Human-Computer Interaction (HCI). A larger screen is useful for better interaction between the user and the phone, because it brings convenience and more possibility in information acquiring, photo editing and game playing. Similar to Apple, today's many popular digital devices and systems are giving great attention to UX. As a result, 'we should definitely shift attention (and resources) from the development of new technologies to the conscious design of resulting experiences, from technology-driven innovations to human-driven innovations (Hassezahl, 2011: 7)

UX is a very inclusive, flexible and creative framework that allows researchers to select, create or utilize different tools for different study subjects. For instance, Riel et al. (2017) studied the watch time of embedded course videos by analysing the computer server log; When examining the user experience of new media phenomenon, the bullet screen, Djamasbi et al. (2016) tracked viewers' positive/negative moods and endearment with videos by surveys. Kujala et al. (2011) put forward an innovative method to measure the user experience of branded mobile phones: they ask their research participants to draw curved lines representing change of their satisfaction as time goes by. In conclusion, previous research methods of User Experiences vary greatly and there is the need and space for creative and effective new study topics and tools.

A great many previous works use the UX framework as an evaluation criterion (Zaharias and Pappas, 2016; Santos et al., 2016; Nakamura, Oliveira and Conte, 2017; Pettersson et al., 2018). They aim at developing lists of entries that can be used to assess UX. Those entries can include aesthetics, instant support, usability and so on. They give little attention to actually improve the UX of their evaluated platforms. Plus, different projects list different criterion. It is difficult to select one evaluation list to follow. In this thesis, the UX framework is used more as a construction method than an evaluation method. It aims at constructing specific solutions and guiding principles at actually improving UX.

Designing according to Users' Habits and Context of Use

Many argue for the importance of designing according to users' habits and context of use (Consolvo et al. 2002; Arhippainen and Tahti, 2003; Al-Turjman, 2016; Hussin et al., 2017). Some of these studies are valuable because they test out the methods to collect such user and context data. These methods include the more basic ones like identifying target user group and platform, interviewing and observation, as well as the more advanced ones for mobile-based systems

like environment sensors. Other projects are reviewed here because designing according to users' habits and context of use also require them to follow different specific design principles.

Arhippainen and Tahti (2003) outline three major points for designers who design according to users' habits and context of use. First, it is pivotal to identify target use group. For instance, designers need to consider is the product for general use or specific use, are the users familiar with digital technology in general or not. Second, design practice is differentiated according to platforms. UX study for websites can mainly focus on visuals, while designing for mobile devices also has to consider size, weight and mobility (Arhippainen and Tahti, 2003). Thirdly, Interview and observation are effective methods to collect user and context data (Arhippainen and Tahti, 2003). Interview creates 'a calm and nice atmosphere' (Arhippainen and Tahti, 2003: 32) for users to express their ideas and feelings. Interview is also a good way to acquire background information from users before the experiment session (Arhippainen and Tahti, 2003). Arhippainen and Tahti (2003) emphasises on asking simple questions (Arhippainen and Tahti, 2003) from the interviewer's end, so that the interviewees can understand the questions easily and have enough to say.

Like Arhippainen and Tahti (2003), Hussin et al. (2017) also argue that it is important to identify different user group, according to demographics. In addition, Hussin et al. (2017) also use interview as research method to gather user and context data. To be more specific, Hussin et al. (2017) use criterion like task time and user satisfaction (Hussin et al., 2017) to evaluate the UX of concerned platforms. Task time is used to test the efficiency of Interface and user satisfaction is deployed to evaluate heuristics. Combining task time and user satisfaction covers the two major aspects of UX. Hussin al. (2017)'s study demonstrates that task time and user satisfaction can be two useful criteria used in designing user study. Combining Hussin et al. (2017) with Arhippainen and Tahti (2003)'s advocate for simple question interview and observation, it is argued that designers pay attention to task time during observation and ask simple questions

about task time and satisfaction during interview.

Arhippainen and Tahti (2003) and Hussin et al. (2017) discuss the more basic methods in collecting user and context data. Other researchers study mobile-based systems and use more advanced methods, like environment sensors, to acquire information on users and contexts. For example, AI-Turjman (2016) makes use of smartphone sensors to collect data on users' context. The tools he uses include social media profile authorization, cellular/WiFi network-enabled location-based services and online/offline tracking Apps. AI-Turjman (2016)'s context awareness technology is studied based on mobile platforms, instead of websites. However, it is still a creative and practical example of gathering context data and do UX design accordingly. More importantly, this type of study maps out the future development of systems who are still predominately based on website, instead of smartphone or other mobile devices.

Additionally, users' habits and context of use determine a project's guiding principles. Depending on the users' background and the actual environment of use, designers choose to follow different principles. Guay, Rudin and Reynolds (2019)'s University of Toronto Scarborough Library study proposes to 'aim for less experienced users if possible' (2019:94). Their design principle is to design the interface as simple and straightforward as possible. This is because their research participants are undergraduate students who are new and inexperienced users of the website. Yang (2020) designs a mobile phone food App for pregnant women specifically. Her main principle is promoting healthy lifestyle. Another principle is privacy-protecting, as this App asks for many personal information. These examples show that to design according to users' habits and context of use require designers to decide on and adhere to appropriate principles.

To sum up, many researchers think that it is crucial to design according to users' habits and context of use (Consolvo et al. 2002; Arhippainen and Tahti,

2003; AI-Turjman, 2016; Hussin et al., 2017). Some of these studies are useful because they test out different techniques for gathering user and context data. These approaches range from the most fundamental, such as defining the target user group and platform, interviewing, and observation, to the more sophisticated, such as environment sensors, for mobile-based systems. Other projects are discussed here since designing for users' behaviours and context of usage necessitates adhering to various design principles.

Integrating Interface Elements

There are previous works on integrating interface elements from existing systems to support desired interactions within new contexts. Lukoff et al. (2021) studies how UX can affect users' sense of agency, which means 'an individual's experience of being the initiator of their actions in the world' (Synofzik, Vosgerau, and Newen, 2008; cited by Lukoff et al., 2021: 88). To find out what UX design elements can contribute to users' sense of agency, Lukoff et al. (2021) surveyed 120 YouTube users and then asked 13 YouTube users to co-design. Their major finding is that for enhancing user's sense of agency, the adjusted version of the following mechanisms of YouTube could be deployed by other systems: recommendations, playlists, search, and auto- play.

According to Lukoff et al. (2021), both You Tube's recommendations and search can provide users with sense of agency, but the current design is not enough. As a result, designers are to create their own RS and SE according to their own purpose. Another finding of Lukoff et al. (2021) is that, when users have a specific purpose of use, instead of just general browse, they prefer design mechanisms that give them more control. This asks designers to provide mechanisms like SE and RS more clickable and useful on-screen interactive features, so that users can exert more control over their use of the interface. As more control is what users desire, giving users more control can motivate users to interact with the system more.

While Lukoff et al. (2021)'s study is about the UX elements of YouTube that can be extracted by other platforms, Zhang, Deng and Shi (2017)'s Chinese live TV project is about adding those elements to an established interface. Zhang, Deng and Shi (2017) design the user interface of live TV in China. They complete a mixed method research. They interviewed 30 users over the telephone and surveyed 100 TV audience with questionnaire. Their findings are mainly used to design three functions: TV channel list, programme recommendation and unified search that allows users to access both contents from live TV and the Internet.

Zhang, Deng and Shi (2017)'s project demonstrate the feasibility and effectiveness of adding elements to an existing interface based on UX research. The advantages of this study are that it adopts mixed methods and has a relatively large sample size. The 100 survey participants are purposefully recruited to represent the composition of TV audiences in China. The TV study provides valuable qualitative and quantitative data. Users' requirement for RS and SE are supported by both types of data.

However, their 30 telephone interviewees are consisted of 10 elderly and 20 housewives, which means they have not interviewed any student or professional. Among the 30 interviewees, there are 28 females and only 2 males. They do not explain the reason for such selection of telephone interviewees. There is an obvious bias in their qualitative data. In consequence, future designers and researchers need to pay close attention to the selection of interviewees.

There are previous works on integrating interface elements from existing systems to support desired interactions within new contexts. Lukoff et al. (2021)'s study finds that other applications can creatively adapt YouTube's recommendations, playlists, search, and auto- play. Zhang, Deng and Shi (2017) add TV channel list, programme recommendation and a search function to China's live TV interface. Based on UX research, Zhang, Deng, and Shi (2017)

illustrate the feasibility and efficacy of adding mechanisms to an existing interface. Plus, the study yields valuable qualitative and quantitative data. The TV project has its strengths and weaknesses, it serves as a good example for future studies.

To conclude, UX studies 'all aspects of the end-user's interaction with the company, its services, and its products' (Norman and Neilson, nngroup.com, 2021). Researchers like Norman (1998), Katz (2010), Hassenzahl (2011) and Kim (2015) notice that popular technological products do not often boast 'new, innovative technological breakthroughs' (Kim, 2015:4). Rather, they have relatively good UX. As a result, they advocate for more emphasis given to UX. In Human-Computer Interaction (HCI), it is a very inclusive, flexible and creative framework that constantly calls for new study topics, tools, methods, etc. UI and Usability are important attributes of UX (Norman and Neilson, 2021). The pragmatics and the hedonics are frequently used to decode UX (Hassenzahl, 2007) as well. However, there should be more studies that can extend beyond usability studies and more studies that use UX as a construction method, rather than an evaluation method.

The Interactive, Motivating and Standard Principle

Instead of emphasising on technology, UX research and design focuses on how technology can better serve the human needs. As a technological buzzword and a bourgeoning field of study, UX has been studied from many aspects, among which education is an important aspect. These studies include Hearst's (2011) Human-centred technology, in which she discusses how standard Google-like User Interfaces and ergonomics can contribute to a 'natural' design. Cobb (2019)'s responsible recommending affirms the power of platforms and calls for filtering, censorship and law and regulations from regulating bodies, other than the self-governing of major platforms. A user interface's aesthetics (Katz, 2010) and attractiveness (Nakarada-Kordic and Lobb, 2005) are also linked to positive

UX experience.

These projects all prove that UX design does have real impact on, and sometimes very powerful influence over, users' interaction with technology. Moreover, there is still not a fixed idea of what aspects should a standard UX study include. Perspectives and principles developed by researchers all add to our understanding of UX and help expand the boundaries of UX as a research field. As a result, UX can be understood as a research field with great flexibility and diversity, with different perspectives and guiding principles.

UX in Education

In recent years, UX has been applied to more and more areas and it is also applied to digital educational environments. Ahn (2018) proposes the idea of Learning Experience (LX), which situates UX specifically in the educational context. She defines LX Design as 'taking an expansive view of what learning looks like, how we guide it, and what technologies amplify learning practices' (Ahn, 2018: 1) and believes thus LX 'coincides nicely with practices in user experience design (UX)' (Ahn, 2018: 1). She has her own standard of positive UX in education: engaging, innovative, and effective' (Ahn, 2018: 1). Moreover, Ahn (2018) argues that the aim of UX design in education should not be creating a perfect situation for all users. Instead, any design endeavour could be actually improving the UX for some users.

To improve the UX of educational technology, Park and Lim (2018) focus on the Emotional Affordance (EA) of online learning technology. Just like digital literacy, emotional competence is also a critical skill for the twenty-first century (The World Economic Forum, 2015). Park and Lim (2018) emphasises on the importance of users' emotions and what design features contribute to positive educational outcomes. They argue that 'in an online learning environment, learners might feel lonely, anxious, bored, or frustrated (Järvelä et al. 2011; Wosnitza and Volet 2005; Zembylas et al. 2008, cited by Park and Lim, 2018: 53)', because of the lack of direct interaction among peers and with teachers

(Artino and Jones 2012; Dabbagh and Kitsantas 2004; MacFadden et al. 2005; Whipp and Chiarelli 2004). Consequently, UX designers should aim to help interface users overcome negative emotions.

Miltenoff (2015)'s study of gamification combines the design of computer games and digitised study tasks. 'Gamification is defined as the process of applying game mechanics and game thinking to the real world to solve problems and engage users' (Miltenoff, 2015:2). Gamification can bring to UX: fun, motivation and problem-solving skills (Miltenoff, 2015). Motivation comes from both 'the level of internal motivation and on the level of interpersonal motivation' (Miltenoff, 2015: 5). International motivations result from the fun and interactive aspects of gamification. Interpersonal motivation is because gaming in class can involve competition among students and in the meantime provide social opportunities for class participants.

Researchers like Ovesleova (2016) and Gokdemir, Akdemir and Vural (2013) combine classic educational theory with the design of digital educational platforms. Gagne (1965)'s 'nine events of instruction' is considered 'the foremost …systematic approach to instructional design and training' (Kruse, 2008). Researchers like Ovesleova (2016) and Gokdemir, Akdemir and Vural (2013) use Gagne's (1965) as the requirements of eLearning systems' user interface: 'Gaining Attention; Informing Learners of Objectives; Stimulating Recall of Prior Learning; Presenting the Stimulus; Providing Learning Guidance; Eliciting Performance; Providing Feedback; Assessing Performance; Enhancing Retention and Transfer' (Gagne, 1965). These requirements depict what a positive user experience could include. Additionally, the combination of classic educational theory and e-learning interface design can be seen as the reasons why we need to improve e-learning's User experience. A good user experience transcends a user-friendly interface. In fact, it is able to make the actual learning experience more satisfactory and enjoyable.

2.3 The Three Design Principles

The first guiding principle of my study is the interactive principle, which means

providing more user-friendly interactive features for the users. Interactivity means ‘a dynamic and reciprocal communicative relationship between a user and a computerized media device where each new action is contingent on a previous action’ (Oxford Reference, oxfordreference.com, 2021). Interactivity can be based on the source, the message or the medium (Sundar, Xu and Buller, 2010). There are standard interactive features like clicking, dragging, expanding, etc. and enhanced interactivity like avatar and the 3D world (Sutchliffe and Hart, 2017).

Based on these theories, it is proposed that to follow the interactive principle, I can create both the interactivity that provides and the interactivity that enables. The LMS and MOOCs will be given more standard, medium-based interactive features, such as clickable and personalized recommendations and search results presented in interactive snippets. These features will provide users with more opportunities to interact with the system interface. Then, users will be encouraged by my UX design to participate in the forum discussions more, this will increase the message and source-based interactivity. The forum will be extracted from by the search engine. This design enables users to interact with the platforms more by being active creators of UGC.

The second principle is that a good e-learning platform's UX should be motivating students to learn. Scholars in psychology, education and UX have often used the dichotomy of internal and external motivation (Deci and Ryan, 1985). Extrinsic motivation can come from curricular requirements and social aspects. Intrinsic motivation is the result of autonomy, competence and relatedness (Deci and Ryan ,1985). The design of my Recommendation System (RS) and Search Engine (SE) follows the motivating principle. Because of the importance of motivation in educational and other activities like sports exercise and consumer activity, the motivating principle can be applied to UX design in those other field as well.

Last, I propose to design my e-learning interface to be standard, which means ‘accepted as normal’ and ‘used as a measure or norm’ (Oxford Lexico, Lexico.com, 2021). The focus of my study is to creatively apply the standard

Google-like or YouTube-like interface design elements to e-learning platforms, not to create a novel interface like some scholars have done for instance. Also, many studies that combine UX with interactivity and motivation leads to another non-standard design principle: gamification. The reason why the standard principle is followed rather than the novel one is because novel interfaces take great effort to design, develop and integrate.

2.3.1 The Interactive Principle

'Although interactivity has been defined and explicated in many ways' (cited by Sundar, Xu and Buller, 2010: 2246), this project uses Sundar's taxonomy of source, message and medium interactivity and Sutcliffe and Hart (2017)'s standard and enhanced interactivity classification. Based on their theories, it is argued that from the UX perspective, we can design the interactivity that provides opportunities for the users to interact with the system and the interactivity that enables the users to create User-Generated Content (UGC). The interactive principle has been around since the creation of the Web 2.0, but it is still relevant today.

Interactivity as a Parameter of UX

Many have marked interactivity as the key element to separate Web 2.0 from Web 1.0 (Flew, 2008; Jarrett, 2008). Interactivity is defined as 'a dynamic and reciprocal communicative relationship between a user and a computerized media device where each new action is contingent on a previous action' (Oxford Reference, 2021). The UX framework is frequently used to study interactive products (Hassenzahl and Tractinsky, 2006; Hassenzahl, 2010; Hassenzahl, Diefenbach and Goritz, 2010) like technological gadgets, online platforms or information systems. As a result, interactivity is often regarded as 'foundational to human-computer interaction' (Sundar, Xu and Bellur, 2010: 2247), not a parameter to assess the interaction.

When the classic UX dichotomy of pragmatics and hedonics (Hassenzhal, 2007) is based on interactive products, it is assumed that all items being analysed

have good interactivity. The fact is, in terms of interactivity, all items offer different experiences. Some applications like games, are already using enhanced interactive features like Avatar or 3D graphics. While other applications are still mainly deploying standard interactive features. Among those applications, some have a great deal of interactive features, others have relatively limited interactive features. As a result, De Angeli and Sutcliffe (2005), Sutcliffe and Hart (2017) have included interactivity as another parameter to UX research. In other words, questions like what types of interactivity it provides and the level of interactivity it offers can be used when conducting UX study towards a system.

The Importance of Interactivity

According to previous research, interactivity generally has a positive correlation with UX. Sutcliffe and hart (2017) found that interaction enhance UX. Interactivity has a proven link to elements of good UX like users' positive attitudes and satisfaction (Grigorovici, Nam and Russill, 2003; Lee et al.,2011; Lyons, Reysen and Pierce, 2012). Specifically, in the e-Learning context, interactivity has an impact on e-learning quality and effectiveness (Johnson, Hornik and Salas, 2008; Wang, Vaughn and Liu, 2011; Blasco-Arcas et al., 2013). 'Furthermore, animation and interaction may have had a positive effect on user perception of content which is an important finding for education related web sites' (Sutcliffe and De Angeli, 2005: 415). This further proves UX' value as a digital system's UX can affect users' perception of the content it provides.

On the contrary, Sutcliffe and Hart (2017) found in their user study that, many of the users' negative experiences are due to the lack of interactivity. Some of the comments include: 'There's hardly anything to click on'; 'When I clicked on pictures, I tried to show them full size, but I couldn't' (Sutcliffe and Hart, 2017: 236). Their study shows what users do expect an adequate number of interactive features when using a digital system. The lack of interactivity can lead to user dissatisfaction. Moreover, users regard interactivity as a UX parameter.

Source, Message and Medium Interactivity

Sundar (2007) and Sundar, Xu and Bellur (2010) proposes that there are three

types of interactivity: source interactivity, message interactivity the medium-based interactivity:

> While ‘‘source interactivity’’ refers to the interface’s ability to allow users to serve as sources or gatekeepers of communication (e.g., customization and blogging features) and message interactivity pertains to the interface’s potential for a threaded exchange of related content (e.g., bulletin board/chat features), medium-based interactivity refers to the different interaction techniques available on the interface for accessing embedded information (Sundar, 2007; Sundar, Xu, & Bellur, 2010; cited by Sundar et al., 2013: 112).

In short, source interactivity focuses on users, message interactivity focuses on the messages themselves and medium-interactivity emphases on the medium that facilitates the message exchange between users. Sundar (2007) and Sundar, Xu and Bellur (2010)’s taxonomy is selected because it covers ‘all three basic elements of mediated communication – source, modality, message’ (Sundar, 2007). As a result, this taxonomy provides a relatively comprehensive picture of interactivity that comes from all aspects of a communication process.

Standard and Enhanced Interactivity

Sutcliffe and Hart (2017) divide interactive features into standard and enhanced ones. Standard interactive features are ‘sliders and zoom control, mouse-over effects, and pop-up features improve users’ UX attitude ratings’ (Sundar et al., 2014, cited by Sutcliffe and Hart, 2017: 231) and ‘menus, links, sliders, icon manipulations; and interactivity to mediate communication between people, such as chat rooms, wikis, and feedback forums (Hoffman & Novak, 1996, cited by Sutcliffe and Hart, 2017: 231)’. They define ‘Enhanced Interactivity’ as ‘user interfaces which afford interaction in a graphical world with active media and mediated by a user presence’ (2017: 231). Examples include 3D interactive worlds and avatars. Sutcliffe and Hart (2017)’ theory is valuable in that it not only considers what can be achieved by technology today, but also looks into the possibility of technology in the near future.

The Interactivity that Provides

Combining Sundar, Xu and Bellur (2010) and Sutcliffe and Hart (2017)'s theories, interactivity can be divided into the interactivity that provides and the interactivity that enables. The first type of interactivity provides opportunities for users to engage with the digital systems. These interactive features include clickable and personalized recommendations and search results presented in interactive snippets. The second type of interactivity allows users to creatively contribute to the digital system by making forum posts and commenting on other users' posts.

Using the Interactivity that Provides to Guide UX Design

In order to boost interactivity that provides, my principle is to provide better medium interactivity by creating more standard interactive features. Medium-based interactivity refers to the different interaction techniques available on the interface for accessing embedded information'. (Sundar, 2007; Sundar, Xu, & Bellur, 2010; cited by Sundar et al., 2013: 112). The LMS and MOOCs will be given more standard, medium-based interactive features. These features can provide users with more opportunities to interact with the system interface.

A few examples include that users can interact with the system by typing into the search bar; users can scroll down the search history/suggestion menu dropped down from the search bar; users can click on links of recommended study materials. These features are created to better support users' learning and administrative goals when using an educational platform. In general, the proposed design can boost interactivity by providing more interactive features that can help users to achieve their goals.

The Interactivity that Enables

The interactive principle is not only providing, but also enabling. With the guidance of the interactive principle, the first aim is for the system to have more interactive features, so users can have more opportunities to interact with the system. To achieve this goal, the focus is on designing for medium-based

interactivity by enabling users to enjoy more standard interactive features like clicking, dragging, scrolling. The second aim is to enable users to take advantage of the interactive features, not as passive users but as active creators. UX designers should design more standard interactive features to generate more source and message interactivity.

Reflecting upon Foucault (1991)'s discipline theory, Jarrett (2018) argues that interactivity has 'non-disciplinary features' (Jarrett, 2008: 3). 'Discipline is a discursive framework by which activity is organised so that "the correct training" of individuals occurs (Foucault, 1991; cited by Jarrett, 2018: 2). 'Discipline … unifies the body and the tool into a single apparatus, fixing the relationship between them. Discipline requires the body and the tool to be 'brought together in a complex body–object articulation through tight organisation and coordination of movements' (Foucault, 1991; cited by Barry, 2001; cited by Jarrett, 2018: 3). On the contrary, interactivity has 'non-disciplinary' characteristics in terms of flexible time, creative capacity and body-object articulation (Jarret, 2008).

Interactivity has the following characteristics: flexible time, creative capacity and body-object articulation (Jarrett, 2018). Flexible time' means that 'instead of having content randomly pushed towards them at predetermined times and in predetermined formats, participatory media users have relative control over what and how they engage with a Web 2.0 site. This includes the time of activity both as producer and consumer' (Jarrett, 2008: 4). 'Creative capacity' refers to 'the capacity of a renewed agency in media production to disrupt the knowledge/power nexus (for instance, see Landow, 1992; Lanham, 1993) and the basic power relations of mass broadcast media' (Jarrett, 2008: 2). 'The individual texture, content and style of any individual's contribution to their blog, wiki, Flickr image or podcast, although enabled by the interactive functions of the technology, are not entirely structured by those affordances. This leaves space for creative expression' (Jarrett, 2008: 4).

Body-object articulation decides that interactivity does not entirely determine how users interact with the digital system. Instead, interactive features make it possible for users to consume information or create information in their own way.

This is how interactivity leaves creative space for users. Moreover, this space is flexible as users can choose when and where to interact with the system. In general, interactivity has the enabling function: it enables users to use digital systems in a flexible and creative way.

Using the Interactivity that Enables to Guide UX Design

To follow the enabling interactive principle means to encourage users to use the system according to their own need. Their need not only includes using interactive features as passive users, but also to generate their own content as active creators. Another inevitable buzzword of Web 2.0, other than interactivity, is User-Generated Content (UGC). 'User-generated content comes from regular people who voluntarily contribute data, information, or media that then appears before others in a useful or entertaining way, usually on the Web—for example, restaurant ratings, wikis, and videos' (Krumm, Davies and Narayanaswami, 2008: 10). To provide users with the enabling interactivity requires the proliferation of UGC on the concerned e-learning platforms. University forums are where the UGC is in LMS. Consequently, the university forums are used to support the design of my Search Engine.

According to Sundar et al. (2013), the enabling interactivity is source interactivity. ''Source interactivity'' refers to the interface's ability to allow users to serve as sources or gatekeepers of communication (e.g., customization and blogging features)' (Sundar, 2007; Sundar, Xu, & Bellur, 2010; cited by Sundar et al., 2013: 112). The definition of source-based interactivity links itself to the use of UGC. Enabling interactivity let users to access and use their university's forum easily. Again, standard instead of enhanced interactive features are designed here. As technology develops, more studies can be done to create enhanced interactive features.

The Relevance of Interactivity Today

The interactive principle is still relevant today. First, although the concept of Web 2.0 (O'Reilly, oreilly.com, 2005) has been popular for more than a decade,

Web 2.0 is still the dominant form of internet today. Second, in UX, we assume interactivity as a foundational characteristic of the subjects being studied. It is proven that Interactivity can and should be used as an evaluation parameter for UX as well. Third, many everyday technological products, especially institutional or educational information systems like the LMS and MOOCs, still have room for improvement in terms of interactivity. Because Web 2.0 is still popular today; interactivity is not only the defining characteristic of Web 2.0, but also a UX parameter; LMS and MOOCs still lack interactivity, for those three reasons, the interactive principle is still relevant today.

The interactive principle is not only applicable to education, but also can be applied to other fields. According to Sundar, Xu and Bellur (2010), interactive tools are also popular in other digital areas such as health-related information search, online shopping and artistic experiences. Interactivity, as a main selling point of computer/online games, has also been studied in relation to the UX of games (Jennett et al., 2008; Schild, LaViola, & Masuch, 2012). However, interactivy receives less attention in many other domains (Sutcliffe and Hart, 2017), such as education.

The interactive principle can be applied to other UX studies. If the goal is to evaluate and improve the UX of an interactive system or product, UX designers can analyse whether the system or product followed the interactive principle. Questions to be considered include whether there are enough interactive features to provide good UX and whether suitable types of interactive features were selected for the system. To better use the opportunities brought forward by the Web 2.0, we can design more interactive features that enable the users to use the system in a creative way. As technology develops, it may be possible for LMS and MOOCs to incorporate more enhanced interactivity features, such as creating 3D virtual leaning environment and avatar for learners and teachers.

2.3.2 The Motivating Principle

Promoting motivation is an important task in education. With the increasingly close combination of education and electronic technology today, the research on students' motivation has expanded to the study of e-learning platforms. Motivation is regarded as an important parameter to assess the UX of e-learning platforms. Motivation has been proved to improve students' academic performance (Munoz-Organero, Munoz-Merino and Kloos, 2010) and online learning success (Antino, 2008). Motivation is divided into extrinsic and intrinsic ones (Deci and Ryan ,1985). Extrinsic motivation can come from curricular requirements and social aspects. Intrinsic motivation is the result of autonomy, competence and relatedness (Deci and Ryan ,1985). By using a Recommendation System (RS) and a Search Engine (SE), my design follows the motivating principle to encourage students to learn using the LMS. My design promotes extrinsic motivation by presenting curricular requirements to users. It boosts intrinsic motivation by giving users autonomy, competence, and relatedness. Because of the importance of motivation in educational and other activities like sports exercise and consumer activity, the motivating principle can be applied to UX design in those other field as well.

Although it is rare to see previous researchers use motivation explicitly as their guiding principle, many scholars have discussed providing motivation as an important part of UX design. Ahn (2018) argues that good LX design should be engaging and promoting interest. In other words, a good e-learning interface should be motivating students to learn. In the theory of gamification, Miltenoff (2015) explicitly discusses motivation, in terms of internal and external motivation. Gagne (1965)'s nine events of instruction outline the essential process of teaching and learning. His theory includes that education needs to stimulate students with novelty, uncertainty, and surprise (Gagne, Briggs, and Wager, 1992). Novelty, uncertainty and surprise are tools used by educators to motivate students to engage in learning activity.

Intrinsic and Extrinsic Motivation

'Motivation refers to the internal processes that give behavior its energy and

direction (Reeve, 1996, cited by Zaharias and Pappas, 2016: 72)'. 'Energy relates to the strength, intensity, and persistence of the behavior concerned. Direction gives the behavior a specific purpose' (Zaharias and Pappas, 2016: 72). In education and psychology, motivation can be categorised into intrinsic and extrinsic motivation (Deci and Ryan ,1985). Intrinsic motivation comes from relatedness, competence and autonomy (Deci and Ryan ,1985). 'Relatedness refers to the universal need to interact and be connected with others. Competence refers to the universal need to be effective and master a problem in a given environment. Autonomy refers to the universal need to control one's own life' (Deci and Ryan, 1985, cited by Zaharias and Pappas, 2016: 66). Extrinsic motivation is 'grounded in external factors such as social approval/disapproval, rewards, or avoiding negative consequences' (Zaharias and Pappas, 2016: 72).

Motivation is regarded as 'perhaps the most important element' (Zaharias and Pappas, 2016: 72) and 'one of the main principles (Kim & Frick, 2011； Cited by Harandi, 2015: 426)' of education. It is believed that motivation has a very direct impact on student engagement and academic success. 'If students are more motivated to learn, then they are more likely to be engaged; and if they are engaged and engaged successfully, they are more likely to achieve the learning objectives (Kim & W. Frick, 2011; cited by Harandi, 2015: 429). As a result, promoting student motivation has been a constant quest in education.

Such motivation is influenced by UX: 'the number of hits to read e-learning content, the number of hits to participate in forums, and a student's updating his or her profile have been positively correlated with autonomous and e-learning-specific motivations' (Munoz-Organero, Munoz-Merino and Kloos, 2010: 471). Schober and Keller (2012) argued that User Experience is one of the most important factors that influence the learner's motivation. Based on a survey with 446 learning professionals, Zaharias and Pappas (2016) marked motivation as one of their four dimensions to evaluate the UX of LMS.

Extrinsic Motivation Design: Motivation from Curricular Requirements

Arguably, students' use of the LMS is motivated by their curricular

requirements. Schober and Keller (2016), Mayr et al. (2009) and my experiment all confirmed that students' motivation to use the LMS is not high all the time. Their motivation is high when their study required them to use the LMS. In order to promote university students' extrinsic motivation by UX design, it is required to present more content based on their curricular requirements.

Students' motivation to use the LMS is not consistent. Harandi (2015) found that e-learning technology itself can enhance students' motivation to learn. Schober and Keller (2016) argued that with LMS, the common expectation is that student can 'learn anytime, anywhere' (2016: 39). However, students are not really motivated to take this opportunity (Schober and Keller, 2016). In fact, students' motivation to use LMS is higher in class than out and high when they are given tasks and right after workshops. Schober and Keller (2016) found that students' LMS activities 'outside of their lessons is generally low throughout the year' (2016: 39). The activities peaked only when they were required to do discussions and after they attended workshops (Schober and Keller, 2016: 39). Schober and Keller (2016)'s discovery is supported by Mayr et al. 'The LMS was more often accessed during lessons than from outside school' (Mayr et al., 2009; cited by Scholar and Keller, 2016: 39).

Although Schober and Keller (2016)'s study is based on school students aged 15-19, not university attendees, their work is still relevant. The fact that they analysed school students can possibly explain why the motivation is high during in class hours. As university students have the need to do self-study after class, their motivation to use LMS outside classes might be higher than school attendees. However, their study is still relevant because they studied users' motivation in the academic context. There might be similarity between school attendees and university students' motivation, for example, university students do not have the same level of motivation to use LMS 'anytime, anywhere', neither. They also have peaks and low points in their motivation. This is supported by my experiments as my participants expressed that they felt more drive to use the LMS when they study for what was covered in class, do assignments and during exam times. Other times, they felt more drive to use other platforms like Google or YouTube, or other subject-specific websites.

Arguably, students' use of the LMS is motivated by their curricular requirements. Schober and Keller (2016), Mayr et al. (2009) and my experiment all confirmed that students' motivation to use the LMS is not high all the time. Their motivation is high when their study required them to use the LMS. For example, when they are given a task or assignment to finish, or when they are studying for an exam. Consequently, to follow the motivating principle, the LMS should present more content related to students' curricular requirement. This accounts for why I design my Recommendation System (RS) to use the required and extended reading lists as recommendation seed. In this way, the LMS actively integrates curricular requirements and promotes students' motivation.

To present more content based on curricular requirements is providing extrinsic motivation. "It is extrinsic motivation if the person participates in the activity because he/she is attracted by external factors (e.g., getting good grades, doing schoolwork to get rewards and special privileges) rather than the activity itself (Ryan & Deci, 2000; cited by Sun and Hsieh, 2018: 106)'. According to the definition of extrinsic motivation, curricular requirements are an important source of extrinsic motivation.

Intrinsic Motivation Design

According to the Intrinsic/Extrinsic motivation model and Self Determination Theory (SDT), intrinsic motivation mainly results from three aspects: autonomy, competence and relatedness (Deci and Ryan, 1985), as mentioned earlier in this thesis. All three aspects can be applied to UX design to reinforce the motivating principle. The two main parts of my UX design, a RS and a SE are construct following the motivating principle.

The first source of motivation is autonomy, which can be provided by a Recommendation System (RS) and a Search Engine (SE). 'The need for autonomy represents individuals' inherent desire to feel volitional and to experience a sense of choice and psychological freedom when carrying out an activity' (deCharms, 1968; Deci & Ryan, 2000; cited by Van den Broeck et al., 2010: 982). In UX design, creating autonomy requires giving users choices, so

they can easily select or look for the information or function they need. It can be achieved by generating more interactive features by a RS and a SE. A RS not only gives users more information to select from, but also this information is generated based on their use of the system. In this way, autonomy is given another layer of meaning. With the SE, when the users' desired information or function is not presented on a webpage, he or she can search for it.

Another dimension of intrinsic motivation comes from users' sense of competence. 'The need for competence is defined as individuals' inherent desire to feel effective in interacting with the environment' (Deci and Ryan, 2000; White, 1959; cited by Van den Broeck et al., 2010: 982). 'Competence satisfaction allows individuals to adapt to complex and changing environments, whereas competence frustration is likely to result in helplessness and a lack of motivation' (Deci & Ryan, 2000; cited by Van den Broeck et al., 2010: 982). Applying their theory to UX, if our targeted users feel relatively competent when using the LMS or MOOCs, they are more likely to motivate themselves to learn from those platforms. If users feel they are not familiar with or not efficient enough at accessing these systems, they will be less driven to use them. Consequently, an e-learning platform with the motivating effect should offer its users a sense of competence.

UX designers can make their users feel competent from two aspects: create easy-to-use interface and fulfil users' common expectation. With an easy-to-use interface, users do not need to spend too much time or effort. It is easy for an average user to understand the platform's functioning mechanism and achieving their goal of use. Users' common expectation include how easy it is to navigate through a platform and what functions a platform should have. An average user should not feel that only pro users can master it or constantly feel the need to seek help.

The third aspect in intrinsic motivation is called 'relatedness'. 'The need for relatedness is defined as individuals' inherent propensity to feel connected to others, that is, to be a member of a group, to love and care and be loved and cared for' (Baumeister & Leary, 1995; Van den Broeck et al., 2010: 982-983).

Arguably, relatedness in intrinsic motivation and the social aspect in extrinsic motivation make the intrinsic/extrinsic model more united than separated. They both address the human need to be connected to and even valued by others. In consequence, social aspect can impact users' motivation to interact with a system. In order to boost motivation, UX designers can promote users' social presence and interaction. Among the many functions in today's LMS and MOOCs, the discussion forums are one that have a great number of features of social networks or can be seen as a social network itself (Bandias and Guiding, 2012; Krishnan and Rogers, 2015). As a result, while we design the RS and SE of LMS, we can make use of the discussion forums.

Following Deci and Ryan (1985)'s Extrinsic/Intrinsic motivation model, to promote motivation by UX design should also consider theories and practice from the intrinsic aspect. Intrinsic motivation results from autonomy, competence and relatedness (Deci and Ryan, 9185). To foster autonomy requires giving users more choices in accessing information and functions. To make users feel competent, the system needs to have a user-friendly interface that is both easy-to-use and can fulfil users' common expectation. Lastly, users' intrinsic social needs have to be addressed too, so that the system can enhance its motivating ability by relatedness.

2.3.3 The Standard Principle

In the standard principle, 'standard' has two meanings: 'accepted as normal' and 'used as a measure or norm' (Oxford Lexico, Lexico.com, 2021). The standard principle requires designers to follow industrial standard like Google and YouTube to design the SE and RS. Google and YouTube achieve the industrial standard status because of their large user base, users' familiarity with their UI and satisfaction with the UX they provided. Google and YouTube's SE have a long search bar in the centre of their webpage, where users can type in their search's key words and get results in the Search Engine Research Pages (SERPs) Google and YouTube, especially YouTube, display clickable recommendations on the right part of the UI. Following the standard principle also means that novel UX design principles and ideas, such as gamification and

questionnaire-based search engine is not the main focus of this project.

In the English language, the word standard has many meanings. In this thesis, standard has two layers of meanings. First, it describes something that is ‘used or accepted as normal or average’ (Oxford Lexico, Lexico.com, 2021). Second, a standard is ‘something used as a measure, norm, or model in comparative evaluations’ (Oxford Lexico, Lexico.com, 2021). In general, a standard design principle means that we seek to make the system normal and follow the examples of established industrial leaders. It is not the aim of this thesis to design LMS and MOOCs to be niche, novel, or avant-garde.

Using the Standard Design to Guide UX Design

Google-like standard SE interface is as such: ‘the standard type-keywords-in-entry form/view-results-in-a-vertical-results-list interface’ (Hearst, 2011: 60). Google and YouTube’s SE have a long search bar in the centre of their webpage, where users can type in their key words and get results in the Search Engine Research Pages (SERPs). The Search bar consistently presents on each pages of the website, so users can interact with the SE whenever they want. Other standard Google-like, YouTube like features include a drop-down menu that appears beneath the search bar to present user’s search history and search suggestions. The SERPs display search results in interactive snippets.

When it comes to the interface of Search Engine (SE), Google is often seen as a standard. Nowadays, Google is also used as a synonym of search. Instead of saying ‘search for something online’, we can say ‘Google it’. This also confirms Google’ status as an industrial standard. Scholars like Hearst (2011) and Kammerer and Gerjets (2011) specifically use the term ‘Standard Google-like’. Moreover, the standard principle contributes to Google’s popularity, transfers into positive UX and fortifies users’ familiarity.

The Benefits of Being Standard

The standard Google-style search UX contributes greatly to Google’s overwhelming popularity. Researchers like Schonfeld and Guthrie (2006) and Perruso (2016) have found that Google is the most popular search engine for

college students and faculty. When they ask their research participants why they favour Google, the response they give is usually in terms of UX, not the search result quality. For example, one student in Griffiths and Brophy (2005)'s study said the following about Google: 'Google is very straight forward. You put in your word and it searches.... Bright, eye-catching—simple. Not confusing' (Cited by Perruso, 2016: 616).

Many scholars argue that a standard Google-like search bar provides positive UX. Gross and Sheridan (2011) have that 'a single search box discovery solution …was an effective interface for users (2011: 236).' It is 'simple to use', 'smoothes the navigation for students' and 'seemed to deliver satisfactory results' (Gross and Sheridan, 2011:236). It should be 'applied to all sources …because of its clarity and ease of use' (2011: 242).

Additionally, as so many major websites adopt a standard Google-like interface, users are familiar with this type of interface. With a novel interface, an average user often needs to invest time and effort in understanding the mechanism behind it. Consequently, a novel interface usually is not an easy to use one. 'An easy-to-use search interface is one that intuitive to use and 'makes sense' to average users so that they do not spend time thinking how to use it' (Fatima, Luca and Wilson, 2014 a: 925). When interacting with a system, users will often prefer familiarity to novelty. 'End users will often use default sources (Marchionini, 1989) that have proven useful in the past, or that are readily accessible and easy to use' (Marchionini, 1992: 158).

A Criticism on Gamification

When it comes to Recommendation System (RS), very limited attention has been given to the design of its UX and UI (Murphy-Hill and Murphy, 2014). This thesis argues that the design of RS interface for LMS and MOOCs should also follow the standard principle. By following such a principle, Google and YouTube's example can be followed Google and YouTube, especially YouTube, display clickable recommendations on the right part of the UI.

Research combining interactivity, motivation and UX often leads to the topics of gamification (Gautam, 2012 cited by Zaharias, 2016; Buckely, 2016; Sun and Hsieh, 2018). '"Gamification", an umbrella term for the use of video game *elements* (rather than full-fledged games) to improve user experience and user engagement in non-game services and applications' '(Deterding et al., 2011:2426). Computer games generally have many interactive features and are designed to motivate users to play. The assumption is that if educational systems can boast the same level of interactivity and motivation as games, they will be more attractive to students and make the learning experience more enjoyable and effective.

For a few reasons, this project follows the standard principle, instead of novel UX design principles like gamification. Some of the reasons include gamification is still a niche area; It will take great effort to design, develop and integrate it with educational platforms; Not all functions of LMS and MOOCs can be gamified, especially the administrative ones. It is not necessary to gamify the student administration functions of LMS. It is easier to apply gamification to small scale study task.

Dichev and Dicheva (2017) argue that Gamification has other drawbacks such as the concentration on certain subjects and areas and the ignorance of others, not being systematic enough and failure to achieve the expected motivation. According to Dichev and Dicheva (2017)'s research, the majority of gamification projects is on subjects from Computer Science (CS) and Information Technology (IT). MOOCs also have more gamification applications than LMS. MOOCs also have more gamification applications than LMS. Moreover, Dichev and Dicheva (2017) argue that there is a lack of systematic study of gamification in education. For them, systematic studies have to consider 'what kind of game elements under what circumstances can drive desired behavior are not quite systematic' (Dichev and Dicheva, 2017: 9). This means that many of the research on gamification are too theoretical but have very little practical impact. This is another reason why gamification, despite its many attractive attributes, is still not widely applied. As a result, 'effect on motivation or participation is lower than the expectations created

by the hype' (Broer, 2014; Cited by Dichev and Dicheva, 2017).

Other Novel Ideas

Institutional platforms, like those in the banking, medical and educational areas, do not see themselves as search engines. They see their end product as offering real-life services such as banking services, medical assistance and education. For institutional systems, search is more of a transitional nature. Consequently, if they add a search engine onto their digital system/platform, they may hold different perspective from Google and YouTube and may expect their users to have different search goals.

For this reason, when designing search engines for institutional platforms, some designers/ researchers divert from the standard Google-like interface and try to explore whether a novel interface is a better option. One novel example is Luo (2009)'s medical information search engine, known as iMed, uses a questionnaire-based interface. Luo notices that many users are not able to phrase their medical questions well and 'doctors often use questionnaires to interact with patients' (Luo, 2009: 1380). As a result, iMed's search interface's first level is a questionnaire containing 'the 34 most frequently encountered symptoms and signs accounting for more than 80% of the chief complaints with which physicians are confronted' (Luo, 2009: 1382). The main goal of Luo's design is to improve usability and 'search result quality' (Luo, 2009: 1379).

Luo (2009)'s design's conceptual framework is User Experience instead of algorithm, which gives his project an obvious merit: he designs with users' need in his mind and his design goal is to be user-friendly. Many scholars (Clements, Pawlowski & Manouselis, 2015; González-Pérez, Ramírez- Montoya and García-Peñalvo, 2018) argue that today, it is much more common to measure a digital system's success from the software developers' perspective, rather than from the users'. His system has two groups of users: patients and doctors. This questionnaire-based interface serves both groups for it helps patients to express themselves in a way that doctors can easily understand. In addition, Luo (2009)'s interface 'takes into consideration the unique requirements of medical search' (Luo, 2009: 1390). It is the result of situating UX design in a specific field.

Luo argues that ‘iMed makes the user find results in fewer iterations, view fewer search result Web pages, spend less time on the search process, and achieve a higher success rate’ (2009: 1389). I agree with Luo (2009) that with iMed, users do type less and view fewer search results. However, I do not think iMed’s search interface is necessarily timesaving and successful in achieving users’ search goals.

Compared to a standard search interface, users do type less and view fewer search results on a questionnaire-based one. With the questionnaire, it is possible that a user does not need to type any keyword or sentence because he/she can just keep clicking on the questionnaire entries until a satisfactory result is reached. Then, because the questionnaire greatly narrows down the search scope, it is possible for users to view fewer search results. This is a great achievement in terms of search result display because users prefer to read as few search results as possible. In fact, most users usually do not even go beyond the second page and the pages after the second for search result (Craven & Griffiths, 2002; Sullivan 1998, 2002; also cited by Griffiths, 2005: 551).

However, ‘spending less time’ (Luo, 2009: 1389) and ‘achieving a higher success rate’ (Luo, 2009: 1389) are relative. This questionnaire-based interface can actually be more time-consuming than a standard search bar because users have to read through 34 symptoms and signs, while with a standard search bar, they just need to type in a few words. In turns of success rate, it is difficult for users whose condition is not listed among the 34 symptoms to use iMed and achieve their search goal. For users whose symptoms and signs are included in the list, they may have a higher success rate than those who use a standard search bar and is not able to describe their symptoms in a way that medical professionals could understand easily.

Another novel design idea is not inspired by potential institutional requirements but driven by the aspiration to improve UX by proposing a smart way to ‘correct and prompt alternative queries’ (Fatima, Luca and Wilson, 2014 a: 926). This idea is Fatima, Luca and Wilson (2014 a)’s ‘Bag of Keywords’ search interface. When

a keyword for search has different meanings, their system sends users a ‘bag of keywords’, from where users have to select the correct meaning of their keyword. For example, for a search like “java and apple” the user can tag “java” as {language or place} and “apple” as {fruit or device}’ (Fatima, Luca and Wilson, 2014 a: 926).

A major drawback for these novel interfaces is that users need to spend time and effort in understanding how to use it. Luo (2009) has realized this issue himself. ‘All the users are familiar with the traditional keyword query interface and the sequential order presentation of search results. It took these users a while to become accustomed to navigating the search result hierarchy in iMed’s answer interface’ (Luo, 2009: 1389). ‘Participants’ lack of experience and familiarity with tags/tagging specifically in the banking context affected the outcome of this study. We believe this played an important role in the actual user performance’ (Ravendran, MacColl and Docherty, 2012: 157). With the ‘bag of keywords’ interface, users have to understand that when they type in their keywords, what they are given first may not be the search result, but options to tag their actual query among a list of possible queries.

Conclusion

To sum up, ‘standard’ means ‘accepted as normal’ and ‘used as a measure or norm’ (Oxford Lexico, Lexico.com, 2021). The standard principle requires designers to follow industrial standard like Google and YouTube to design the SE and RS. Google and YouTube achieve the industrial standard status because of their large user base, users’ familiarity with their UI and satisfaction with the UX they provided. Following the standard principle also means that novel UX design principles and ideas, such as gamification and questionnaire-based search engine is not the main focus of this project.

Chapter 3 Methodology

The methodology behind this project is Human-centred Design (HCD) which informs UX work: the emphasis on human involvement in all stages of the data collection process. The conceptual framework is User Experience (UX) research: the study of 'all aspects of the end-users' interaction with the… services' (Norman and Neilsen, nngroup.com, 2019). My project mainly uses qualitative methods.

Chapter 3 introduces and justifies this project's data collection and analysis method. This is a qualitative research project that uses observation and semi-structured interview as its data collection method. Both methods are established UX research methods. The participants are five full-time English-speaking university students (bachelors and masters) based in Australia. This is a low-risk human research projects that asks for limited information from the participants and uses anonymity to protect the participants' identity. The number of participants is justified by UX theories and feasibility. The data is examined using thematic analysis combined with inductive reasoning. The combination of methods is selected to take advantage of TA's flexibility and accessibility, as well as to compensate for its limitations.

3.1 Data Collection Stage 1: Observation

The first stage of my research was observation of users' behaviour. Observation is an established UX research method (Interaction Design Foundation, 2017), whose main advantage is that it provides data within minimal interference to users' lives. Observation is also known as 'shadowing', which means that 'the researcher accompanies the user and observes how they use the product or service within their natural environment' (Interaction Design Foundation, 2017). Observation helps the researcher to gain access to users' behaviours that are not filtered by users' own words. 'It allows you to observe behavior rather than opinions' (Interaction Design Foundation, 2017).

However, this aspect of the technique also leads to a disadvantage: there may be times when the researcher feels that he or she needs some explanation about a user's particular behaviour. Moreover, although an observer can infer users' emotions, a further interview can confirm or contradict a researcher's understanding. Consequently, this project's observation will be followed by interviews.

Participants for the study were recruited through purposive sampling. 'A purposive sample is a non-probability sample that is selected based on characteristics of a population and the objective of the study' (Crossman, 2017). With a relatively small data pool, purposive sampling allows the researcher to narrow down the scope of the study and reach the targeted participants with manageable effort. The control is tight but not too tight, so it still leaves space for rich data.

The participants were current university students based in Australia, who have a laptop and consider themselves familiar with digital services such as YouTube and MOOCs. All participants were currently undertaking a university-level course, so they had access to their universities' LMS. All participants studied at universities based in Australia so they all had suitable levels of English and face-to-face data collection was process possible (the last collection session was online because of the Covid-19 restrictions). Participants were also required to have adequate knowledge of how to use YouTube and some previous engagement with YouTube's educational content.

This is a low-risk human research projects that asks for limited information from the participants and uses anonymity to protect the participants' identity. This project generally presents very low risks to its participants, in terms of physical, psychological and social aspects. Only very limited demographic information was collected from them: their age, identified gender, area and level of study. When I shadowed their use of their LMS, I specifically asked them not to show their subject results or academic transcripts. No other potentially sensitive information was presented, either. In the Appendix where the interview transcripts are

attached and the analysis of the transcripts, participants are referred to as Participant A, B, C, D and E, not by their real name. When participants mentioned the name of their university, universities are coded as major metro university 1, 2, 3 and 4. Limited information and anonymity are used to make sure the participants will not be identified, and no sensitive information will be collected or used to cause them harm. This project' ethics is approved by the University Human Research Ethics Committee. The ethics approval number is HRE18- 179.

The number of recruited participants were five because this number is feasible and can still yield adequate data. 'Shadowing is, by its very nature, a qualitative research technique. It is too time consuming and resource intensive to be conducted on a massive scale' (Interaction Design Foundation, 2017). 'Elaborate usability tests are a waste of resources. The best results come from testing no more than 5 users…' (Nielson, nngroup.com, 2000) 'As soon as you collect data from a single test user, your insights shoot up and you have already learned almost a third of all there is to know about the usability of the design' (Nielson, nngroup.com, 2000). According to Nielson (2000), the next four users can all generate a small amount of new data with a large amount of data repeating those from previous participants. 'As you add more and more users, you learn less and less because you will keep seeing the same things again and again' (Nielson, 2000). Consequently, Nielson (2000) argues that in UX research, you only need to test with five users.

Before each session began, the participant was asked to give some basic demographical and educational information, which includes their age, gender identified, level of study and area of study. Limited personal information was collected from participants to protect privacy. Participants of different genders, levels of education and areas of study created diversity in the data set. The participants were two males and three females aged between 22 to 32. Their areas of study covered arts, science and business. There were also different levels of digital media proficiency. For example, Participant A is enrolled in a Masters of Computer Science and is studying recommendation systems.

	Educational level	Age	Gender	Area of Study
Participant A	Master	26	Male	Science (Computer Science)
Participant B	Bachelor	22	Female	Science (Radiography)
Participant C	Bachelor	22	Female	Arts (Education, History and French)
Participant D	Master	32	Female	Arts (Psychology)
Participant E	Master	30	Male	Business (MBA)

Participants' Information (Demographical and educational)

Then, participants were required to think of one topic in their recent study that probed them to learn more. In the observation session, participants were asked to use YouTube to study their chosen topic for approximately 20 minutes. Then, they were asked to continue studying their chosen topic using their university's LMS (Learning Management System) or MOOCS (Massive Open Online Courses). This part was approximately 10 minutes. Each shadowing session was about 30-minute long.

During the observation session, YouTube was given more time, participants required time to watch YouTube videos, while LMS usually generally does not have as many videos. Videos from MOOCS like LinkedinLearning.com were likely to be too long to be covered in the observation session, so users were not given time to watch them fully.

In each session, the researcher sat next to the participant to observe their activities including searching for resources, consuming verbal/audio/visual resources, interacting with resources and other users and negativing between different platforms. The researcher took notes of users' action not interfering with the users' actions. Each participant's screen during the session was recorded

with two iPhone cameras. One camera was set up to record the participant's laptop screen. All on-screen interaction such as the mouse movement, scrolling and video playing were recorded. Another camera was set up to record participants' general action, such as their posture, facial expression and interaction with their keyboard. All video data was stored digitally in Victoria University's R Drive.

3.2 Data Collection Stage 2: Semi-structured Interviews

As argued in previous stage, observation is a good UX method, but it has its limits and is better used in combination with other methods. Consequently, observation is followed by interviewing. Follow-up interview 'helps ensure that participants are actively engaged, and are collecting the required information' (Gaffney, infodesign.com.au, 2006). The next stage of this research is centred on semi-structured individual interviews of the five observed users. As observation does not include interaction between the researcher and the participants, 'researchers often need to probe for more detail based on what they learn in shadowing exercises' (Interaction Design Foundation, 2017). Interviews are an effective method for extracting more information from users. This section was made of the interview process, transcribing interviews and analysing interviews.

The interview was conducted directly after each shadowing session, so that the users still had fresh memories of the observation sessions. The interviews were semi-structured. A question database containing around 20 open-ended questions was prepared. From this database, 10 to 15 questions were selected for each participant. Depending on participant's interaction with the digital systems in the shadowing session and his or her answers to the prepared questions, new questions outside of the prepared questions were also asked. Each interview was about 20 minutes. Twenty minutes was enough to acquire answers needed.

Interviews, especially semi-structured interviews, are a popular qualitative

research method. In order to decode the dynamics behind social media users' publicity and privacy, Lange (2008) conducted 54 interviews. Each interview lasted from one to three hours. The interviewees 'ranged in age from 9 to 43, although most were in the mid-teens to early 20s range' (Lange, 2008: 365). The interviewees came from 'the research team's personal networks' (Lange, 2008: 365) and email recruitment (Lange, 2008). Her interviews are semi-structured because she adapted them 'to the interviewee's particular interests and background' (Lange, 2008:366). The used method is similar to Lange (2008)'s in that both projects utilized semi-structured individual interviews, convenience sampling and purposive sampling.

3.3 Data Analysis Method: Thematic Analysis Combined with Inductive Reasoning

All transcripts were analysed using thematic analysis. Thematic analysis is a 'widely used qualitative analytic method' (Braun and Clarke, 2006: 77). It is 'a method for identifying, analysing and reporting patterns (themes) within data.' (Braun and Clarke 2006:79). 'A theme captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set' (Braun and Clarke, 2006: 82). The advantage of using thematic analysis as a qualitative research method lies in its accessibility and flexibility (Braun and Clarke 2006: 76). 'Thematic analysis is not wedded to any pre-existing theoretical framework, and therefore it can be used 'within different theoretical frameworks (although not all) and can be used to do different things within them' (Braun and Clarke, 2006: 81).

Semantic analysis can be done with two different approaches, an essentialist/ realist approach and a constructionist approach (Braun and Clarke, 2006). 'With an essentialist/realist approach, you can theorize motivations, experience, and meaning' (Braun and Clarke, 2006). On the contrary, 'thematic analysis conducted within a constructionist framework cannot and does not seek to focus on motivation or individual psychologies, but instead seeks to theorize the sociocultural contexts, and structural conditions, that enable the individual

accounts that are provided' (Braun and Clarke, 2006). As this project is UX research, exploring users' inward experiences, it is arguable that an essentialist/realist approach is more suitable.

When using thematic analysis, researchers can determine whether the theme is important or not, not necessarily according to whether the theme is re-appearing across the data or the quantity of its appearance (Braun et al., 2006). This makes thematic analysis a flexible method that gives the researchers a light but reliable foundation for interpretation. However, thematic analysis is not without limitations. One major disadvantage comes from its advantages: flexibility and accessibility make it difficult to decide upon a theme. Another less obvious drawback is that 'a thematic analysis has limited interpretative power beyond mere description if it is not used within an existing theoretical framework that anchors the analytic claims that are made' (Braun et al., 2006: 97). Another drawback to compensate for those two points, I combine thematic analysis with inductive reasoning, also known as induction or inductive approach. 'Induction is the form of reasoning based on empirical observation in the process of developing scientific laws and theories' (Bendassolli, 2013:2).

The Thematic Analysis used in the inductive manner is as such: all five transcripts were read through to look for patterns in the exact words they said and the non-explicit expressions, with reference to the video recordings and the observation notes. In the end, two major themes merged across the transcripts that can be explored to improve LMS and MOOCs' User Experience (UX). These are: Recommendation Systems (RS), Search Engines and a video-based social network.

The data used for analysis were mainly the interview transcripts, not the video recordings. However, the observation sessions and their recordings are still necessary for a few reasons. First, users were asked to reflect on their experience in both their previous study and the observation session. The observation session provided the participants with a layer of foundation to answer the questions and the researcher a glimpse of the students' whole learning experience, which was

much more than the 30-minute shadowed session. Second, During the semi-structured interviews, the impromptu questions were formed based on the observation.

In conclusion, this is a qualitative research project mainly consists of observation and semi-structured interviews. Five university students were recruited as the observation participants by purposive sampling. They were asked to use both YouTube and formal educational platforms in individual 30- minute sessions. Afterwards, participants were interviewed independently for approximately 20 minutes. The interviews were semi-structured. Observation and interview were selected as the data collection method because they are both common and feasible. The combination of these two methods can yield enough data for the research topic. The interview transcripts were analysed using thematic analysis combined with inductive reasoning.

Chapter 4 Data Analysis

The main purpose of this thesis is to find out as an educational resource provider, what perspectives can YouTube provide to university E-Learning projects (from the UX perspective). Research questions include what role UX plays in university students' learning activity; what elements of YouTube's UX are relevant to university websites like LMS and MOOCs; and what principles are used to guide my design.

This chapter analyses the data and answers the main research question and sub questions. In general, university can learn from YouTube the importance of UX; specific design elements favoured by users and guiding principles for design. First, UX plays an important role in university students' learning activities, because good UX can improve users' learning experience. Second, the two major UX elements of the YouTube experience that can be extracted by universities are the Recommendation System (RS) and the Search Engine (SE). Lastly, users require their e-learning platforms to be interactive, motivating and standard. Consequently, 'interactive, motivating and standard' are my guiding principles.

The first research question discusses the role UX play in university students' learning activities. UX plays an important role in university students' learning activities. Firstly, good UX can significantly benefit students' learning experience. For example, RS help students to find useful learning materials; SEs help students to maintain their unique learning styles and achieve their individual learning goals. Secondly, university users compare the UX delivered by different platforms and suggest that LMS learn from Google and YouTube. This shows that scholars need to make comparison between the educational platform of universities and commercial platforms, and then extract the positive aspects of commercial platforms' UX for use by university platforms.

The second research question specifically asks for YouTube's design elements that can be used by university. By anaylsing the data, it is argued that the two major UX elements of the YouTube experience that can be extracted by

the universities are the Recommendation System (RS) and the Search Engine (SE). RS is selected because participants expressed that LMS do not have enough learning materials for them. The recommendation of study resources is an important activity in their academic life. Moreover, they think highly of YouTube's RS. According to the interviewees, SE is another positive attribute to YouTube's UX. SE helps users to achieve their study goal in a timely manner and presents the information in an organized manner. It is also arguable that, SEs help users to maintain their unique learning styles and achieve their individual learning goals. Consequently, it is argued that a SE is necessary for improving the UX of LMS and MOOCs.

The last research question studies the principles for my design. The data shows today's university students are familiar with commercial platforms like Google and YouTube. They frequently use those websites to study and compare their UX with LMS' and MOOCs'. As a result, university users require LMS and MOOCs to be more interactive, motivating and standard. These are the guiding principle of my design.

4.1 The Need of a Recommendation System (RS)

Introduction

One major aspect that contributes to YouTube's positive UX is its Recommendation System (RS). The interesting finding is that, although university users think positively of YouTube's UX, they are not always satisfied with the educational standard of the content produced by the YouTube interface. Recommendation of learning materials is common and useful among university educators and students. However, this type of recommendation is not yet integrated to a sufficient standard in LMS systems. In the interviews, attendees have expressed that the lack of additional learning materials is a main reason for their dissatisfaction of LMS. Consequently, designing a RS for LMS that recommends learning materials is justified. In this section I unpack the interview data to explore users' perceptions of the user experience of different digital

services.

RS and Good UX

One major reason student think highly of YouTube's UX is its Recommendation System (RS). When describing the UX provided by YouTube's RS, attendees used positive words like 'convenient', 'handy', 'good' and 'interesting'. The RS was perceived as helpful to their study because it helped them to find more learning materials than what they were originally provided. The following comments from participants indicate that they were looking for more information than what was in their LMS:

> *'Most of the time YouTube is very convenient for us because the people who are giving their YouTube videos also give some relevant links through which you can go and read more documents'.*

Other participants add an important point. The 'recommended videos' feature in YouTube allows viewers to select other videos on the same topic if the delivery style of a video does not appeal.

> *'I think the design feature of showing the recommended videos, like related videos. I think that's really handy because as I, if you can't, if you don't like the one you're on, you see other ones that are similar or ones that have a similar topic but a bit different. Like it's really good to find them as well'.*

> *'Ah the crash course history one, I'm like, just came up when I looked up ancient Egypt. Um, and then I noticed that it had like a playlist of this whole channel. So, I clicked on that and I had 40 something videos and every video just had a different focus. I think that's a really good idea. So that was really good. I'm like, that's a really good one that could be used as a, as a refresher. That makes sense. You could just find what you're looking for. Yeah'.*

LMS' Lack of Learning Materials

Attendees found that their current LMS present very limited amount of learning materials. At the moment, LMS mainly present lecture slides, lecture recordings and subject reading lists. However, students do want to get more content in relation to their study. the following extracts, the participants expressed that they now used LMS mainly for accessing their course materials and university administration functions like emails and exam results. Words like 'only' and phrases like 'not any extra' repeatedly occurred, which demonstrates their frustration over this situation. One of the participants even explicitly compared LMS to one of his frequently used MOOC and praised the MOOC's recommended subtopics function. Students' need for more learning materials on LMS calls for LMS to have a Recommendation System.

> *'My general impression is it can improve. It can improve in the form of presenting the study material towards the students because we get the study material only with respect to the topic and the slides that we have, so we have the slides and the topics, we don't get any extra material or any extra references to go and do search for other topics. So, that's where LMS lacks'.*

> *'We get more content here (a MOOCs website) …. So, if you are taking a topic you can get subtopics also'.*

> *'If they are going into one topic, then they are covering all the subtopics of that. So basically, LMS has only those topics which is (are) covered in class, not apart from that'.*

> *'Usually, I only use my LMS to download the study materials, including lecture slides and lecture recording. Or use my LMS to check the assignment and exam results.*

A university student can have different study goals, such as passing exams,

or other forms of end-of-semester assessments, expanding the understanding of a subject beyond the classroom output and applying practice to knowledge. The current LMS information structure is only mainly serving the first goal. In other words, LMS is now mainly being used as a course material repository. As a result, the rest of students' need has been overlooked.

This participant explicitly said that LMS need to provide more content:

> *'Because fulfilling goal will require more content than what we are getting on LMS'.*

According to the following interviewee, LMS can fulfil some of their study goals, but not all goals:

> *'So, just achieving a goal would be like just passing those exams, I guess LMS is sufficient. But, if the goal is to pass the exam, a full understanding of how the subject is and also the practical application of that subject, then I guess elements lacks there. So, you need more than LMS'.*

Same as the above interviewee, the following interviewee also said that LMS can fulfil basic study goals like downloading course materials. However, he has higher expectation of LMS. He hopes LMS can also attain to his more sophisticated requirements in learning:

> *'If I just download my study materials in the LMS, then in the past 10 minutes I have completed my goal. But I hope that LMS can help me accomplish more learning goals, especially some complex questions or learning tasks without clear answers.*

The following transcripts show that the Limitation of learning materials on LMS has become a major trigger for unsatisfactory UX.

> *'There is a content limitation on LMS because there are only covering the things that we covered in class. It is like a repeating kind of stuff'.*

‘I initially used it just to download lecture notes or watch online lectures or upload assignments and all that. That's all that I really need it for’.

‘I think it's just a platform for me to just like download, like when I said like just to download lectures and all that.

‘I don't think there's much content on there. Um, other than like my technician (technical) rights or something like that, I would use that for when I listen to lectures and I’ll just take points from this. I did the same thing. I put like the um, the lecture notes on one side and my notes on the other and I just kind of copy. But um, in terms of websites for me, I didn't really use, like I don't feel like it's useful at all’.

‘Some lecturers don't use LMS very much. So, there's no new information being uploaded. So, it's kind of like an open bookshelf where you just take everything that you need at the start and then you don't really return there’.

Outside Sources are not Enough

As discussed above, LMS are not giving students enough learning materials. As a result, students have to go to other websites, like YouTube, to try to retrieve more resources. As the following participant puts:

‘I tend to go back to YouTube and search just to find out if there's any more that I can watch or depending on my level of understanding if I need to find something else that could help me understand it better’.

However, it is not enough to only depend on outside sources, like YouTube. On the university study level, students have the ability to be selective towards online information. They use general platforms like YouTube, but they have a clear understanding that those platforms present a lot of entertainment content, or educational content that do not really correspond to their level of study. The following interviews show that although tertiary students like to use YouTube for its good UX, they are not always satisfied with the learning materials on YouTube.

This participant expresses that because of the nature of YouTube, which is not purely educational, it can be difficult to find useful resources:

> *'Actually, when you search some key words on YouTube, especially when the key words are not very common or popular, you may not be very happy with the results. But I think it is reasonable because most of the content on YouTube are User-generated, the unpopular content or field will have less content'.*

> *'Because comparing to the popular content such as movie trailers or celebrity news, the educational content is not very popular on YouTube. It makes it hard for me to find the useful content sometimes. Also, because YouTube is a global platform, the educational content comes from different countries and different levels, sometimes the content may not suit for me. In other words, the content is not what I am looking for'.*

The following excerpts show that Students understand that the materials they find on YouTube are not always reliable:

> *'Because most of the content on YouTube is User-Generated content, so the level of content production and production standards vary greatly'.*

Although YouTube has a lot of materials, many of which are useless to university users. They will still use it for research purpose, but are not entirely satisfied with the experience:

> *It's just really difficult because obviously there's a lot of junk in there as well. Yeah. So, I don't think it's what I would necessarily think of immediately when somebody says research. But it's definitely something I use as a research tool.*

The Importance of Recommendation

Recommendation of learning materials is a common and useful activity in real life. In the university context, attendees get such recommendation from their peer students or educators. This ensures that the materials they received have already been selected by relatively reliable people. These recommendations can be relevant to their study. The following interview excerpts present two scenarios. In the first and second one, the interviewee and her peer students share learning resources with each other. In the third one, a course coordinator or subject lecturer provided his/her student with a list of links.

'RadioPedia? Um, I heard it from a couple of my friends that (with whom)
we are doing (the) same course'.

'So, I have had friends, especially doing psychology, some of the stuff that I talk about is really interesting to them'.

'The guy who runs the unit…, he provides a lot of resources that you can go to set in and then it links you to the library page and under the library, it's separated by unit. … So, then you can find your different things specifically related to what you're doing. And I think that's really good'.

These scenarios show that recommendations do play a role in helping university students to acquire learning materials, hence helping them to study. However, the current scenarios do have limitations. In circumstances like the first one, the depth and breadth of materials that can be recommended is limited by word-of-mouth recommendation. If the recommendation is only the name of a website, it can be remembered easily. If the recommendation is a few names of academic papers or even researchers' names, it would be difficult for the recipient to engage. The last situation requires educators to manually organize links of e-learning materials. This takes time and effort. Moreover, the educators' recommendations are general: they are for all his students, so on the personal level, they may not be useful to each individual student.

Implications for Design

Users have mixed reviews towards LMS' existing repository function. Some interviewees believe that the existing information structure of LMS can meet their needs of downloading learning materials. While others think that LMS is difficult to use and information on there is difficult to find. This may be because the respondents come from different educational institutions who use different LMS. They all offer the same service, but some may have a better UX than others. Moreover, users are all individuals different from each other. The user who said that LMS was difficult to use admitted that she did not use her LMS often and was not familiar with her LMS. Therefore, we can conclude that the existing LMS can satisfy users' demands for downloading existing learning materials. But it is not adequate to evaluate the UX of LMS on this function alone. Due to the differences between different systems and users themselves, LMS offer different UX in this aspect. Therefore, when discussing ways to improve the UX of LMS, the focus should be on designing functions that LMS do not have yet or improving the functions already existed. In the following excerpt, the participant is generally satisfied with LMS' basic functions like course options list and progress bar:

> *'I felt that this LMS could basically meet my needs, because I saw the course options neatly arranged in a conspicuous position. And each course has a progress bar to remind me how much I have completed, which allows me to have a very clear understanding of the progress of each course'.*

Another participant is not very satisfied with LMS' UX. She thinks YouTube is better because YouTube has a function that her LMS lacks: the Search bar:

> *'I don't really like going onto the, like XXXXX (major metro university 4) or Uni stuff because I feel like it's a bit unorganized sometimes. Not all the time that um, and maybe also I'm not like, the address, familiar with it. So, it's a bit difficult to search for things that I try to find. I find that YouTube is easier, you just type in the search bar and it comes up'.*

Conclusion

In conclusion, participants have expressed that the learning materials on LMS were very limited, mainly including PowerPoint slides, notes and recordings that were already covered in class. This has become a major source of dissatisfaction among students with the User Experience of LMS. Because the learning materials on LMS are limited, students have to use external resources, such as general websites like YouTube, or online resources recommended by their teachers or classmates. Although online resources such as YouTube have a Recommendation System and other functions that can bring a good User Experience, they cannot always meet the needs of university users in terms of content. Word of mouth recommendation, however, is limited by time and space and does not utilize the existing electronic information technology. To sum up, I believe that to improve the UX of LMS, a Recommendation System can be designed to recommend learning materials to users.

4.2 The Necessity of a Search Engine (SE)

Introduction

Besides the Recommendation System, the Search Engine is another theme highlighted by the data. All participants have mentioned that YouTube's positive UX is supported by its SE, because the SE helps them to achieve their study goal in a timely manner and presents the information in an organized manner. Moreover, SEs help users to maintain their unique learning styles and achieve their individual learning goals. For these two reasons, it is argued that a SE is necessary for improving the UX of LMS and MOOCs.

The data also illustrated that university students frequently use Google, YouTube and their university' library website to search. They also compare the search UX delivered by different platforms and suggested that LMS learn from Google and YouTube. Moreover, attendees expressed that they hope LMS' SE can fulfil more complex search requests than just simple key word matching. Based on the data analysis, it is valuable to extract elements from Google and

YouTube and apply them to the design of E-leaning platforms. Such elements include the integration of the discussion forum with the SE.

SE and Positive UX

All participants have mentioned that YouTube's search function contributes to its positive UX. The positive UX comes from the ease to use, fast speed and the search bar. For platforms with a search engine like YouTube and Google Scholar, users have described them as: 'organised (in terms of the search results)' (Participant A), 'easy to find what you are looking for, instant result, familiar' (Participant B), 'easy to use, fast, very handy (Participant C) and 'quick, less time spent' (Participant D). To sum up, search engines' contribution to positive User Experience can be concluded in three aspects: they save time, they help users achieve their goals and they make interfaces more organised.

> *'I find that YouTube is easier, you just type in the search bar and it comes up'.*
>
> *'It's easy to find what you're looking for, I think, (with the) search bar'.*
>
> *'Do you want to find something fast? It could be a really good way to keep that'.*
>
> *'I just sort of just go and just Google for sources on Google scholar.'*
>
> *'It (Google)'s just easy to use. You just type it in and it'll find it for you. So, it's just very handy'.*
>
> *'the search engine is good. I could get quick results when I search for keywords'.*

Arguably, search engines help users to maintain their unique learning styles and achieve their individual learning goals. Participant A is a visual learner and a student who is constantly searching for more content than what has been provided by his lecturers. He constantly mentioned his preference of 'the visual'

when studying and how he felt he needed to get more materials than what was offered on his LMS. In order to fulfill his two unique learning goals: to find visual resources and additional materials, he frequently relies on the Internet search, YouTube search and the search engine in his choice of MOOC. Participant D is a skimmer, or fast reader, who can look through a list of 40 videos' titles in a matter of seconds. Her way of learning is also supported by Search Engines, because the lists she read are actually her own search results. Other users with other different learning styles or goals can also rely on search engines. Search, a universal function can actually help sustain very individual needs and in the meantime offers positive UX. The following interviewee spoke highly of YouTube's Search Engine:

> *'Then there when you type in search terms, you generally seem to get videos that are specific to like, well for me it's specific to my goals because I generally want videos is (that are) going to make a difficult topic a little bit easier to understand, because YouTube is such a universal platform. Then I'll generally find things that are really, really useful for that'.*

How University Users Search

University users frequently use the search function on Google, YouTube and their university's library website. This corresponds to George et al. (2006) and Perruso (2016) 's research on how university users use search. In my experiment, all attendees have voluntarily used YouTube search; some have also used Google search or their library website's SE. Participant A, who was a keen MOOCs user, talked about his experience with the search engine in MOOCs. Participant E, whose LMS already has a SE, used this SE during his session. In general, attendees used the SE of Google, YouTube, their university's library website and LMS either individually, or combinedly.

> *'I prefer to search the key words on Google and briefly browse the definition, explanation and instances from some top-ranking web*

pages. Usually, I would not browse the result located after 10 pages, because usually they do not relate to the key words that I have searched. But sometimes, the definition makes me confused or I can't understand it clearly. So, I would search some short videos on YouTube related to the key words. Mostly I can find some easily understandable short videos'.

The following interviews show that users compared the UX provided by LMS to that of other digital platforms like, like MOOCs, Google and YouTube. For those attendees, YouTube and Google did deliver better UX than LMS. One participant even explicitly expressed that he suggested LMS learn from Google. This shows that users are familiar with the search functions of leading engines. It is the users' expectation for LMS' SE to be more like YouTube and Google. This participant compared LMS with MOOCs. He thinks that a better search engine contributes to better UX:

'And we can actually search topic-wise rather subject-wise (on MOOCs). So, it is like if you search a topic you get more detailed videos. It is a bit more organised compared to what we have on LMS'.

The following participant compared her LMS with YouTube and expressed that YouTube's Search Engine is easy to use. The Search Engine helps users to navigate through a website, so that he or she will not feel that the website's information is unorganized:

'I don't really like going onto the, like XXXX (major metro university 4) or Uni stuff because I feel like it's a bit unorganized sometimes. Not all the time that um, and maybe also I'm not like, the address, familiar with it. So, it's a bit difficult to search for things that I try to find. I find that YouTube is easier, you just type in the search bar and it comes up'.

The following interviewee also compared LMS with YouTube and expressed preference over YouTube because of its Search Engine:

'I just feel …yeah, kind of like… (LMS is) wasting time. Like, I'd rather just use something that will give me an instant result. Like YouTube, like searching in google or searching and all that'.

In the following two extracts, the participant compared LMS with Google and said he hoped LMS' Search Engine can be more like Google:

'the search bar in the LMS often fails to find the desired results. The search mechanism that can only match keywords is a bit outdated. I hope that the search bar can give suggestions and associate content like Google'.

'But now the search bar in LMS gives me the feeling that it is relatively primitive, much like the search engine I remembered many years ago. It will only search the data when the keywords you are looking for is contained in the data and will not associate more of the content you are looking for through keywords.

Three Suggestions for LMS' SE Design

According to the above dialogues, three suggestions were made for LMS' SE design. One, there should be an easy-to-locate and easy-to-use search bar. As one participant said YouTube is easy to use because users just type in the search bar and results will come up. This means that the participant is approval of YouTube's search bar design: it is prominent, users can find it easily. By typing words into the search bar, it is also easy for the users to interact with YouTube's search system. Two, users would like to have search query suggestion, like Google. Three, simple keyword matching is not enough. The first two suggestions led me to design my SE to have a prominent, consistent and standard SE. The third suggestion requires the SE to be able to support Exploratory Search.

Exploratory search means 'search behaviours beyond simple lookup' (White and Roth, 2009: vi). '*Exploratory search* describes an information-seeking problem context that is open-ended, persistent, and multifaceted, and

information-seeking processes that are opportunistic, iterative, and multi- tactical' (White and Roth, 2009: vi). Arguably, users' exploratory search requests can be fulfilled by retrieving from User-Generated Content (UGC). This is how Google and YouTube provide their users with more complex search results than what only simple keyword matching can extract. In addition, my interviewees also discussed the LMS discussion board, also known as discussion forum, whose content can be used as search results to support exploratory search. These ideas will be expanded on in Chapter 6.

LMS' Discussion Forums

Although LMS have discussion forums, there is a lack of motivation for university users to actually use their LMS' discussion forums:

> *'We do have a, um, of like discussion board that we can tap in for different subjects. But I don't think… we didn't really use it. I feel like people are more like, they tend to ask their friends rather than like go online and ask like everyone else in the course, that kind of thing'.*

Due to the lack of user motivation, the number of posts is limited on LMS' forums. While on general forums like the one mentioned by the following interviewee, Reddit, there are many existed posts that can be the answer to users' questions. It is pivotal to motivate users to read and post more on LMS' forums, so that LMS' forums can have adequate UGC to fulfill exploratory search requests.

> *'I think it's a bit longer because you have to write up what your question is and then you have to wait for someone to reply rather than like on Reddit or on Google you find answers straight away. So Yeah, I've found that sometimes like when I don't know something and um, I can't find it on the Internet. I kind of get a bit lazy. Like I forget to ask or ask the next time because my interest is like not there anymore'.*

One reason the interviewee did not use the LMS forum much is because she feels shy and thinks that anonymity can boost her confidence:

'I think maybe I kind of feel shy going onto the university page and ask them questions. Like I think if it feels like anonymous or something, it might be easier for people to not feel shy, like to ask something that they might feel like it's like silly to ask or something'.

This suggests that the LMS forums should have the anonymous option, so users like her can take part in the discussions. However, since the issue of confidence is only mentioned by one participant, it is not enough to conclude that anonymity is the best method to increase forum engagement. As a result, the options of remaining anonymous or using real names should be given to users, so that users of different confidence level can interact in the forum according to their personal requirement.

Compared to YouTube's comment section, this interviewee preferred to use a discipline-specific forum. For her, discipline-specific forum can filter out the non-professional posters and posts:

'(On a discipline specific forum) Sometimes I do because um, there's a lot of people like actual professionals, he qualified, they go on there and they can reply to like posts that students make. So, I think that it could be reliable because yeah, like they're actual professionals and I'll say I like reading like what other people have to say, like, like different techniques and stuff that other people use. I find it interesting'.

This is another reason why LMS' forums should be developed. University users can go to general forums like Reddit or YouTube's Comment section. These general forums present a larger number of posts than LMS' forums and their users are more motivated. However, as general forums are for the general public, the scope of knowledge and the depth of understanding presented by these forums may not always be useful towards university users' need. On LMS' forums, users are usually studying the same subject at the same university. Moreover, faculty staff like course coordinators or subject lecturers and tutors can also participate in the discussions. Consequently, LMS' forums can leave out irrelevant users. Their users generally have similar educational goals. If well-

developed, LMS' forums can be of great benefit to university-level users.

Conclusion

By analysing the data, it is argued that LMS's UX can be improved by adding a Search Engine. University students frequently use Google, YouTube and their university' library website to search. They also compare the search UX delivered by those established platforms and suggested that LMS learn from Google and YouTube. Three suggestions were provided: One, there should be an easy-to-locate and easy-to-use search bar. Then, users would like to have search query suggestion, like Google. Next, simple keyword matching is not enough. The first two suggestions led me to design my SE to have a prominent, consistent and standard SE. The third suggestion requires the SE to be able to support Exploratory Search by retrieving from the LMS' discussion forums. These ideas will be further explored in Chapter 6.

4.3 Conclusion

The major goal of this thesis is to determine what perspectives YouTube can bring to university E-Learning programmes as an educational resource provider (from the UX perspective). What function does UX play in university students' learning activities; what features of YouTube's UX are important to university websites like LMS and MOOCs; and what principles are employed to drive my design are among the research issues.

The first study question focuses on the function of UX in the learning activities of university students. In university students' learning activities, UX plays a critical role. To begin with, a good UX can considerably improve a student's learning experience. For instance, RS assist students in locating helpful learning materials, whereas SEs assist students in maintaining their distinct learning styles and achieving their own learning objectives. Second, university users compare the UXs provided by various platforms and recommend that LMSs take lessons from Google and YouTube. This demonstrates the importance of comparing university educational platforms to commercial platforms, and then

extracting the useful aspects.

The first theme that emerged from the data was the issue of a Recommendation System (RS). The interviewees express that the limitation of learning material is a major source of dissatisfaction with their User Experience of LMS. Because the learning materials on LMS are limited, users have to use external resources, such as general websites like YouTube, or online resources recommended by their teachers or classmates. Although online resources such as YouTube have a Recommendation System and other functions that can bring a positive User Experience, they cannot always meet the needs of university users in terms of content. Word of mouth recommendation, however, is limited by time and space and does not utilize the existing electronic information technology. To sum up, to improve the UX of LMS, a Recommendation System can be designed to recommend learning materials to users. The UX design of a functioning RS is then discussed in Chapter 5: Adding a Recommender System (RS) to LMS and MOOCs.

By analysing the data, it is also argued that LMS and MOOC's UX can also be improved by adding a Search Engine (SE). University students frequently use Google, YouTube and their university' library website to search. All participants mention that YouTube's positive UX is supported by its SE, because the SE helps them to achieve their study goal in a timely manner and presents the information in an organized manner. Moreover, SEs help users to maintain their unique learning styles and achieve their individual learning goals. University users also compare the search UX delivered by those established platforms MOOC and the University ones. They suggest universities to learn from Google and YouTube. Three suggestions are provided: One, there should be an easy-to-locate and easy-to- use search bar. Then, users would like to have search query suggestions, like Google. Next, simple keyword matching is not enough. The first two suggestions lead me to design my SE to have a prominent, consistent and standard SE. The third suggestion requires the SE to be able to support Exploratory Search by retrieving from the LMS' discussion forums. These ideas are further explored in Chapter 6: Incorporating a User-friendly Search Engine

(SE) into LMS and MOOCs.

The final research question focuses on the principles that will guide my design. Today's university students are familiar with commercial platforms such as Google and YouTube, according to the research. They routinely visit those websites to research and compare their user experience with that of LMSs and MOOCs. As a result, university users expect more interactive, motivating, and standard LMS and MOOCs. My design is guided by these principles.

By providing answers to all three sub questions, this chapter answers the main research question: what universities can learn from YouTube, from the perspective of UX. In general, universities can learn from YouTube about the importance of UX, as well as specific design aspects that users prefer and design guiding principles. To begin with, UX is vital in university students' learning activities since effective UX can enhance the learning experience of users. Second, the RS and the SE are two significant UX elements of the YouTube experience that universities can extract. Finally, users demand interactive, motivating, and standard e-learning platforms. As a result, my guiding concepts are 'interactive, motivating, and standard.'

Chapter 5 Discussion 1: Adding a Recommendation System (RS) to LMS and MOOCs

Recommendation Systems or Recommender System (RS) are used by digital platforms to provide suggestions for users. Existing RS usually adopts three methods: content filtering, collaborative filtering and hybrid. YouTube uses a hybrid RS called 'the deep neural networks', whose main challenge is recommendation accuracy. Following YouTube, many researchers regard accuracy as LMS/MOOCs' main challenge in developing RS as well. MOOCs can easily make use of YouTube's RS algorithm because its content is mainly videos, the volume of videos is enormous, and its users could be interest driven. However, I argue that accuracy is only the main problem for platforms like YouTube, who already has a running RS and who has enormous content to be recommended. Different from YouTube, LMS faces two challenges: what should be recommended to its users and how should it connect to digital resources outside of the LMS. In order to tackle these two challenges, I propose for LMS to recommend learning materials to its users. LMS should also take advantage of digital library databases to make recommendation to its users. Finally, a visual representation of VU Collaborate carrying a RS is shown through wire framing. In chapter 6, I apply these ideas and explore a user-friendly search engine in more detail.

Recommendation, a function commonly used by successful online platforms like YouTube, Netflix and Amazon, is not yet active in Learning Management Systems (LMS) and many Massive Online Open Courses (MOOCs). Recommendation makes an important part of YouTube's business (Covington, Adams and Sargin, 2016). On YouTube's webpage user interface, recommendation occupies a prominent space: basically, the whole right column. In this thesis, it is argued that adding digital recommendation is a main area for improving LMS and MOOCs' User Experience (UX).

This chapter discusses what recommendation is, in relation to

personalization, adaptation and other relevant concepts for a smart and responsive digital learning environment. Then, it outlines why RS is important for digital platforms in general and for LMS and MOOCs specifically. Next, it examines the main recommendation methods used by YouTube and other digital platforms. After that, it analyses what LMS and MOOCs can learn from YouTube in constructing their own RS. Lastly, this chapter recommends a feasible way of adding recommendation as a function to LMS.

5.1 Recommendation, Personalization and Adaptation

Recommendation Systems, or Recommender Systems (RS) are used by digital platforms to provide suggestions for their users (Resnick and Varian, 1997; Burke, 2007; Mahmood and Ricci, 2009; cited by Ricci et al., 2011: 1& Ghauth and Abdullah, 2010). This is usually achieved by collecting and analysing data on users' behaviours and preferences (Chatti et al., 2012). Personalization and adaptation are two terms closely related to recommendation. In much of the literature on improving LMS' and MOOCs' UX, recommendation, personalization and adaptation are used as synonyms. This is because all three concepts argue for the same thing: LMS and MOOCs should make use of RS. Arguably, recommendation is the basis for personalization and adaptation. Therefore, this thesis will mainly focus on recommendation.

In e-learning, the key requirements for personalization are 'appropriate, interesting and challenging' (van der Sluijs and Hover, 2009: 46). With a personalized learning experience, only learning materials fit this description should be presented to learners. The material selection process is based on each individual learner's learning progress. Attentions are to be given to what they have not learn yet, what they will be interested to learn and what is beyond their competence now but can be delivered to them later. Another similar concept is adaptation. 'The term adaptive e-Learning refers to a set of techniques oriented to offer online students a personal and unique experience' (Omedes, IADLearning.com, 2016).

Most scholars do not distinguish between recommendation, personalization and adaptation and tend to use them as each other's synonyms. For instance, in Murad et al. (2018)'s overview of published literature, they use 'recommendation' for their article title. In the article, the concept of 'personalization' and 'adaptation' appear multiple times. When analysing open source LMS Moodle (Modular Object-Oriented Developmental Learning Environment), Despotovic-Zrakic et al. (2012) uses 'adaptivity' in their article title. However, 'personalization' is a key word and frequent appearance in the essay. 'Personalized recommendations' also are used as a synonym to those notions. Santos and Boticario (2010) mainly write on recommendation and recommender system, 'adaptation and 'personalization' are used in their essay as well. Apart from recommendation, personalization and adaptation, a few other concepts also seem to be inter-connected, for instance, 'smart LMS (Murad et al., 2018: 116)' and 'responsive learning (Van del Sluijs and Hover, 2009: 46)'.

One reason why personalization is used as recommendation's synonym is because personalization has a narrower and a wider meaning. On some platforms, users are given the option to 'personalize' their webpage with things like font, how many items in a row or Website logo. 'Personalization' here is understood narrowly as an option given to users. This personalization function does not necessarily mean different users get different user interface from designers. In fact, all users of a particular platform is given the same interface design, but everyone's interface displays different recommended content, according to their own preferences. This is the wider understanding of personalization, which accounts for the whole interactive experience. With the wider understanding of personalization, personalization is usually the presentation of recommendations.

Moreover, adaptation includes both personalization and recommendation. Adaptation is the ability of a digital system to generate and present recommendations to its users, according to users' preferences. A platform achieves adaption by first using an RS to select items that may be interesting

to users. Then, the platform engages with the wider meaning of personalization and present selected items to users. In this sense, adaptation is attained through recommendation and personalization. Personalization is built on recommendation. In consequence, RS can be regarded as the basis for all other conflated concepts.

The industry is still at a very early stage for developing RS for LMS and MOOCS. LMS simply do not have recommendation features (De Bra et al., 2010) and universities in general still have not fully explored the opportunity for recommendation (Santos and Boticario, 2010: 2794). In the future, when RS in LMS and MOOCs has become relatively mature, more effort could be specifically invested in the study of personalization and adaptation. Right now, RS should be focused because it is the foundation of personalization and adaptation. In this project, I will focus on Recommendation alone.

5.2 Recommendation Systems (RS)' Importance Today

One main reason for developing RS is that today we have too much information online. The Internet has made it possible for information to be accessed, regardless of time or space. Every second, great volume of User-Generated Content (UGC) is being uploaded and consumed because of Web 2.0. In this age, 'information overload' (Itmazi and Megias, 2008: Chatti et al., 2012) is a major issue and 'attention becomes the scarce factor' (Duval, 2011: 1). In general, we do live in a time when digital information of all kinds competes with each other for our limited attention.

The great abundance of information is not necessarily negative, if it is dealt with properly. Too much information can bury users in a pile of useless content and even cause stress and anxiety (Marr, Forbes.com, 2015). However, researchers like Koren, Bell and Volinsky (2009) see in information overload 'unprecedented opportunities to meet a variety of special needs and tastes' (2009: 42). Indeed, in the pre-Internet era, it was more difficult to access information than now, due to time and space restraint. The volume of

information on Web 1.0 cannot compare to that of the UGC-filled Web 2.0. Today, the main challenge becomes how to select the appropriate and interesting items from a myriad of information and match them with the right users.

RS have emerged as a main tool to match users with items on the Internet. ‘E-commerce leaders like Amazon.com and Netflix have made recommender systems a salient part of their websites’ (Koren, Bell and Volinsky, 2009: 42). ‘YouTube recommendations are responsible for helping more than a billion users discover personalized content from an ever-growing corpus of videos’ (Covington, Adams and Sargin, 2016: 191). Apart from YouTube, Amazon and Netflix, more and more websites like Facebook and Instagram are also operating and developing their own RS.

RS have the benefits of encouraging sales, cultivating customer loyalty and enhancing UX. For commercial websites, there is clear evidence demonstrating that RS boosts sales. ‘According to a report by industry analyst Forrester, one-third of customers who notice recommendations on an e-commerce site wind up buying something based on them’ (Grossman, TIME.com, 2010). Moreover, RS are responsible for ‘enhancing user satisfaction and loyalty’ (Koren, Bell and Volinsky, 2009: 42), as well as ‘add another dimension to the user experience’ (Koren, Bell and Volinsky, 2009: 42).

To summarize, information overload is a major issue in today’s digital landscape. Because of information overload, a main challenge and opportunity for online platform operators is how to match users with items that may be interesting to them. RS have emerged as a popular tool for assisting tackling this challenge. RS helps boosting sales, growing customer loyalty and improving UX. As a result, successful commercial websites like YouTube, Netflix and Amazon are all taking advantage of and developing RS.

Why LMS and MOOCs Need RS

LMS and MOOCs need to develop and operate a feasible RS. Firstly, educational systems like LMS and MOOCs also have the issue of information overload, just like other digital platforms such as Netflix. Secondly, RS is an already well-developed technology, well-used by other interactive platforms. The success of commercial platforms has with RS, can serve as an inspiration for LMS and MOOCs (Ghauth and Abudullah, 2010). LMS and MOOCs are both interactive systems that could benefit from the use of RS as well. Third, users of LMS and MOOCs are individual learners with different learning requirements and needs who are accustomed to recommender systems in the other products they use. According to my data, university students do demonstrate the demand for RS in LMS and MOOCs.

Just like other sectors of the Internet, LMS and MOOCs are not exempt from information overload. Scholars like Itmazi and Megias (2008) and De Bra et al. (2010) have outlined the abundant learning resources recorded in LMS. 'Typical LMS, which contains thousands of courses, suffers from the information overload problem' (Itmazi and Megias, 2008: 235). 'Many courses have a repository of files: text files, PowerPoint, perhaps video lectures' (De Bra et al., 2010: 3029). Just like LMS, MOOCs also holds a great number of educational resources. EdX.org, a MOOCs provider created by The Massachusetts Institute of Technology (MIT) and Harvard University, has more than 70 course providers and 1,800 courses online in 2017 (Shah, classcentral.com, 2018). In general, LMS and MOOCs also present the issue of information overload, in terms of not only information volume, but also information type.

LMS and MOOCs are both interactive systems who should make use of RS. The technology behind RS is well-developed and ready to be adopted by many more systems. 'Recommender systems are an extensively studied and well-established field of research and application' (Adomavicius and Tuzhilin, 2005, as cited by Verbert et al., 2012). RS has gradually become an inevitable

part of many interactive systems. ‘Recommendation Systems (RS) have been widely implemented and accepted in many sectors of Internet: e-Commerce, Web Pages, Censorship systems and other sectors like News and Encyclopedia’ (Itmazi and Megias, 2008: 234-235). ‘The success of the implementation of a variety of recommender systems in e-commerce, for recommending from a large number of items, has been inspiring for e-learning researchers’ (Soonthornphisaj et al., 2006; Liang et al., 2006; Tang and McCalla, 2003, cited by Ghauth and Abudullah, 2010: 712). ‘LMS is an interactive and interaction system’ (Itmazi and Megias, 2008: 235) and should not let the opportunity of using RS slide away.

The last reason why LMS and MOOCs need RS lies in today’ students, also known as users of LMS and MOOCs. The collective body of students are actually made of individuals who ‘do differ in skills, aptitudes, preferences, discernment of information and perhaps particular capacities and needs due to special (dis) abilities they may have’ (Jonassen et al., 1993, cited by Kerkiri and Paleologou, 2009: 58). Consequently, showing different students the same resources, with zero or minimum personalization, does not seem to have much appeal. Students are individuals with different educational background and learning requirements. This calls for recommended content tailored for each student individually.

Despite of their individual difference, students do have one demand in common: according to my research, university students do demonstrate the need for RS in LMS and MOOCs. For example, Participant A mentioned that providing ‘relevant links’ is an advantage of YouTube, while the lack of recommendation on ‘extra materials or references’ is a disadvantage of LMS. Participant B also reported that not enough content being recommended to her on LMS is making LMS unhelpful to her study.

To sum up, educational digital platforms like LMS and MOOCs have the issue of potential information overload. RS has been a technology well developed and well applied on many interactive platforms. LMS and MOOCs

should take advantage of RS as well. Moreover, university students come from various educational backgrounds and have different learning requirements. RS can help make their learning process more personal and engaging. Additionally, my interview participants do demonstrate a demand for RS in the digital systems they use. For these reasons, I argue that LMS and MOOCs need to develop and operate a RS.

5.3 A Review of Existing Recommendation Methods

Existing RS generally follow three strategies or methods: content filtering, Collaborative Filtering (CF) (Koren, Bell and Volinsky, 2009) and hybrid (Chatti et al., 2013:4, Ghauth and Abdullah, 2010; Adomavicius & Tuzhilin, 2005). Different strategies have their own strengths and weaknesses. For example, content filtering is simple and effective, but it is less accurate than CF. The more accurate CF suffers from the cold start problem, which prevents new products from being recommended (Koren, Bell and Volinsky, 2009: 43). To combine both strategies' strengths and compensate for their weaknesses, hybrid RS are built. Hybrid RS are usually more complicated and arguably more accurate than the other two, but they are not necessarily more popular at the moment. All three types of RS, content filtering, collaborative filtering and hybrid, are currently being used by different platforms according to their own requirement.

Content filtering RS are simple but effective. With content filtering, 'the user will be recommended items similar to the ones the user preferred in the past' (Chatti et al., 2013: 4). Content filtering RS remember a user's item preference. They also analyse different items according to their characteristics. Items will be recommended a user if they share similar characteristics with the user's preferred ones. Koren, Bell and Volinsky (2009) argue that Content filtering is 'simple and does the job' (2009:42). However, it 'require(s) gathering external information that might not be available or easy to collect' (Koren, Bell and Volinsky, 2009: 42). External information is often required to characterise items on a digital system.

Unlike content filtering which takes into consideration the targeted user and items related to his/her choice, collaborative filtering (CF) is more focused on data from peer users. With CF, 'the user will be recommended items that people with similar tastes and preferences liked in the past' (Chatti et al., 2013: 4). Koren, Bell and Volinsky (2009) argue that CF is generally more accurate than content filtering. This is because CF adds another layer to the recommendation process: peer ratings. The main drawback of CF is the cold start problem (Burke, 2007; Koren, Bell and Volinsky, 2009), which means CF is unable to recommend new products (Koren, Bell and Volinsky, 2009: 43). The reason for that is when new products first appear on a system, they do not have any user preference or ratings.

'A hybrid recommender system is one that combines multiple techniques together to achieve some synergy between them' (Burke; 2007:378). Hybrid RS are able to benefit from different strategies' advantages and minimize their disadvantages. For instance, using content-based strategy in a hybrid RS 'can compensate for the cold-start problem… and the collaborative component can work its statistical magic by finding peer users who share unexpected niches in the preference space that no knowledge engineer could have predicted' (Burke, 2007: 378). As a result, using hybrid methods can often improve a RS' accuracy and efficiency (Thorat, Goudar and Barve, 2015).

A hybrid RS is usually more complicated and arguably more accurate than the RS using only content filtering or CF. However, it is not necessarily the most popular RS now. An obvious reason is that not all platform operators can afford to develop a complicated hybrid algorithm. In fact, all three types of RS are currently being used by different platforms according to their own need. For example, YouTube currently uses a hybrid RS (Malik et al., 2016) called 'the deep neural networks (Covington, Adams and Sargin, 2016)'. YouTube is able to invest time, effort and money into developing a complicated RS. It also has the data generated from their large user base and great video volume. Currently, a hybrid RS is the right choice for YouTube,

but not necessarily for other platforms. Netflix commissioned their collaborative RS known as 'the matrix factorization' (Koren, Bell and Volinsky, 2009).

In general, I suggest digital platforms should select RS according their own need. For platforms new with RS, it is easier to start with either content filtering or CF than invest into a hybrid one. Smaller scale platforms can use content filtering to compensate for the lack of peer data. By only using content fileting can let them set up a RS with relatively less time and effort. Larger scale platforms should consider how to make good use of their peer data. They can use CF and even progress to hybrid

5.4 The YouTube RS' Implications for UX Design

YouTube RS' Implications for Universities in General

Scholars like Ghauth and Abdullah (2010) maintain that YouTube's UX design has served as an inspiration for educational technology. In this section, I argue that YouTube' RS have three major implications for universities. To start with, YouTube has always acknowledged the importance of RS and RS' interface presentation. Next, YouTube's RS is not unchangeable. Rather, it is constantly being developed and upgraded. Last, YouTube develops its RS by two steps: identifying challenges and creating solutions. All three implications are applicable to both MOOCs and YouTube.

YouTube has always valued RS and RS' interface presentation. Davidson et al. from Google regard RS as 'a key method for information retrieval and content discovery in today's information-rich environment' (2010: 293). Covington, Adams and Sargin from Google praise RS for 'helping more than a billion users discover personalized content from an ever-growing corpus of videos' (2016: 191). The presentation of RS to users is also important. 'Presentation of recommendations is an important part of the overall user experience' (Davidson et al., 2010). In 2010, Davidson et al.'s goal in presenting recommendations included to help users decide whether the item

is interesting or not quickly. Today, recommended videos occupy a prominent space on YouTube' user interface. Users can interact with the recommendations quickly and easily. In conclusion, YouTube has always recognized the salience in developing RS and RS' presentation to users.

YouTube's RS is constantly under development and being updated. By 2010, YouTube had just been running recommendation features on its homepage for more than a year (Davidson et al., 2010). This RS had mainly focused on 'a user's personal activity (watched, favorited, liked videos)' (Davidson et al., 2010: 294) and video similarities (Davidson et al., 2010). This means YouTube's first RS were using content filtering strategy. In 2016, Covington, Adams and Sargin described YouTube's new RS as a 'deep collaborative filtering model', also known as the combination of deep learning and CF, (2016:197) and a 'non-linear generalization of factorization techniques' (2016: 192). Factorization technique is a CF technique; the non-linearity is achieved through mixing other techniques. In general, from about a year before 2010 to 2016, YouTube's RS developed from using content filtering techniques to using hybrid methods.

In addition, the construction process of YouTube's RS includes identifying recommendation challenges and generating solutions. Covington, Adams and Sargin (2016), suggest that YouTube's RS face three main challenges: scale, freshness and noise. Scale means YouTube's RS has to deal with its 'massive user base and (video) corpus' (Covington, Adams and Sargin: 2016:191). Freshness is an ongoing challenge dated back to 2010 (Davidson et al.), it generally refers to how to recommend new videos to users. Noise refers to useless or corrupted data, it is also mentioned by Davidson et al. (2010). In order to address all three challenges, Covington, Adams and Sargin (2016) come up with the current YouTube RS strategy: to use both CF and deep learning for the deep neural networks.

Debating Accuracy

On successful commercial platforms like YouTube and Netflix, attaining

accuracy is the goal of their RS. Covington, Adams and Sargin (2016) have constantly demonstrated that when dealing with scale, freshness and noise, their goal is to achieve recommendation accuracy. (Koren, Bell and Volinsky, 2009: 42) also express that they invented the Netflix RS so that it is more accurate than previous ones.

Since commercial platforms' RS are inspirational for the higher education sector (Ghauth and Abdullah 2010), many previous researches on adding RS to LMS have treated improving accuracy as their main goal. This includes Despotović-Zrakić et al (2012)'s provision of adaptivity in Moodle LMS courses, Andronico et al (2003)'s integration of multi-agent RS into a mobile LMS and Santos and Boticario's (2010)'s Tutor-Oriented Recommendations Management for Educational Systems (TORMES).

Those projects do provide some worthy arguments, data and design attempts. However, none of their suggested design is being widely used today, which led me to argue that achieving accuracy should not be seen as the goal for LMS' RS. My argument is supported by scholars like Ghauth and Abdullah (2010) and Murad et al. (2018). 'Although much research has been done on the recommendation system; as far as the author's knowledge, most researchers focus on the accuracy of recommendation systems in predicting recommendations rather than knowledge acquired by students' (Murad et al., 2018: 114). Ghauth and Abdullah (2010) also criticized the over emphasis on 'system's accuracy'.

Accuracy is more of an issue for platforms with a myriad of content and an already established RS, like YouTube. For each user, a LMS' content is mainly provided by his/her universities and educators, the volume cannot compare to YouTube's UGC. In addition, LMS does not have a RS yet. In 2010, when YouTube only had its first RS for more than a year (Davidson et al., 2010), it did not regard accuracy as its main goal either. The main issue for LMS and other platforms new with RS is how to construct a suitable new RS, not how to improve an existing RS. Consequently, achieving accuracy is

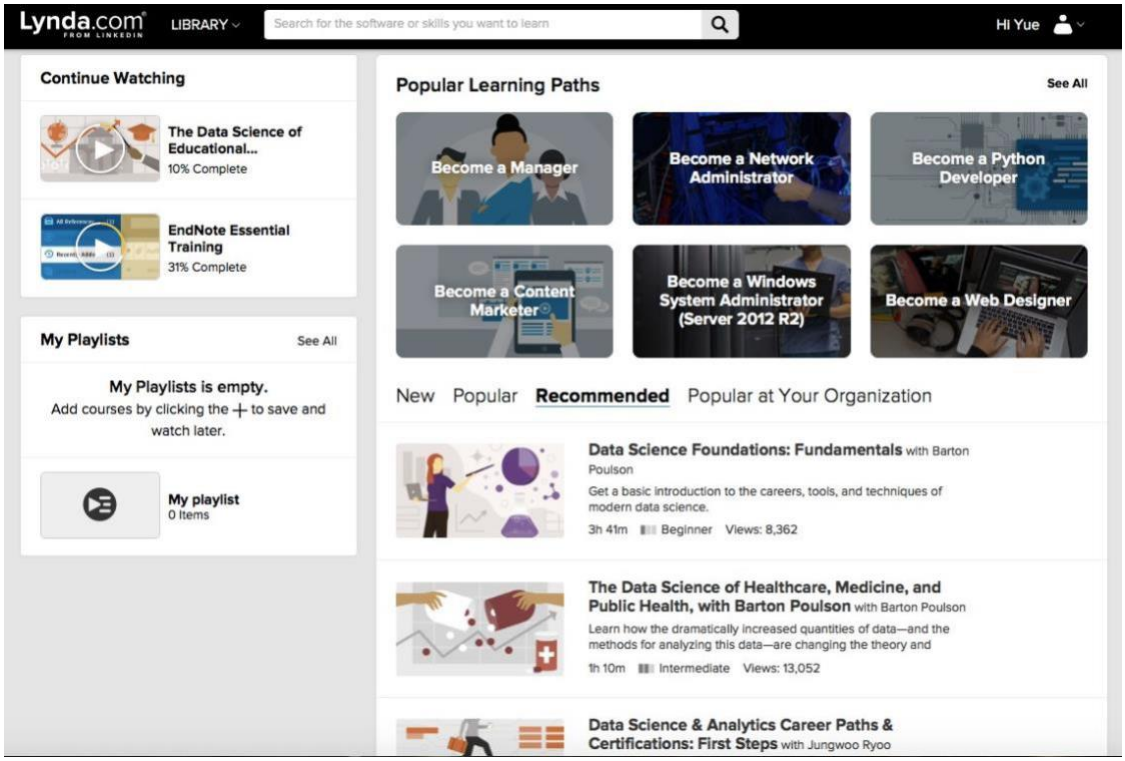
not the main goal now for LMS.

YouTube's Different Implications for MOOCs and LMS

Comparing to LMS, MOOCs share more similarity with YouTube and can learn from YouTube more directly. Like YouTube, MOOCs' content is mainly videos. The video resources on MOOCs are abundant. MOOCs' users may come with a relatively general learning purpose: instead of trying to fulfil goals from their university study, they may visit MOOCs just out of interest. To sum up, MOOCs are similar to YouTube because of their video content, the abundance of video content and users' learning purpose. Arguably, it is easier for MOOCs to learn from YouTube than LMS.

Universities' LMS are internal systems for enrolled students, but MOOCs are open platforms for all. In my designed LMS, users will not be recommended course content from other courses, but only academic materials that they can access in their subjects and through the library databases. However, MOOCs user will get recommendations on courses other than their selected ones. The main aim of the LMS RS is to motivate users to study for their university courses. The MOOCs RS is designed to help users find potentially interesting topics and courses other than what they have already watched.

Right now, there are many different MOOCs providers available, for instance, Lynda.com, EdX.org and Coursera.org. Each provider is at a different development stage with RS and all providers have different interface layouts. Some MOOCs already have a functioning RS like Lynda.com (see Screenshot 1). Others like edX.org have some RS-related functions, but they are implicit. Furthermore, although all major MOOCs' user interface is organized around delivering courser videos, so far there is not a standard interface layout for MOOCs. In fact, different MOOCs have very different interface layouts. Therefore, I will not be able to propose an interface design for all the different MOOCS.



Lynda.com's Recommender feature on its user interface
https://www.lynda.com <viewed 5 Aug 2019>

Theoretically, this is what designers of MOOCs can learn from YouTube. Firstly, incorporating an RS is crucial for digital platforms. RS is essential in engaging users, providing interactivity and enhancing UX. Secondly, an RS should be given a prominent space on user interfaces of learning environments. Thirdly, RS on MOOCs should be constantly under development and often updated. Last, accuracy can be seen as the main challenge for developing RS for MOOCs (a quick re-cap here about what accuracy means). In order to achieve accuracy, MOOCs developers can study and extract useful ideas from YouTube's hybrid RS.

LMS require a more complicated RS than MOOCS. LMS are very different from YouTube in terms of functions, content and the fact that LMS do not have RS yet. LMS has two main functions: student administration and learning facilitation (De Bra et al., 2010). With these two functions comes a

great variety of content: texts, audio recordings, videos, links, online tests and PowerPoint files… This makes LMS very different from YouTube and MOOCs, whose content is primarily organized in the form of videos. Moreover, most LMS, not matter what e-learning company built them, do not have an RS on its user interface yet. Consequently, what LMS can learn from YouTube is much less direct than what MOOCs can.

In the previous section 'YouTube RS's Implications for Universities in General', I have written three implications for both MOOCs and LMS. To start with, RS and their interface presentation are of great importance for digital platforms. Then, RS should be constantly researched and updated according to the development of the platform. Last but not the least, the dichotomy of challenge and solution can be used as a way to construct RS. I disagree with the idea that YouTube's challenge of accuracy should be used by LMS. When designing for LMS' first RS, it is imperative that we identify LMS' own challenges and create solutions accordingly. In next sections, I will outline two main challenges of building RS for LMS and propose my solution for them.

5.5 Addling a RS to LMS: the Challenges

YouTube's RS faces three main challenges: scale, freshness and noise' (Covington et al., 2016:191). Scale means YouTube's RS has to deal with its 'massive user base and (video) corpus' (Covington, Adams and Sargin: 2016:191). Freshness is an ongoing challenge dating back to 2010 (Davidson et al.), it generally refers to how to recommend new videos to users. Noise refers to useless or corrupted data, it is also mentioned by Davidson et al. (2010). The purpose for identifying these challenges is to help make accurate recommendations. Taking implication from YouTube's UX, many academic researchers (Despotović-Zrakić et al, 2012; Andronico et al, 2003; Santos and Boticario, 2010)' idea is that accuracy is also the main challenge faced by RS in LMS. I disagree with them and argue that LMS' main challenges in recommendation are: what should be recommended on LMS and LMS' lack of connection with outside sources.

Challenge 1: Recommendation Candidate in LMS

On an interactive platform, a recommendation candidate means an item or a type/group of items that could potentially be recommended to a user. A recommendation seed refers to an item liked or rated highly by a user. A seed's characteristics are analysed by the system to find recommendation candidates. Both candidate and seed are common concepts in the study of RS.

As discussed previously, RS play a crucial role in enhancing digital platforms' UX. Many researchers (Despotović-Zrakić et al, 2012; Andronico et al, 2003; Santos and Boticario, 2010) have recognized the importance of adding an RS to LMS and proposed their own design. However, until today, LMS is still in want of a feasible recommendation system. Arguably, a core question that should be answered first is what should be recommended in LMS, or what items should be LMS RS' recommendation candidates. Without answering this question, it is difficult to make suggestion for LMS.

A very limited number of studies have explicitly discussed what should be recommended, also known as the 'recommendation candidate', in LMS. Even in those studies, recommendation candidate is not a main research question. Santos and Boticario (2010:2794) suggest recommendation candidate on LMS could either be 'simple as suggesting a web resource, or more interactive (i.e., an on-line activity) such as doing an exercise, reading a posted message on a forum or running an online simulation'. Murad et al. also support the idea of recommending a variety of learning materials. 'This recommendation can be in the form of online activities such as problem exercises, reading messages posted, or running on-line simulations' (Murad et al., 2018: 117). Although these researchers have superficially considered the issue of recommendation candidate, their analysis is barely a summary of the items on LMS, not what items should be recommended to users.

Commercial platforms that use successful RS like YouTube, Facebook and Netflix all have only one main recommendation candidate. YouTube

recommends videos; Netflix recommends movies and TV shows; Facebook, in its early days, mainly focused on recommending 'people you may know (Facebook friends)'. It may be easy to assume that these choices of candidate came naturally to them. After all, YouTube is for sharing videos, Netflix is for watching movies/TVs and Facebook is for keeping contact with friends. However, just like LMS, these services have many other functions as well: user profile management, social networking and links to outside sources, just to name a few. If they attempted to run their recommendation system without first deciding on one exact recommendation candidate, they would face great difficulties as well. For example, instead of recommending videos, YouTube could get lost in recommending videos, users, user-posted links and channels altogether. In general, successful commercial platforms all have one main category of recommendation candidates.

Following YouTube and other websites with successful RS implement, I argue that LMS should also decide on one category of recommendation candidate. LMS has two main functions: student administration and learning facilitation (De Bra et al, 2010). The first decision we need to make is: should we recommend items from student administration or learning facilitation. Here I agree with De Bra et al. (2010), learning should be prioritized over administration. Administration tasks are there to support learning. Plus, previous projects have inevitably all focused on recommending learning materials rather than administrative tasks. These researches include Tang and McCalla's smart recommendation for an evolving e-learning system (2003), the European Union's Generic Responsive Adaptive Personalized Learning Environment (GRAPPLE, grapple.win.tue.nl, 2008-2011) and Santos and Boticario's Tutor-Oriented Recommendations Management for Educational Systems (TORMES) (2010). To conclude, LMS should select one recommendation candidate for learning facilitation.

To sum up, the RS is only for locating only learning materials like subject videos, not administrative tasks such as enrolment. This is because major

websites only recommend one main areas of information to their users. For example, early Facebook only recommends ‘people you may know’, not unlinked users’ posts; YouTube only recommends videos, not user account management or payment subscription. In addition, On LMS and MOOCs, learning is prioritized over administration. Administration tasks are there to support learning. Moreover, previous projects all support the recommendation of only learning materials. To conclude, LMS and MOOCs providers will only use my designed RS for students to locate learning materials.

The second decision we need to make is: when we are building a RS to aid learning, what learning materials should be recommended. De Bra et al. (2010) is mainly concerned with the varied form of content. On LMS, ‘many courses have a repository of files: text files, PowerPoint, perhaps video lectures’ De Bra et al. (2010: 3029). YouTube and MOOCs’ form of content is mainly videos. Their RS recommend videos based on users’ preferred and highly-rated videos. The presentation of YouTube’s RS is neat, as all recommendation candidates are videos. On the contrary, LMS contain a great variety of content forms: lecture recordings, lecture slides, required readings, extra readings, embedded videos, links to outside sources, interactive test, and so on. It is difficult enough to decide which one(s) of these we should recommend to users, not to mention if we are to recommend a few different content forms, the presentation of our RS would not be so organized.

Challenge 2: LMS’ Disconnection with other Websites and Systems

Arguably, another challenge faced by LMS is its disconnection from other websites and systems. Researchers like Tang and McCalla (2003) and De Bra et al. (2010) identify this as a challenge for LMS’ RS. They have suggested their own solutions to this challenge. De Bra et al. (2010)’s solution is GRAPPLE, which enables educators from primary, secondary and tertiary education to collaborate across a variety of LMS and provide recommendations for life-long learners. Tang and McCalla’s proposal is ‘an open evolving e-learning system (where) learning materials are automatically found on the Web and integrated into the system based on users’ interaction

with the system' (2003:1). I argue that disconnection is a major challenge because it limits the volume of not only learning materials on LMS, but also user data and item information.

If LMS remain disconnected from other websites and platforms, there will not be enough items to be recommended in LMS. Tang and McCalla (2003) see LMS as a closed system with pre-insert learning materials. On LMS, learning materials are suggested by lectures/tutors and these learning materials are easily accessible by their students. RS are usually built to help users get access to items they will otherwise not know exit. For example, YouTube uses a RS to help users 'discover' new content (Covington, Adams and Sargin, 2016), not to suggest videos that are already known or have been watched by users. There is no point in building a RS for only to present to students the list of readings given by their lecturers.

Disconnection also results in the lack of data for analysing both users and items. Google owns YouTube. Registered users navigate YouTube with their Google account. Any link users go to through Google or is partnered with Google can send back useful information to YouTube's RS. The whole process is known as data mining. In contrast, users' online activities outside of LMS and MOOCs, does not send data to LMS and MOOCs (De Bra et al., 2010). As discussed in above paragraph, the number of LMS' learning material items is limited. As a result, users' interaction with those items is limited as well. There may not be enough data to construct a good RS.

De Bra et al. (2010) acknowledge the issue of disconnection and provide their own solution. De Bra et al. (2010) mention that it is sometimes possible to access an outside website from a logged in LMS. 'However, these external applications cannot communicate back to the LMS' (De Bra et al., 2010: 3029). What he means is, once a user gets out of one LMS, their online activity does not provide much data for the LMS's RS. His response is the project GRAPPLE, where different LMS 'share information about a learner' (2010: 3030). 'When the learner moves to a different school, university or company, the information a learner decides to disclose must be accessible

for a new LMS (De Bra et al., 2010: 3030).' The main achievement of GRAPPLE is it helps provide recommendations for life-long learners.

There are three drawbacks of GRAPPLE. First, it requires too much collaboration between educators and platform designers, across too many different educational stages and platforms. Such collaboration may not be easy to accomplish. Second, the recommendations are not timely enough because GRAPPLE mainly generates recommendations based on a user's earlier educational background. For instance, for a newly admitted first-year university student, recommendations are generally based on his/her primary and secondary studies, whose connection to his/her university study may be very weak. Throughout the years, his/her learning style may change as well. Moreover, as he/she has just been admitted into university, there will not be enough data to make recommendations for his /her current study. Last, this system is not designed for all life-long learners, but only young life-long leaners whose primary and secondary schools are able to run an LMS and provide digital records. Older learners will not have enough data simply because their earlier education was not digitalized. To sum up, GRAPPLE's limitation includes the fact that it depends too much on collaboration, the system is not timely enough and it is exclusive to older users.

Tang and McCalla (2003) also agree that LMS is disconnected with other websites and platforms. For Tang and McCalla (2003), there are two different types of interaction in digital systems. 'One is the collaboration between the system and the user, another is the collaboration between the system and the open Web. Users do not have direct interactions with the open Web; though the system can retrieve relevant information related to a learner and his/her learning characteristics' (Tang and McCalla, 2003:2). 'Current web- based adaptive learning systems have been focusing on the interrelations between users and the system' (Tang and McCalla, 2003:10). Tang and McCalla's opinion is that LMS has been ignoring the interaction between LMS and the open Web.

As a response to the disconnection challenge, Tang and McCalla (2003)

propose an ‘open evolving e-learning system (where) learning materials are automatically found on the Web and integrated into the system based on users’ interaction with the system’ (2003:1). They propose to use CF strategy to select papers for recommendation. Tang and McCalla also plan for their RS to carry ‘a paper-updating module powered by an imbedded web crawler, responsible for accommodating new papers and removing some old-fashioned papers’ (2003: 4). Apart from the obvious benefit of recommending new papers, this module can also effectively solve the cold start problem. Tang and McCalla (2003)’s research still has a few limitations. Their research uses academic papers related to users’ study topic as their recommendation candidate. They do not, however, explicitly explain why academic papers are selected as the candidate. Additionally, they do not visualize exactly where their RS will be presented on LMS. Next, their system is composed of a paper repository of different study topics. ‘E-versions of all papers, including magazine articles, conference papers, workshop papers, etc. will be stored in the Paper Repository’ (Tang and McCalla, 2003: 6). They do not specifically say how this paper repository will be added to LMS. However, they did clearly say that educators would have to manually add tags to all the papers in the repository (Tang and McCalla, 2003), which is a great amount of work to be done.

In conclusion, LMS is disconnected from other websites and systems on the Internet. This disconnection makes it difficult to add an RS to LMS because a closed LMS does not have enough items to be recommended. A disconnected LMS does not have enough data on users or items to create a good RS, either. Researchers like Tang and McCalla (2003) and De Bra et al. (2010) have proposed their own solutions to this challenge. However, their solutions still have limitations.

5.6 Adding Recommendations on LMS: A Design Proposal

In previous sections, I have argued that developing RS for LMS primarily face two challenges. The first challenge is how to decide on one recommendation candidate. The other challenge is how to make connection

between LMS and other websites and systems. In this section, I propose to construct a RS for LMS that deals with both challenges: a RS for LMS powered by digital library system. The main feature of this RS is the collaboration between a university's digital library system and LMS. The following paragraphs outlines how the RS design is guided by the interactive, motivating and standard principle, the proposed RS' recommendation seed, recommendation candidate, recommendation strategy, recommendation presentation, how this system provides solution to identified challenges, review of related projects and the algorithm needed to realize my design. The design is illustrated by the Recommendation System Flowchart and Wireframe system homepage.

The design is guided by my three UX principles: interactive, motivating, and standard. Guided by the interactive principle, this RS is created to give LMS users more interactive functions like clicking, dragging, scrolling. With the recommendation column on their interface, users can click on recommended learning materials, email themselves interesting entries, move the mouse to get the hover menu and scholl down the recommendation list. These features allow users with more opportunities and possibilities to interact with the system.

The second principle is motivating, both extrinsically and intrinsically. The RS motivates students extrinsically by using their curricular requirements. Curricular requirements, such as reading and exam requirements, have a sense of urgency and necessity that can easily transfer into external motivation. This RS uses the required and extended reading lists as recommendation seed. In this way, the LMS actively integrates curricular requirements and promotes students' motivation.

Intrinsic motivation comes from autonomy, competence, and relatedness (Deci and Ryan ,1985). As for the design of the RS, intrinsic motivation mainly comes from autonomy. Autonomy in UX requires giving users many choices in accessing information and functions. Without a RS, users have to search for information and

functions through layers of webpage menus. The existence of a RS provides more opportunities of accessing a wider range of information and functions.

The last guiding principle is the standard principle. The standard principle requires designers to follow industrial standard like Google and YouTube to design the RS. YouTube gives great salience to the presentation of its own RS. It puts its recommendations on the interface's right-hand side. Each recommended item is presented as a hyper-link. The recommendations are generated based on both users' browsing history and peer data. Following the standard principle, this RS's interface design is similar to YouTube, so that users can easily start to benefit from the RS, instead of spending too much time getting familiar with the it.

For identifying recommendation seed and generating recommendation candidate, my proposed RS uses universities' digital library system. With one university account, a user can log into both his/her institute's LMS and digital library system. A LMS has users' information such as their area of study, level of study and reading lists arranged by subject lecturers. The library system has the potential to keep track of users' search/access history and preference over items. These records should be affiliated with users' university account. LMS' user information and library systems' user preference can be used for RS construction. Secondly, library is one of the most important and frequently used resources for university study. It has a great many resources that could be recommended to university students. Besides, not too much extra work will be required as digital library systems are already established platforms.

In my proposed RS, recommendation seeds include any item(s) a user has recently accessed on his/her universities' library website and items on their subjects' reading lists. With a user' access history as recommendation seed, we are able to react to his/her recent study requirement and interest. But this is not enough. Unlike in the entertainment area, higher education's recommendations should concern more than just user' interests or preferences (Santos and Boticario, 2010). 'Items liked by learners might not

be pedagogically appropriate for them' (Tang and McCalla, 2003: 2-3). Therefore,Itmazi and Megias (2008) argue that teachers should play a role in providing resources for recommendations in LMS. Consequently, my aim is to ensure professional input from educators are also represented in my RS. This is achieved by including course reading materials as recommendation seeds.

I propose to use CF as recommendation strategy in this library system based LMS RS. As discussed in previous sections, the realization of CF typically requires a user's profile, items' information and peer ratings of items. In my system, a users' profile is his/her university account profile, with which he or she can log into both LMS and library system. Peer data is how many times an item has been accessed by all users of the library. Items information is each item's meta-data, because digital library's academic resources are generally recorded with rich meta-data, which includes an item's bibliographical details, length and database information. Moreover, universities' digital library system usually provides access to many paid databases like JSTOR and ScienceDirect. Some of these databases already have an RS. For example, on the right-middle area of its user interface, IEEE Explore shows items similar to users' search result under the name 'more like this' (see Screenshot 2). With those databases' permission, their recommendations can be integrated into my proposed RS. This will allow us to take advantage of leading digital Databases' RS and recommend more items to users.

IEEE Explore's 'More Like This' Tab

https://ieeexplore.ieee.org/document/7791219, <Viewed 5 Aug 2019>

YouTube demonstrates that the presentation of RS is important. It is proposed that the presentation of recommendations will be on the right-hand side of LMS' user interfaces, just like YouTube. I think YouTube put its recommended videos on the right because we conventionally read from left to right. When users get to a webpage, they will first focus on their search result or main content. Then they will move their attention to the right, to interact with the recommendations. In addition, in my RS, each item will be listed in the form of hyper-links. With hyper-links, users can easily and quickly get access to items that interest them. Preferably, these hyper-links will give users direct access to digital learning materials. In this way, users do not have to redirect multiple times through pages of LMS and library system. Moreover, the presentation will be able to include recommendations based on users' recent library search, recommendations based on subjects' core readings and recommendations based on extra readings. Users can easily choose to have all three types of recommendations displayed or only one or two of them displayed.

An issue concerning presentation is a typical LMS has so many different pages, on which page or pages should recommendations be presented. Like

LMS, YouTube has many different pages: a homepage, a video player page (mainly for users to consume videos), a user's channel page (mainly for users to upload and manage their own videos), a user's library page (users' watch history and saved videos) and more. Recommendation is mainly presented on YouTube's homepage and video player page, arguably because these two pages' functions are most closely related to YouTube's recommended videos. Consequently, it is proposed that recommendations will mainly be presented on pages related to students' learning activity.

My suggested RS provides solution to the recommendation candidate challenge. I decide on one type of recommendation candidate for LMS: academic materials in a university's digital library system. This is because as demonstrated before, LMS' RS should aim at helping to learn, instead of student administration. 'Research and use of library resources have long been critical parts of the educational process' (Black and Blankenship, 2010:458). Digitalised library resources including academic papers have been mentioned by a few researchers before. Tang and McCalla (2003) use academic papers as their recommendation candidate. Itmazi and Megias (2008: 239) suggest 'online library resources' could be recommended in LMS. 'Dey, Abowd & Salber suggest recommendation can be generated from 'reading material relevant to the topic under discussion' (Murad et al., 2018: 114). Consequently, it is suggested that a university' LMS RS utilizes the university's digital library system.

The disconnection challenge has led me to explore what system or website could potentially be connected to LMS, without too much complexity. A university student account usually gives access to both a LMS and a digital library system. Some students include me do often run both LMS and digital library simultaneously and are busy referring to both systems when doing studies. These have led me to plan a connection between LMS and library system. Additionally, library systems are well connected to digital academic databases and other educational resources. By connecting to library system, LMS is able to achieve connection with other websites and platforms.

Compared to previous projects, a LMS RS supported by digital library system has a few advantages. Unlike GRAPPLE, my system does not require collaboration among professionals from different institutes and platforms. Rather, once my RS is set up, collaboration between LMS and digital library system is automatic. Different from Tang and McCalla (2003)'s project, my RS does not ask university lecturers and tutors for additional work. However, university teachers still play a crucial role in providing recommendations because the reading list they create for students are used as recommendation seed.

A few previous studies have connected a university's LMS with its digital library system. University of Kentucky provides a library tab on their LMS. This tab 'provides a page of links that essentially serve as a portal to library services (Chestnut et al. 2009, cited by Farkas, 2015:2)'. This project only aims to set up a quick and easy library access on LMS. Portland State University's LMS contains a library widget on the front page (Farkas, 2015:2). 'This widget provides the ability to search the discovery tool and access several key library resources' (Farkas, 2015:2). Unlike University of Kentucky, Portland State University's widget also offers a research function and the access to more specific resources. 'Ohio State University's Carmen Library Link, where librarians develop course and subject pages outside of the LMS that are then dynamically pulled into the LMS' (Black and Blankenship 2010, cited by Farkas, 2015:2). The Carmen Library Link is similar to my RS in that it actually provides recommendations on LMS using the library resources. However, librarians are required to create recommendations to students according librarian's own knowledge and understanding of different university courses.

Carmen Library Link project requires much effort from the librarians' end and cannot benefit all students. Unlike Ohio State University's Carmen Library Link project, my design does not require librarians to manually create a learning repository for each university courses. Their approach takes too much time and effort. When the Carmen Library Link project was running, the librarians at Ohio State University were only able to create recommendation

for a few courses. Consequently, not all students at the university were able to benefit from that system. In contrast, my project can benefit all students with access to a university's LMS and digital library system.

My system can provide more useful and personalised recommendations than the Carmen project. With Carmen Library link, librarians were acting as a filter for information/knowledge. The items selected by librarian may not all be useful to students. My RS uses readings provided by each subject's lecturer as recommendation seed. Those readings are pedagogically proved and may be more reliable and useful than a librarian's list. Plus, my recommendation seed also includes users' own search and access history. This enables my system to provide more personalised recommendations than Carmen Library Link, whose users share the same recommendations with their classmates.

To realize my design, an algorithm is to be set up for the sharing of information and data between LMS and their respective digital library system. A LMS need to share its student profiles and lecturers' reading lists with the library system. A library system will collect data on users' preferences whenever they log onto their library system. However, there are times when a user logs only onto his/her library system, not his/ her LMS. We need to build a technological support to ensure that library-collected data are frequently delivered to LMS and reflected on the recommendations.

Given the above, I propose a RS design with which an institute's LMS and library system cooperate to generate recommendations for their users. This project provides solutions to LMS' two challenges in developing RS. My proposed RS identify both users' preferences and course reading lists as recommendation seed. The recommendation candidate is academic material stored in a university's digital library system. I use CF as my recommendation strategy because the combination of LMS and digital library system provides enough data for CF: user information, item information and peer ratings of items. Compared to previous projects that links library to LMS, my research requires much less effort and is able to provide more pedagogically proved

and personalised recommendations.

Conclusion

Following the interactive, motivating and standard principle, I propose to create a Recommendation System (RS) supported by digital library system. This RS is to be presented on Learning Management Systems (LMS). I discuss why recommendation, personalization and adaptation are often used as synonyms by other researchers and recommendation is used for my research. Then I outline the importance of RS in general and for universities specifically. Existing recommendation strategies include content filtering, Collaborative Filtering (CF) and hybrid. YouTube currently uses a hybrid RS named 'the Deep Neural Networks'. YouTube RS' implications for universities are that they should realize the importance of RS and RS' presentation on a user interface. Plus, a RS should constantly be updated according to the platform's development. It is argued that Massive Online Open Courses (MOOCs) could make use of YouTube's recommendation strategy. However, when it comes to RS, LMS faces challenges different from YouTube and MOOCs. Arguably, LMS' main challenges are what should be recommended and its disconnection from other websites and platforms. In response to these two challenges, I propose a RS design with which an institute's LMS and library system work together to generate recommendations for their users.

Chapter 6 Discussion 2: Incorporating a User-friendly Search Engine (SE) into LMS and MOOCs

Introduction

'A search bar allows people to search through a large collection of values by typing text into a field' (developer.apple.com, 2019). A user-friendly search bar is now an essential element of digital interfaces' good User Experience. My research participants demonstrate that YouTube's search engine is one main reason they use YouTube and YouTube's search bar provides a positive UX. Major website like Google, YouTube and Amazon all adopt a standard Google-like search. It is argued that LMS and MOOCs should have a standard Google-like search interface. This search bar should also maintain a prominent and consistent presence. Chapter 6 also discusses this search engine's search scope and Search Engine Results Display Pages (SERPs). It is argued that LMS' search engine should search internally in LMS, both learning materials and student administration functions should be included in the search scope. The SERPs should demonstrate search results in interactive snippets, like Google and YouTube. Because my search system responds to users' exploratory search requests, some snippets will demonstrate content from university's forum and Question-and-Answer websites. Although search is viewed as one of the most important functions for retrieving information online, there is very limited published study on adding exploring search bars in a research bar in LMS and MOOCs. Chapter 6 fills this research gap.

The Main Argument

University faculty and students frequently use Google and universities' digital library systems for searching. Google searches the general Internet and digital library searches the university's library databases. These two combined covers a great proportion of the Internet for academic purposes. However, an important part of the Internet is left unsearched: The Learning Management System (LMS). Even for an individual user, the LMS stores a great amount of learning materials

and administration functions. This calls for an information retrieval system that is essential, effective even routine: a search engine. An ideal search situation in the higher education context is when university staff and students use Google, digital library and LMS' search engines collaboratively. Since Google and digital libraries are already established, my goal is to design a search engine for universities' LMS.

Because a search engine is mainly made of three components: 'the crawler, the indexer and the user's end' (Havalais, 2009; Libby:), this chapter will discuss LMS' search engine from these three components. In terms of crawling, this search engine does not repeat what Google and digital libraries have already covered. The LMS search engine searches within itself: all the student administration functions, and study materials stored in an individual's LMS. Users interact with this engine by typing texts into a prominent and consistent search bar. The indexer presents a list of results with interactive features and also results that responds to not only simple keyword matching search, but also the more comprehensive Exploratory Search (ES).

An ideal search situation in the higher education context is when university staff and students use Google, digital library and LMS' search engines collaboratively. Google searches the general Internet; Digital library searches their university's library databases and LMS searches within itself: all the student administration functions, and study materials stored in an individual's LMS. Since Google and digital libraries are already established, my goal is to design a search engine for universities' LMS. This search engine is constructed by User Experience research methods and catering for users' goals in an efficient way. Three main aspects of the search engine will be discussed: the crawler, the indexer and the user's end.

The studies on algorithm and search result optimization prevail the research and design of search engines (Geiger, 2009). As a response, researchers like Geiger (2009) argue that the users' goals and needs should also be looked into. This search engine is constructed by User Experience research methods and

catering for users' goals in an efficient way. LMS' search engine does not need to repeat what Google and the library systems have already covered, because university staff and student are frequently using Google and digital libraries. Google and university libraries provide positive User Experience as well.

6.1 The Importance of Search Engines (SE)

What is a search engine? A search engine is a digital 'information retrieval system' (Halavais, 2017: 13). Most commonly, Users interact with the system by inserting texts into a search bar. The system then gathers information from within a platform or the Internet according to users' texts and presents to users a selection of hyperlinks. A search bar is where interaction happens between users and a search engine. 'A search bar allows people to search through a large collection of values by typing text into a field' (developer.apple.com, 2019). A search bar is usually a long narrow blank space where keywords can be typed into, the search button can be clicked and, in some cases, a drop-down suggestion menu can appear.

Search engines are of great importance in today's digital information landscape. We do live in an age when we have an abundance of information online, which calls for efficient and satisfying way of navigation through this information. Search engines are particularly useful because they allow users to 'face a huge amount of information' and 'to navigate that information in an efficient and satisfying way' (Davidson, Liebald and Liu, 2010: 293). They are so important that they are referred to as 'the first option for people who want to find information' (Geiger, 2009); 'essential tools in the quest to locate online information for many people' (Jansen and Spink, 2006: 248); and 'part of our daily routines (ScienceDaily.com, 2009).

Moreover, search engines are functioning as the gateway to online information and user functions. On the one hand, the successful application of search engines leads to the access to information and functions. On the other hand, the absence of search engines cause inconvenience in retrieving information. 'There

is a large amount of data stored over the Internet that is only useful if accessed as information' (Fatima, Luca and Wilson, 2014:445). Lopatovska, Fenton and Campot (2012) find that when users are not allowed to use search engines, their use of other electronic channels is reduced as well.' (Lopatovska, Fenton and Campot, 2012: 6)'. These other digital channels include email and social media sites. Without search engines, users start to use print sources and consult other people (Lopatovska, Fenton and Campot, 2012). Another example for this is, we do not usually use all the functions on a device or system. In fact, we usually use only a small percentage of functions on our devices or systems. One possible explanation is that these devices or systems do not have a search engine that gives us easy access to these functions. As a result, many information or functions remain undiscovered. In short, while we praise the access provided by search engines, we need to be aware of the void created by the lack of them.

Search engines' presence and importance will only increase in the near future, for both current and future Internet users. With constantly increased amount of digital information, current Internet users will have to make use of search engines more. Moreover, 'a new generation of researchers will be coming in a few years' time that will have grown up with popular internet search tools' (Lossau, 2004: 4). Younger users who grow up with search engines may see search engine as an inevitable part of the Internet. It is likely that they will be more aware of the void created by the absence of search engines and less tolerated to devices and services without a search bar.

6.2 How University Students and Faculty Use Search

Although LMS do not usually have a functioning search engine, university students use search engines frequently for academic purpose. Open web search engines, particularly Google, and university digital library system's search bar are extremely well used among university students. In terms of user experience, they demonstrate high level of satisfaction towards both search engines. When it comes to search behaviours, university students are not different from general web users: they like to use key words for searching and usually only read through

the first page of search results. Here speed and easiness are emphasized.

During a 4-year (2008-2012) research, Perruso (2016) followed 386 undergraduate students throughout their study and found out that undergraduates demonstrate strong reliance on Google for academic research. 'In each semester, at least one third of the participants said they *started* their research on Google or another search engine, with more than two thirds *starting* there as first-semester freshmen' (Perruso, 2016: 626). However, they hypothesized that 'students *started* their research with library resources more often as they progressed in college' (2016: 621).

While Perruso (2016) studies undergraduate students, George et al. (2006) focus on graduate students. In consistence with Perruso, George et al. (2006)'s study also found out that university students mostly use Google and library database for academic search. Different from Perruso (2016), they focused on graduate students. 'For graduate students (97%) using the non-library Internet, nearly three-quarters (73%) mentioned using the Google search engine for their information seeking (50% in humanities to 93% in computer science)' (George et al. 2006). 'Most graduate students (78%) use the university library databases' (George et al. 2006). George et al. (2006) also found out that university students are highly satisfied with libraries' online service. 'Nearly all (94%) graduate students use the university libraries' online services saying they are easily accessed, fast, convenient and time-saving' (George et al.: 2006).

6.3 What LMS' Search Engine looks for? The Search Scope

As discussed before, university students and faculty have already been frequently using Google and universities' online library for searching and are satisfied with the User Experience. Consequently, I do not think a general search engine like Google or that of the library systems should be created for Learning Management Systems (LMS) or MOOCs. Neither do I think a portal or link to Google or university's digital library search system should be added on LMS or MOOCs because users can easily go to them. I argue that LMS should have a

search engine that searches only what is within LMS, including both student administration functions and individual student's learning materials.

Among Vickery and Vickery (1993)'s 'major design decisions' (109) for online search interface design, there are: 'information sources' and 'subject domain' (1993： 109). 'One major decision would then be what type(s) of the database are to be accessed' (Vickery and Vickery, 1993:109). 'Subject domain related to a decision about databases is one about the subject scope of the database information to be accessed' (Vickery and Vickery, 1993:110). In short, when designing a search interface, designers have to consider in which database(s) and the scope of the concerned database(s) the engine will search.

There is very limited literature on adding a search engine to LMS, among which even less explicitly consider what should the engine search for. Avgeriou et al (2003) include a search engine in his design pattern for LMS because 'there are cases where the learning resources are numerous and diverse, resulting in the students spending much time and effort in trying to locate them' (Avgeriou et al, 2003: 16). Their proposed engine allows users to search for both academic materials and 'education-related events …by title or description' (Avgeriou et al, 2003: 22).

In terms of academic materials, their proposed search engine is like 'the ones found in generic web sites' (2003: 16). 'Searching can apply to all learning resources, therefore this pattern is related to E-book delivery, Glossary, Course announcements' (Avgeriou et al., 2003:16). Materials are organized by metadata. Learners or instructors insert the metadata manually.

Avgeriou et al (2003)'s proposal has two main drawbacks. Firstly, this engine is a repeat of Google Scholar and universities' digital library search engine. To achieve what they have proposed, what is required is only to incorporate a library or Google Scholar search bar in LMS. Secondly, their system requires educators to manually insert metadata onto learning materials. This requires extra time and effort from the educators' end. Moreover, new digital materials are being

published daily, which will result in constant unorganized materials. They also did not specifically map out which database(s) they propose to use and how their engine will link to these databases. So again, the only feasible way to achieve their design is to add Google Scholar or digital library or any academic database to LMS.

One interesting point of their design is that their engine also searches for 'education-related events… by title or description' (Avgeriou et al, 2003: 22)'. 'Some LMS incorporate calendar systems that hold a number of features, enabling the user to publish events and customize the calendar according to his/her needs and preferences' (Avgeriou et al, 2003: 22). Google Scholar, university libraries and academic databases do not store Education-related events. So, this unique design feature is specifically related to LMS. Using keywords to search for part of the LMS is useful to users.

Another study that mentions LMS' search scope is Sharples (2000)'s design proposal for personal mobile lifelong learning technology. He suggests that desirable interactive technology should 'carry out more efficient Web searches (than general search engines)' (2000: 183). His vision also includes searching for 'other users who are performing similar tasks' (2000: 183). Another one of his noticeable visions includes presenting the search engine's interface as a digitally simulated teacher. However, Sharples (2000) does not explain how his design provides users with more efficient search than the general Web. Neither does he elaborate on why users need to search for peer users in LMS.

I argue that the first step to designing a search engine for LMS is to decide what this engine will search for, also known as the search scope. 'A search scope defines a subset of information in the search index' (Microsoft, support.office.com, 2010). 'Typically, search scopes encompass specific topics and content sources that are important and common to users in the organization' (Microsoft, support.office.com, 2010). My proposed search engine searches only within the LMS, so it is different from Avgeriou et al. (2003)'s repeat of Google Scholar and digital library search. Within LMS, this engine mainly searches for

two things: student administration functions and individual learning materials.

Student administration makes an important part of LMS. ‘Many (perhaps even most) educational institutions like schools, colleges and universities are using a Learning Management System (LMS) to manage or keep track of the students’ progress through the curriculum. For the institutes, it is very important to know who is enrolled in which courses, what their exam results and credits are, and thus also when the students are ready to graduate’ (De Bra et al., 2013: 3029). It is imperative to help both faculty members and students to navigate through digital administration tasks in their LMS fast and efficiently.

Unlike my proposed recommender system (RS), which does not include student administration functions as its recommendation candidates, my proposed search engine searches student administration functions. In the previous chapter, I argue that a recommender system (RS) should be added to LMS, and this RS should recommend learning materials instead of administration functions. Apart from the reasons given in the previous chapter, learning is a more continuous action than student administration. This means, with my proposed RS, students could start learning at any time once they log into their LMS. However, students only need to fulfil administration tasks at a few specific moments, for example, when they look up their unit guides, when they check their exam results or when they apply for assignment extensions. When they log onto their LMS with these specific tasks in mind, it would be convenient for them to locate useful links fast. This is where a search engine that searches for administration functions becomes convenient.

Apart from student administration function, my engine also searches for different materials stored in each user’s individual LMS. Students can search for their own course guides, unit guides, assignment descriptions, upcoming events, recommended reading lists, lecture slides and recordings, tutors’ contact details, as well as textbook lists. Faculty members can search for their own uploading function, marking system, attendance lists, assignment collection system and plagiarism check report, etc. Search results are based on the scope of each

person's needs, rather than the monotonous simple search results from the entire LMS.

The designed SE helps users to locate materials both at the level of learning resource (e.g., video) and at the level of course administration (i.e., to encourage enrolment, subscription payments). As both administrative tasks and learning materials are of great importance to users' engagement with LMS and MOOCs, my SE's search scope includes them both. This design can benefit different users of LMS and MOOCs, such as students, teachers, and administrators. In this way, users can locate information fast and efficiently.

Although the proposed SE can bring many new opportunities for students to interact with LMS, its search scope should be carefully outlined. When students search for learning materials, they will not be given course content from courses other than their own. This is because of considerations of ethics, copyright and even data storage. If they hope to study for courses outside their enrolment, they can use MOOCs instead. However, when students search for university administration tasks and information, results open to all students will be presented. To sum up, students will not be able to use LMS as MOOCs in that they will not be able to search for course content outside of their own enrolment, but the administrative information is shared among all students at one university.

Scholars like Vickery and Vickery (1993) argue that designers need to make some 'major design decisions' (109) for online search interface design including information sources and subject domain (Vickery and Vickery, 1993). However, very limited projects have explicitly considered what should LMS' search engine search for. Avgeriou et al (2003)'s proposal is a repeat of Google Scholar and universities' digital library search engine. Sharples (2000) has some interesting visions but fails to elaborate on them. I argue that the first step to designing a search engine for LMS is to decide what this engine will search for, also known as the search scope. My proposed engine searches within the LMS, its search scope includes student administration functions and individual users' learning

materials.

6.4 The Search Engine (SE) Interface Design

My argument is that not only a search bar should be added to LMS and MOOCs, on both platforms the search bar should also have the following characteristics: standard, prominent and consistent. Firstly, prominence means that the search bar should be occupying an important space on the website/platform so that it is easy for users to locate it. Secondly, when users interact with a website/digital platform, they go into different pages of the website/platform. Consistency means that the search bar should be on all the webpages and should remain in the same place across different pages. Last but not the least, I design my search bar to be a standard Google-like one, instead of an innovative one. In conclusion, my proposed search bar for LMS and MOOCs has a prominent, consistent and standard presence.

Search Bar and Good UX

A friendly user interface is essential for creating a positive UX, as the user interface is usually the starting point for user interaction. Some scholars go as far as to even call it 'the most important feature that will enhance the user experience' (Fatima, Luca and Wilson, 2014 a: 925). If user interface is the starting point for user interaction, search bar can be viewed as the starting point for user's interaction with the interface. 'The starting point for a search interface is to get a query or search keyword/s from the end user and endeavour to understand what the user is looking for' (Fatima, Luca and Wilson, 2014: 926). Through search bar, users use keywords to give the system instructions and the system act accordingly.

The existence of a search bar has become users' common expectation when interacting with a system. 'As we've seen in recent studies, they typically scan the homepage looking for "the little box where I can type (Neilson, nngroup.com, 2001)'. 'Users often move fast and furiously when they're looking for search' (Neilson, nngroup.com, 2001). Leading platforms like Google and YouTube all

have prominent, consistent and standard search bars so that users can use them fast and the fury caused by not locating them will not last long. More and more smaller platforms like smaller-scale online retailers are integrating search bars on their websites. As search bar becomes more and more common on various digital platforms, platforms without a search bar risks failing users' expectation.

A search bar reduces users' efforts spent on a system or platform. As Geiger (2009) and … have demonstrated, digital users greatly value opportunities to invest the least-effort possible in information retrieving. This is also known as 'the least-effort principle'. 'In digital marketing, there is a rule of three: if it takes more than three clicks to get to a piece of content, the chances of anyone reading it are exponentially diminished' (Niles-Hoffman, axonify.com, 2017). A search bar is an effective way to help reducing the number of clicks from the user' end. 'A Google search takes one or two clicks' (Niles-Hoffman, axonify.com, 2017). While a typical LMS without a search bar takes 'around 9, sometimes as high as twelve' (Niles-Hoffman, axonify.com, 2017) clicks.

To sum up, search bar can be viewed as the starting point for user's interaction with an interface. As a result, a user-friendly search bar can greatly add to positive User Experience. The existence of a search bar has become users' common expectation when interacting with a system. Additionally, a search bar reduces users' efforts spent on a system or platform by reducing users' number of clicks. For these 3 reasons, it is argued that in order to improve User Experience, LMS and MOOCs should incorporate the design of a user-friendly search bar.

Prominence of the Search Bar

As discussed in the previous section 'The Search bar and Good UX', search is such an important function today and is an essential design feature of good UX. The salience of search requires its prominent location on the interface. 'Users are now expecting to be able to search more than they used to' (Fries, spyrestudios.com, 2017). In journalism, the Inverted Pyramid rule asks the most important information to be put at the top of the news report. In UX design, we should also put the most important section, the most frequently used function in

the most prominent place.

Researchers like Fries (2017) put forward other reasons to justify search bar's prominence. One reason why 'it's being brought closer to the front of many designs' is 'search is getting smarter' (Fries, spyrestudios.com, 2017). Indeed, before we achieve today's search technology, search was not as useful as it is today. We used to leave the prominent space to other more developed functions such as navigation.

In order to achieve prominence, there are three aspects in which we could perform the design task: central location, decent size and visual contrast. I put forward these three aspects by observing leading search engines like Google and YouTube, as well as university library websites and academic databases. Take YouTube for example, its search box is at the top middle of the webpage. The search box is long enough for a few keywords or even an average sentence. The search box can hold only one row of keywords or sentence, but this one row is by no means shallow. Last but not the least, YouTube's search box is clearly defined by black lines so that the white search box stands out from YouTube's white background. The search button is also very obvious: a small magnifier symbol against a grey background. Central location, decent size and visual contrast are employed to give YouTube's search bar prominence.

LMS's search bar should be at the top middle of the interface, like YouTube, Amazon, library website and academic databases. Google's search bar is not only in the middle but also in the centre of the page. Although this is even more eye-catching than YouTube's alike, it is not practical for LMS. I design LMS' search bar to take after YouTube instead of Google so that the space below the search bar can exhibit other useful resources and links.

My proposed search box has a decent size in terms of length and height. It is common for major websites like Google and YouTube to have a long query box that can accommodate a few keywords or even an average sentence. This is supported by experts like Neilson (2001), for a long search box maintains usability: 'the search input field should be wide enough to contain the typical query; if the

box is too small, the query will scroll and diminish usability' (Neilson, nngroup.com, 2001).

It is obvious that Google and YouTube need long query box because their users sometimes type in a full question. For example, one of YouTube's popular search queries is 'How to solve a Rubik's cube?' One of Google's popular queries is 'How to screenshot on Mac?' On library and academic database's websites, the query bar is long because students and faculty can search for academic resources by name. Academic papers' name can be long. For some other websites like Amazon, where users are less likely to type a full sentence into the search bar, they still have a long query box like Google and YouTube. They maintain a long search box in case users need to type in more keywords to narrow down their search. Also, as search becomes smarter and smarter, users may also type in a full question in the near future. In general, a search box should be long enough to accommodate a few keywords or even a sentence of average length.

In regard to the height of the search box, the general practice is to have one row of query instead of multiple rows. Users prefer fast results and investing minimum effort in getting the results, so a one-row box is adequate in most cases. This one-row query box has a comfortable, not squeezed look. There is generous space above and below the texts. My proposed LMS search bar has the same one-row look like the general practice.

The last element of prominence is the ability to stand out from the background. A search bar with good UX should clearly stand out from the webpage background so users spend only minimum effort in locating them. There should also be contrast between the search box and the search button. Consequently, after inserting their query, users can easily press the search button. Moreover, 'including a search button with a contrasting color (which is extremely useful in web design) will make the search area easier to find' (Fries, spyrestudios.com, 2017).

Geiger (2009)'s Qualitative study find that Students and faculty's search engine of choice is Google, because Google is thought of as: 'fast, easy, and

clean' (Geiger, 2009: 17). Fast, easy and clean UX comes from the prominence of search bar. In conclusion, the LMS search bar should have a prominent presence. There are three elements contributing to prominence: central location, decent size and visual contrast.

Consistency of the Search Bar

My search bar has a consistent presence on LMS. Consistency has two layers of meanings. First, every page of LMS should demonstrate the search bar. This idea is supported by experts like Neilson (1997): 'Search should be… available from every page'. There should be 'a search button on *every* page' (Neilson, nngroup.com, 1997) Second, on every page, the search bar should occupy the same prominent space. In this way, users can easily locate and make use of the search bar in every step of their interaction.

Maintaining a consistent search bar is the practice of many websites. General websites like Google, YouTube and Amazon keep their search bar on the same spot on every page. On YouTube's homepage, video player page, users' channel, the search bar is the same design and remains at the same spot, so users at different stage of use can easily locate and use the search bar. It is the same for educational websites including university library systems and academic databases like IEEE and JStor. However, many universities' general websites and LMS exhibit inconsistency when it comes to search bar. A search bar appears on certain pages but not all pages. Inconsistency can cause confusion and inconvenience to users. When users need to locate information or links, they have to go to different pages, sometimes in a back-and-forth manner, to look for the search bar.

A consistent search bar can provide users with support throughout their journey of interaction. Often when users interact with a digital system, they browse many different pages of the system. For designers, it's hard to predict on which pages users are most likely to require the search bar. Therefore, to provide a search bar that always exists and keeps the same location on different pages can better meet the search needs of users.

To sum up, LMS' search bar should have a consistent presence. Here consistency means that each webpage of the platform should have a search bar. On every page, the search bar should occupy the same prominent space. The need for consistency is supported by both real-life instances and expert opinions. A consistent search bar can avoid confusion, assist users with every step along the way and generate good UX.

SE Design Guided by the Interactive, Motivating, and Standard Principles

The design is guided by my three UX principles: interactive, motivating, and standard. Guided by the interactive principle, this SE is created to give LMS users both the interactivity that provides and the interactivity that enables. The first aim is for the system present interactive features for users. A SE allows users to interact with LMS and MOOCs. Interactive activities include typing keywords, clicking the search button and clicking on search results. The second aim is to enable users to take advantage of the interactive features not as passive users, but as active creators. Users are encouraged by this SE to participate in the LMS' forum discussions. This can increase the message and source-based interactivity. This design enables users to interact with the platforms more by being active creators of UGC.

The motivating principle guides the SE design mainly by promoting Intrinsic motivation. A SE gives users a high degree of autonomy. With a SE in a system, users can easily search for their desired information or function. As SEs are so common and easy to use today, the presence of a SE can make users feel confident about their own ability to navigate through a platform. This generates a sense of competence. According to the relatedness theory of the intrinsic motivation mode (Deci and Ryan, 1985), social aspect can impact users' internal motivation. In order to boost motivation, The design of my SE promotes users' social presence and interaction. Among the many functions in today's LMS and MOOCs, the discussion forum is the one with a great number of characteristics of social networks or can be seen as a social network itself (Bandias and Guiding,

2012; Krishnan and Rogers, 2015). As a result, while I design the SE of LMS, I make use of the discussion forums.

The standard principle suggest that designers follow industrial standard like Google and YouTube to design the SE. Some of the reasons that account for Google and YouTube's industrial standard status are their large user base, users' familiarity with their UI and satisfaction with the UX they provided. Following the standard principle means that novel UX design principles and ideas, such as gamification and questionnaire-based SE is not the focus of this project. This project designs its SE to be a standard, google-like one.

The Standard Google-like Search Interface

Leading platforms like Google, YouTube and Amazon all adopt a standard Google-like search bar, which is characterized by the search box, the location of the box and the drop-down menu. The search bar itself is a long white box where users can type in a few key words or even a sentence; Users can then click the search button (the magnifier symbol). A standard Google-like search bar locates in the middle or on the top of the webpage. Plus, if a user has previously recently used the search bar, a drop-down menu will appear under the search box. The drop-down menu shows users' search history before any text insertion and query suggestion once any text is being typed into the search box. The drop-down menu shows a few lines of search history or query suggestion in a lager box than the search box itself, but usually the user does not need to scroll down the webpage to see the full list.

As detailed in above paragraph, a standard Google-like search bar has 3 main elements: the long white search box with the search button, the notable location of the search box and the drop-down menu. In terms of UX, this trichotomous design is positive because it offers users speed, ease of use, flexibility and personalization. Google-like search box assumes prominent location on a webpage, so users can quickly and easily use it. The search bar itself is designed to be able to contain multiple keywords or even a sentence when needed. It gives users flexibility to enter queries long or short. The drop-down menu makes the

search process more personalized and also saves time and effort. In general, standard Google-like search box offers positive User Experience.

The Drop-down Menu

As I have discussed in the preceding section, the standard Google-like search interface has three main features: the long search box, the central location of the search box and the drop-down menu. The long search box and the central location of the box are so obvious that they instantly come to users' mind when they think of Google. When discussing the prominence and consistency of the search bar, I include the long search box and its central location. The drop-down menu, although is being frequently used on Google, YouTube and Amazon, is overlooked. Here I will elaborate on the drop-down menu.

In the standard Google-like drop-down menu, there are two types of suggestions: search history and search suggestions. When a user puts the mouse in the search bar, before the user types in any words, the drop-down menu shows users' search history. Search history refers to search terms that the user has recently typed. Once the user starts to type into the bar, search suggestions will start to appear. 'Search suggestions are recommended queries that appear in a dropdown as users type in a search box. These recommendations appear beneath the search box and change as users type each letter of their query' (Moran, nngroup.com, 2018). Search suggestion is also called 'predictive search' (Laubheimer, nngroup.com, 2016). 'In recent years, search suggestions have become an expected sign of a well-designed search feature' (Moran, nngroup.com, 2018).

The drop-down menu is attached to the search bar, or 'right below (Laubheimer, nngroup.com, 2016)' it. When the menu appears, the drop-down box does cover other content on the interface. When users are conducting searching, they primarily focus their attention on the search bar, so the drop-down menu's coverage of other content is not a usability concern. When users finish their search and enter the next page, they will be presented with a clear search bar without the previous suggestion box. I deign my LMS search bar to be of the

same style: the drop-down menu appears right below the search bar and covers other content on the interface when users are typing.

The drop-down menu shows a few lines of search history and/or search suggestions in a box larger than the search box itself. Google ‘s drop-down menu shows 10 lines of search history or 10 lines of search suggestions or 10 lines of search history and suggestions combined. YouTube’s drop-down menu shows 6 lines of search history and 14 lines of search suggestions. As users keep typing, the menu will keep giving suggestions based on the last word being typed. The suggestion list may be long or short, depending on how many suggestions can be generated from the letters. The list will not exceed 10 lines for Google and 14 lines for YouTube.

The numbers of lines come from careful consideration. These numbers of lines give generous suggestions to users. In this way, users are more likely to be given useful suggestions. Compared to Google’s 10 lines of search history, YouTube only displays 6 lines of search history. A reduced search history lines may come from the perspective of projecting users’ privacy. Moreover, YouTube may be more focused on helping users discover new content, while Google is more focused on helping users find what they search for. In consequence, YouTube has more lines of search suggestions than Google. Last but not the least, these numbers are not too big, so users do not need to scroll down the webpage to see the full list.

I design my drop-down menu to be showing 10 lines of search history and 10 lines of suggestions. In terms of new content discovery, my search scope is much smaller than YouTube. So, I do not design my search suggestion to be 14 lines, instead I go for only 10 lines. I do think my users’ past search queries are useful. As a result, the search history has 10 lines. However, different LMS and MOOCs can have their own numbers of lines according to their understanding of their users’ need.

The drop-down menu makes the search bar an interactive and personal space. The search bar is not a place that passively records the users’ queries. It is

actively reacting to user queries by making use of the drop-down menu. This interactive process 'facilitates an understanding of user requirements for the data' (Fatima, Luca and Wilson, 2014 a: 925). According to Fatima, Luca and Wilson (2014), the benefits of such facilitation include saving time, enabling effective communication and providing a friendly user-interface (Fatima, Luca and Wilson, 2014 a: 925-926). Moreover, Geiger (2009)' research participant lists 'personal' (2009: 17) as one of the major reasons of using Google. As the prominence and consistency of Google's search bar remains the same for all users, the personalized experience comes from the drop-down menu.

In conclusion, the drop-down menu shows users' search history and search suggestions based on the letters and words typed by users. The menu occupies the space right below the search bar and presents many lines of history and/or suggestions. This Google-like drop-down menu makes the search process interactive and personalized. According to Google and YouTube,the numbers of lines of search history and search suggestions come from careful consideration. Consequently, I design my search engine to display 10 lines of search history and 10 lines of suggestions.

Conclusion

A user-friendly search bar is crucial for providing good UX. Leading platforms like Google, YouTube and Amazon all adopt a standard Google-like search bar, which is characterized by the search box, the location of the box and the drop-down menu. There are some instances in which novel search interfaces are created. However, LMS' search engine should still have a standard Google-like interface. Moreover, the search bar should assume prominence and consistency.

6.5 Search Engine Results Pages (SERPs) Design for Supporting Exploratory Search

'*Exploratory search* describes an information-seeking problem context that is open-ended, persistent, and multifaceted, and information-seeking processes that are opportunistic, iterative, and multi- tactical' (White and Rose, 2009: VI).

One recent dichotomy of search can be applied to my design of LMS' search system. In this dichotomy, there are mainly two types of search: lookup search, (Athukorala et al, 2015; Palagi et al., 2017) and exploratory search. Lookup search means 'the most basic kind of search and refers to focused searches where the user has a specific goal in mind and also an idea of the expected result' (Palagi et al., 2017: 2). 'Exploratory search scenarios are characterized by needs that are "open-ended, persistent, and multifaceted, and information-seeking processes that are opportunistic, iterative, and multitactical"' (White and Roth, 2009, as cited by Wilson et al., 2010: 7). Existing LMS search engines usually conducts simple search. This is supported by researchers like Athukorala et al. (2015). 'The predominant design goal in information retrieval (IR) systems has been fast and accurate completion of lookup searches' (Athukorala et al, 2015:2635). My proposed search engine conducts lookup search just like existing search engines in LMS. However, in order to provide better UX, it also has the ability to facilitate exploratory search by integrating LMS' discussion board and other resources in LMS.

Look Up Search

Lookup search 'is the most basic kind of search and refers to focused searches where the user has a specific goal in mind and also an idea of the expected result' (Palagi et al., 2017: 2). 'Lookup tasks return discrete and well-structured objects such as numbers, names, short statements, or specific files of text or other media' (Marchionini, 2006:42). Lookup search can search for close-ended facts and information that already exist in a system or can be easily indexed by a system.

Existing search engines in LMS and MOOCs mainly perform lookup search. For example, Learning Management System MOODLE' search engine searches for a university's provided courses. Massive Online Open Course LinkedIn Learning's search bar suggests its users to search for 'skills, subjects or software'. This is understandable, as 'lookup search is by far the better understood and assumed to have precise search goals. The predominant design goal in information retrieval (IR) systems has been fast and accurate completion of lookup

searches' (Athukorala et al, 2015:2635).

By only performing lookup search, existing search engines in LMS have a small search scope. They generally search for university courses, subjects and skills, etc. As a result, lookup search can help users in finding some information. For instance, With MOODLE or LinkedIn Learning, if a user's query contains keywords that indicate a course or subject, he or she will be provided with a list of results by the search engine. However, this small scope does not cover everything in an educational system, which can be useless when users' intended search results are not covered. In MOODLE or LinkedIn Learning, if a user's query is neither a course name nor a subject title, he or she will be either given no search result or irrelevant results.

Moreover, by only performing lookup search, existing LMS search engines are not motivating students to use LMS for studying. On LMS, lookup search mainly fulfills student administration tasks, not learning tasks. For example, on MOODLE, when a user searches for a course, what he or she will get as search results are course information, not actual learning materials of this course. Course information, like course name, code and description, are not very useful once a student has already started his or her course. This is less a problem for MOOCs, as users can search for course, subjects or topics, the search results will be actual course videos. From there users can start learning right away.

To sum up, lookup search helps users to achieve their close-ended goals such as looking for specific 'numbers, names, short statements, or specific files of text or other media' (Marchionini, 2006:42). It is still the predominant goal of most search engines to perform lookup search (Athukorala et al, 2015). These search engines include that of LMS' and MOOCs'. By only performing lookup search, existing search engines in LMS and MOOCs have a small search scope. In LMS, only conducting lookup search is not motivating students to use LMS for studying.

Exploratory search

'*Exploratory search* describes an information-seeking problem context that is open-ended, persistent, and multifaceted, and information-seeking processes

that are opportunistic, iterative, and multi- tactical' (White and Rose, 2009: VI). Arguably, any search activity that is not a lookup, can be seen as exploratory search. In reality, the situations are diversified. An exploratory search could be performed when a user is trying to find answers to open-ended questions, instead of keyword-based facts; or when a user is not sure how to form a clear query; or when a user is discovering how to use a specific system. More instances include 'searching to learn', which 'involve(s) multiple iterations and return sets of objects that require cognitive processing and interpretation' (Marchionini, 2006: 43). Another example of exploratory search is 'social searching where people aim to find communities of interest or discover new friends in social network systems' (Marchionini, 2006: 43). In general, exploratory search describes search tasks that are the opposite of simple close-ended lookup search.

Exploratory search is different from lookup search in many aspects. Unlike lookup search when users type in a few keywords and will be provided with results by the search engines, exploratory search may take longer, require a few more attempts or the user to go to different resources. 'For *exploratory* tasks we cannot identify a single and direct path that leads to the desired results' (Athukorala, 2015: 2639). As argued in the previous section, lookup search alone has a relatively small search scope and is not contributing to students' learning motivation. Lookup search combined with exploratory search can increase the search scope. Exploratory search can also help motivating students to learn. This will be further explained later.

Exploratory Search and Education

Exploratory search should be used to aid learning activities. As Marchionini (2006) argues, 'searching to learn', which 'involve(s) multiple iterations and return sets of objects that require cognitive processing and interpretation' (Marchionini, 2006: 43), is an important task of exploratory search. For researchers like Pereira et al. (2019), exploratory search is intrinsically a learning process. 'The exploratory search is defined as conceptual exploration, commonly used in scientific discovery, learning, and decision-making contexts' (Pereira et al., 2019: 17). Consequently, 'the main goal in ES is learning' (Palagi et al., 2017: 3).

It is imperative for the higher education sector to adopt exploratory search on their digital platforms. Rahdari et al. (2020) argue that exploratory search should be used to support university users for two main reasons. One, early academic researchers, like undergraduate students, do not always have a clear understanding of their subject matter. Two, 'many students' methods for finding a research opportunity are in fact themselves "opportunistic", shaped by a sequence of encounters with information and people, both formal and informal, with one encounter leading to another related encounter (Rahdari et al., 2020:2). Exploratory search can cater to users with an unclear understanding of their search subject and usually has non-linear, relatively complex search process. As a result, exploratory research should be making use of by the higher education sector.

Exploratory search can bring positive UX. Rahdari et al. (2020) refer users who engage in exploratory searches to as 'Explorers'. According to their experiment, explorers were 'significantly more productive' than users who use lookup search. 'They also reported significantly more positive experiences, including satisfaction with the system and results, feeling in control, and confidence' (Rahdari et al. 2020: 12). In general, explorers are more satisfied with their UX when using a system with search function, than look up search users.

Algorithm Needed

An algorithm needs to be established to decide whether users' query falls under the category of lookup or exploratory search. Such algorithm already exists and has been studied by researchers like Athukorala et al. (2015). This algorithm may use indicators like 'the first query length, maximum scroll depth, and task completion time' (Athukorala et al., 2015: 2636) to separate lookup search and exploratory search. Athulorala et al. In terms of query length, if a query is more than 8 words long, it is very likely to be of exploratory nature. If a query is only around 3 keywords, it is highly likely that it is just a lookup. Acording to Athukorala et al. (2015), in exploratory tasks, users are more likely to 'scroll deeper into the result list' (2015：2649) and spend more time. Althukorala et al. (2015) argue

that these three indicators are ‘the most informative’ ones. According to their research, ‘the core lookup tasks are separable from the core exploratory tasks with nearly 85% accuracy’ (Athukorala et al., 2015: 2636).

Researchers like Athukorala et al. (2015) and Palagi et al. (2017) agree that some search tasks have borderline characteristics, which means that it can be difficult for the system to clearly decide whether it is lookup or exploratory, or it can have both natures, or it can be ‘core lookup’ (Athukorala et al., 2015) but with exploratory characteristics, or ‘core exploratory’ (Athukorala et al., 2015) but with lookup characteristics. Due to this situation, a great amount of research work has been done to develop smarter, more accurate algorithm to fulfill the detection task. When this algorithm is improved, it can also be applied to LMS and MOOCS. In the meantime, we can take advantage of existed algorithm to construct my proposed search engine that can respond to exploratory search.

Supporting Exploratory Search

It is difficult to design the UX to fulfil exploratory search. Exploratory search can be understood as a process from the users’ end. In this process, a user may go to different sources and create their own path while doing the exploratory search. In this sense, it is generally difficult to design one system to fulfil users’ exploratory need. For example, my participants go to YouTube, their LMS, MOOCs and possibly other discipline-specific websites to study. It is impossible to design the UX of any one of these systems to provide the UX of all of these systems combined.

But if we regard exploratory search as any search activity that is beyond simple keyword search that extracts facts and numeric, it is possible to levitate the UX of a system to fulfil exploratory search. By this definition of exploratory search, users’ need is to acquire answers to comprehensive queries or open-end questions. Consequently, if a system can respond to comprehensive queries and open-end questions, this system can facilitate exploratory search.

An effective way to achieve exploratory search is by retrieving User-Generated

Content (UGC). ‘User-generated content comes from regular people who voluntarily contribute data, information, or media that then appears before others in a useful or entertaining way, usually on the Web—for example, restaurant ratings, wikis, and videos’ (Krumm, Davies and Narayanaswami, 2008: 10). On the World Wide Web, UGC is great in volume. To include UGC as part of the content strategy is low-cost, as Krum, Davies and Narayanaswami (2008) put it, UGC is ‘fairly inexpensive to obtain’ (Krumm, Davies and Narayanaswami, 2008: 10). Moreover, UGC is provided by real ordinary users, who can understand the needs of other ordinary users and provide useful insights towards their questions.

In real life practice, leading search engines like Google and YouTube frequently use UGC to support their users' exploratory search. Online encyclopedia website Wikipedia often appears in a prominent place on Google’s SERPs. Wikipedia’s entries are created and maintained by users (en.Wikipedia.org, 2020), which makes Wikipedia a great example of UGC. When giving open-end questions as the search query, Google frequently retrieve content from online forums like Quora. Similar to Wikipedia, Quora is also a platform of UGC. With ‘Broadcast Yourself’ as its slogan, YouTube also has a great volume of video content created and uploaded by ordinary users. When users perform exploratory search on YouTube, it's highly likely that they will be given UGC in the SERPs.

Because of the benefits of using UGC and UGC’s status on common search engines, the proposed LMS search engine will also use UGC to support exploratory search. As De Bra (2004) argues, the two main functions of LMS are facilitating learning and student administration, so a lot of information on LMS is either officially released or authorized by the universities. As a result, LMS is generally not associated with being UGC platforms. However, in a place where discussions of LMS have often overlooked (Stromman, 2015), there is UGC highly relevant to learning and student management. This place is the LMS’ student forums, also known as discussion boards.

On LMS, university students enter forums through their subject units and interact with their teacher(s) and peer students by asynchronously posting and

replying to discussion threads. The entry point to the LMS online forum is generally the units/subjects taken by each student. A student can enter the forum of several units at the same time. Both teachers and students of the unit can use the forum to discuss topics related to the course and student management. The forum discussions are posted asynchronously (Barrett and Liu, 2014; Stromman. 2015)and organized in the style of threads. 'The interaction within the forum is asynchronous, and the participants can reply to each new discussion started, regardless of location and time. Each reply is added onto the end of the discussion, giving a collection of postings displayed from oldest to most recent. A discussion thread is built up of an initial posting and the replies received, forming an extended string-based "conversation" on a particular topic' (Stromman, 2015: 48).

According to previous research, forums on E-learning platforms have the following characteristics: ubiquitous, lack of use and have the potential to develop. 'The discussion forum is a ubiquitous component of every management system and online learning platform from Blackboard to Moodle to Cousera' (Morris and Stommel, 2015). However, compared to other digital platforms where university students are very active on, LMS' forum generally lack participation (Morris and Stommel, 2015). Researchers also often overlook the forum when they study about LMS (Stromman, 2015). 'Discussion forums have the same potential all digital pedagogy tools have' (Morris and Stommel, 2015) and teachers and students do have expectations for forums to develop (Morris and Stommel, 2015).

Forums on e-learning systems are in in want of participation, but there are still a few posts that are disproportionately popular who receives large volume of interaction. For example, one post on VU's LMS asking people to share learning tips has over 1,500 responses. Many of the responses have been read and rated by other users. This shows that students are still interested in participating in discussion forums and replying to posts. There are also many students who think the content in the forum is useful to them.

However, many other posts perform poorly: they receive very little attention.

Some forum posts get zero reply or maximum four or five replies. This corresponds to Morris and Stommel (2015)'s observation that compared to popular social media sites, students in general are really reluctant to use e-Learning platforms' forums. There are two possible reasons for this. One, it is difficult for students to actually access their forums and discussion threads. Although on LMS and MOOCs, forums are usually linked to subject units, even on the subject unit page, it still requires clicking on a number of different buttons to finally end up in the unit's forum. In addition, it is difficult for students to quickly find useful posts or replies in the forum. Second, users lack the motivation to post and interact on LMS forums. Morris and Stommel (2015) find that some teachers even include posting on o the LMS forum as part of the assessment to ensure participation. To sum up, the difficulty of access and the lack of motivation can account for the lack of participation on e-learning systems' forums.

To solve the access problem, the forum needs to be included in the search scope. By doing so, users can insert exploratory search queries into the search bar without the fear that no search result will turn up. If a post in a forum can answer to exploratory search, SERPs should have a post in the forum. This way, users can not only find search results that respond to their exploratory search, but also easily and quickly find the entry to the forum. For LMS to cope better with exploratory search, more UGC is needed.

The current phenomenon is that many students and teachers use third-party platforms, such as Facebook or Second Life, for study-related communication and group discussion (Wang et al., 2012; Oznur, Yanpar-Yelken and Tokmak, 2018). Or they look for learning materials on websites other than LMS. Admittedly, successful commercial platforms are designed to represent the cutting-edge technology they use and to attract customers. But the lack of a reward mechanism in LMS' Forums is also a major reason for university users' shift to third-party platforms. More importantly, the lack of UGC can lead to a decrease in user's motivation to consume information and interact with posts on the forum. The decline of enthusiasm will lead to fewer and fewer contributors.

First, the university can officially post information to attract students to read,

such as frequently asked questions. These questions could be related to issues that students encounter while studying or living on campus. When users think of a question, they will immediately think of looking for the answers on the discussion forum. In order to achieve this goal, the entry to the discussion forums should be very obvious, in other words, it should be very easy to find. As users browse through questions, their chances of answering them also increase.

Many universities operate a Questions & Answers, or Q&A website/webpages. There, university staff write down questions frequently asked by students and provide answers. The aim of operating such websites is for students to quickly and easily find answers to their questions, without the need to contact the university faculty or staff. However, these websites do not always present to students obviously on the university LMS and can have hundreds of pages without a SE. It is difficult for students to actually find the website and use it efficiently. In addition to post official information on the discussion boards, universities can make good use of their Q&A websites by letting a Search Engine extract information from them. In this way, students' exploratory search queries will have more possible answers. This method also covers what the forum UGCs do not cover, or do not cover properly.

In addition, providing the possibility to socialize is also a way to improve students' enthusiasm in using the forums. Simple and traditional forum functions, like posting and reading posts, can no longer meet the increasing social needs of users (Morris and Stommel: 2015) Sometimes searching is not only about finding answers to questions, but also about finding like-minded friends. This is why many UGC platforms prefer to label themselves as communities. If the student forum can also be identified by students as a community, it will greatly facilitate the LMS to produce UGC. This also expands the search scope of exploratory search.

Specific Practices can be Divided into the Following Categories:

1. **Create User Profile**

Creating profiles for all users, including students, teachers and administrators.

In this way, each user in the Forum is a separate individual, everyone will be responsible for their words and deeds in the forum. When an individual's speech in the forum is well received and popular, the sense of honour generated will continue to motivate users to create content. This will slowly spawn many users who are willing to answer questions and good at answering questions and will also promote the development of the entire forum atmosphere. Create a virtuous circle for UGC.

User profiles should appear in the user interface as hyperlinks. If a reader is interested in a user because of a post, the reader can click the hyperlink to go to the user's profile page to get more information. Users can also send messages to others in the forum.

2. Content Rating

All forum users can rate the content in the forum, and other users' comments on the content posted will have an impact on the reputation of the publisher. This can be achieved by the number of likes of the published content, the duration of sticking, and the number of posts set as the essence. The more content authors who have received good reviews, the more attention they will naturally receive and even become a professional. This method can motivate users, especially when publishing content, improve the quality of content. The higher the quality of the information in the forum, the greater the help for exploratory search, especially in terms of search content.

3. User Behaviour Rating

The rating of user behaviour is as important as the rating of content. User ratings can include the number of users' posts, areas where they are good at answering questions, number of followers, and online duration. Users with more posts and longer online hours tend to be more active in the forum; users with higher numbers of followers also represent their higher popularity; the most important thing is the field they are good at answering because they are good at answering questions in a certain field of users can often give more professional

and popular answers. All these data can help search engines in ordering results, and users with higher ratings are more likely to provide more valuable answers.

4. Real-name Authentication

Users will be able to choose to use anonymous or real names and identities in the forum. If a user chooses to post with your real name and identity, he or she will get a real-name authentication mark, such as the authentication of celebrities or enterprise users on platforms such as Instagram. Posting with your real name can not only display the authentication symbol, but also improve the authority of the post. For example, when educators or university administrators release official materials and information, real-name authentication can help users distinguish the authenticity of the information.

Design Elements in Detail

In this section, I analyse the different elements of a SERP and explain the features which could be applied to a LX results function.

Tags on the SERPs

The needs and habits of LMS users determine which tags should be placed in the priority position. The most famous theme park in the world, Disney, attaches great importance to the use of tourists' data in the design of its theme park to meet the needs of customers as much as possible, thus improving the visitors' experience. For example, if is always a lot of customers waiting in line at the entrance of an ice cream store, it means that they should increase the size of the ice cream store to shorten the queuing and thus improve the experience. This is also the reason why it is necessary to collect LMS user data to serve User Experience design.

What user data needs to be collected by LMS designers is a very important question. First of all, the types of documents frequently retrieved should be considered. The advantage of this is that the selection of tags is based on the user's habits, rather than having the LMS designers decide which tags to be

placed below the search bar. As for the LMS system, the tags may be different from those of other commercial search engines such as Google, and tend to be used by LMS users, such as files (PDF, Docx., XLSX., PPTX.), lecture recording, activities (Assignment due date, Exam date, Student activities), and forums (Class discussion). In addition, the frequency of each tag being searched is used for determining its ranking order. The higher the search frequency is, the more times the tag content is searched by users, and the more obvious it should be placed. Determining the content and ordering of tags by these two important indicators will have a positive impact on the design of the LMS search bar, because the search bar of LMS will not be uniform, and different LMS users will get different search tags, but in either case, it will be optimized according to user habits.

There should be a time limit for collecting the data. This period should not be very short-term and should generally be more than 6 months. Because a decent sample size is needed to ensure that the results are valid and meaningful.

Conclusion

A user-friendly search engine is now an essential element of digital interfaces' good User Experience. Chapter 6 argues that in order to improve the UX of LMS and MOOCs, they should have search engine. Chapter 6 puts forward my design proposal from three aspects: the search scope, the search engine user interface and the Search Engine Results Pages (SERPs). It is argued that the proposed SE searches both study materials and student administration functions. The SE user interface should have a standard, prominent and consistent presence. Last, the SERPs are made of clickable snippets and other interactive features. The SERPs also responds to exploratory search by retrieving from the university forums. The significance of chapter 6 is it answers the question of how to improve e-learning platforms' UX designing a practical Search Engine for them. There has been very limited number of studies on this topic.

Conclusion

When it comes to teaching and learning, YouTube enjoys great popularity among university students and educators. However, most YouTube videos' quality is generally not satisfying enough for education at the university level. Arguably, it is the UX provided by YouTube that attracts university students and teachers. This thesis aims to find out what universities can extract from YouTube's UX and use those findings to enhance the UX design of LMS and MOOCs. The main finding is that universities should incorporate a RS and a SE in their design of LMS and MOOCs. Universities can follow the interactive, motivating and standard principle when designing the UX of their e-learning platforms. The research outcome is presented by an exegesis and a creative demonstration of LMS/MOOCs interface design through flowcharts and wireframes (see illustration 1-6, Page 129-135).

In this thesis, Chapter 1 is an introduction that discusses the background, the aims, the research questions, the significance and the UX prototype. Chapter 2 is a literature review that covers the research background, User Experience (UX) as a conceptual framework and the three guiding design principles: interactive, motivating and standard. Chapter 3 explains the qualitative data collection methods and data analysis method centred on Thematic Analysis (TA) and Inductive Reasoning. Chapter 4 draws the link between the research data and the main argument: what universities can learn from YouTube from the UX aspect is to incorporate a RS and a SE, following the interactive, motivating and standard principle. Chapter 5 and 6 each dedicates to one main suggestion. This thesis provides suggestions to improve university platforms' UX. It also generates a combination of new guiding principles for UX design.

In terms of limitation, this study and the references used are generally based on universities who can afford to operate a LMS or MOOC. We lack knowledge of and input from universities who cannot afford such technologies. Additionally, although the number of participants is justified for my work, it is still limited. Lastly, in order to link the guiding principles more closely with the practical design, the

practical design is already mentioned in the literature review part. Future research can be done to compensate the limitations.

Illustration 1: Flowchart of the Recommendation System (RS)

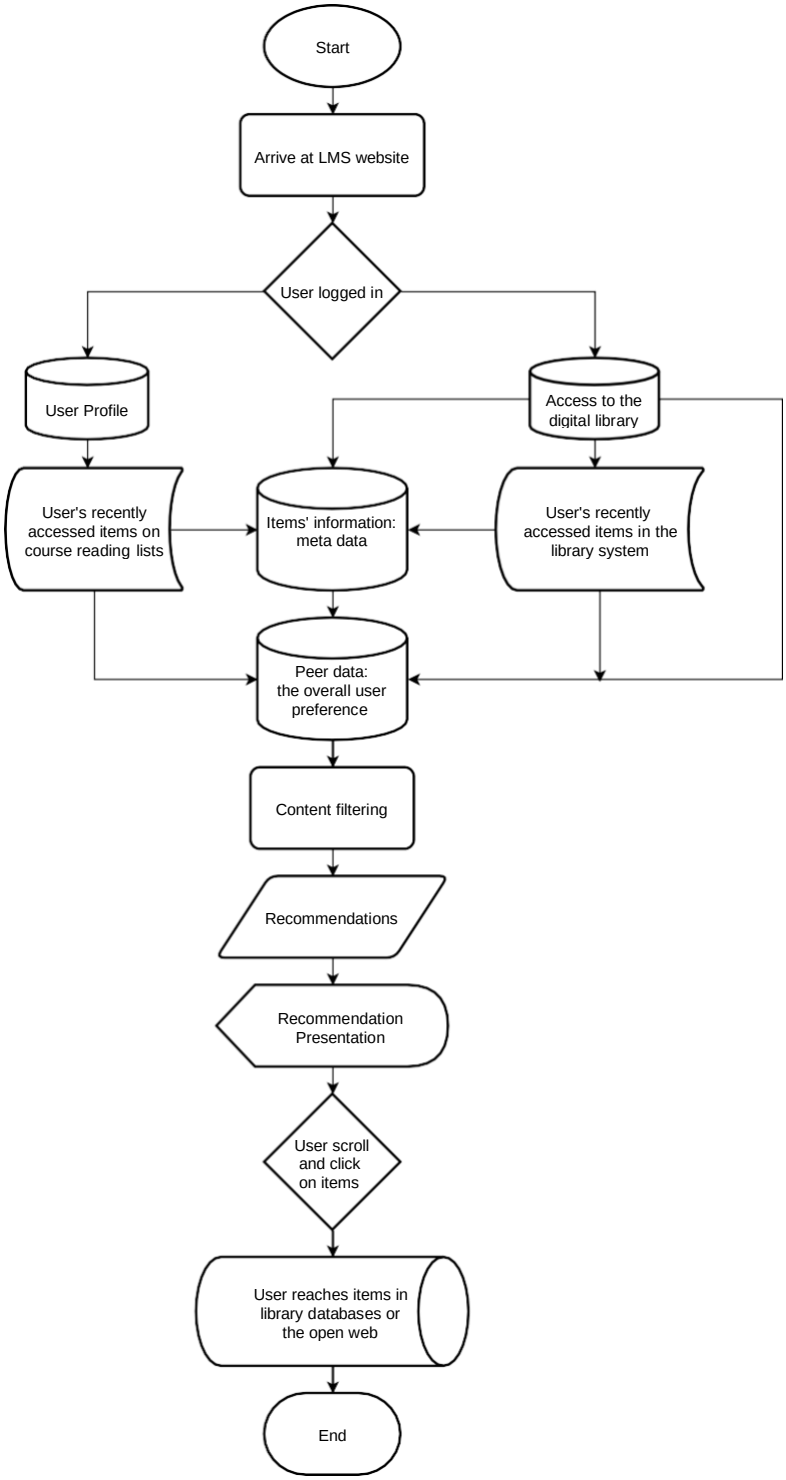
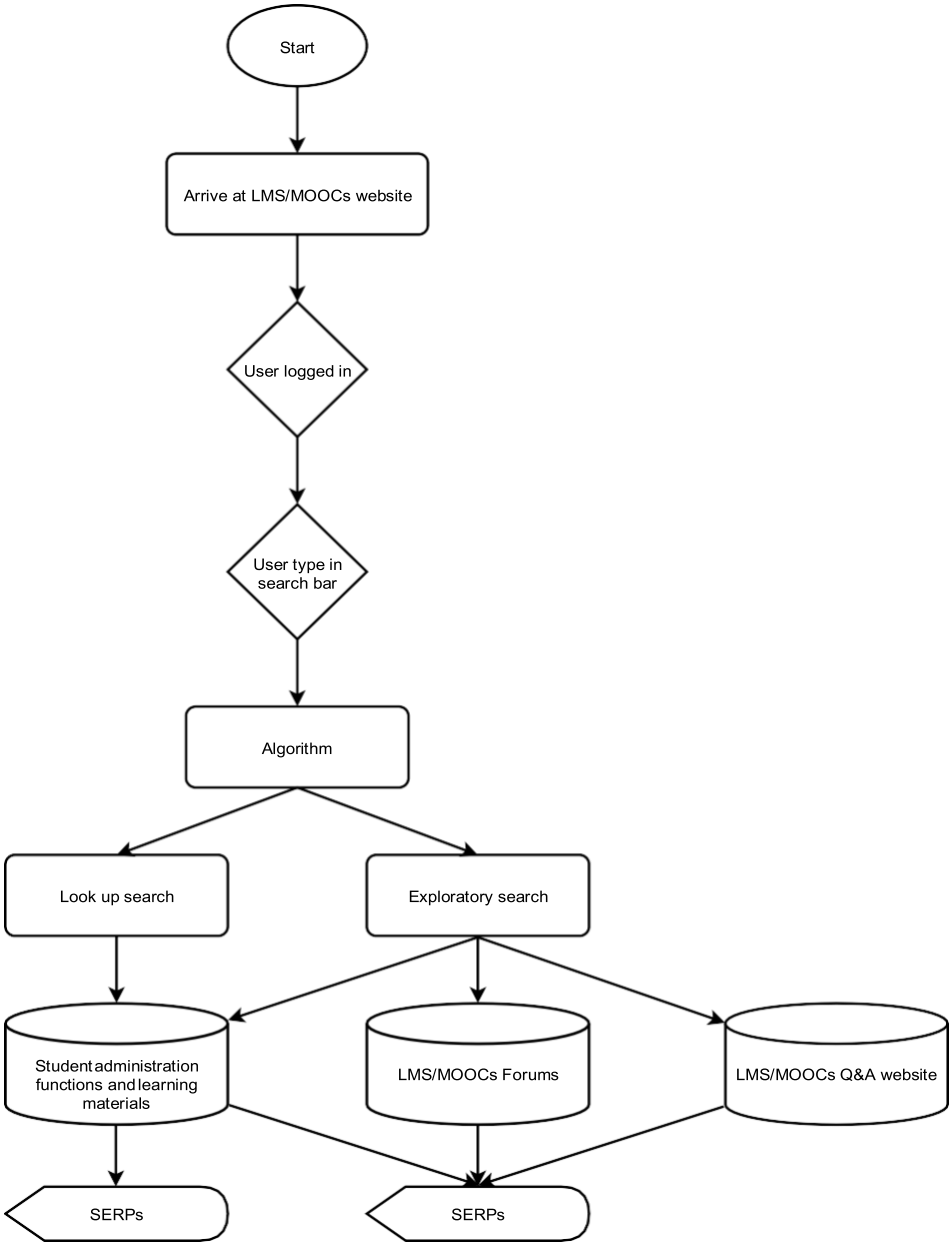
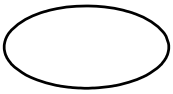


Illustration 2: Flowchart of the Search Engine (SE)

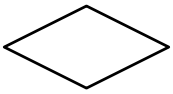


Flowchart Legends

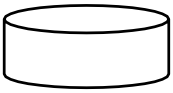


Start

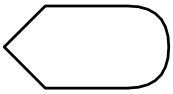
Process



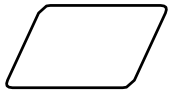
Decision



Database



Display



Data

Stored Data

Direct Data

Illustration 3: Wireframe for the System Homepage

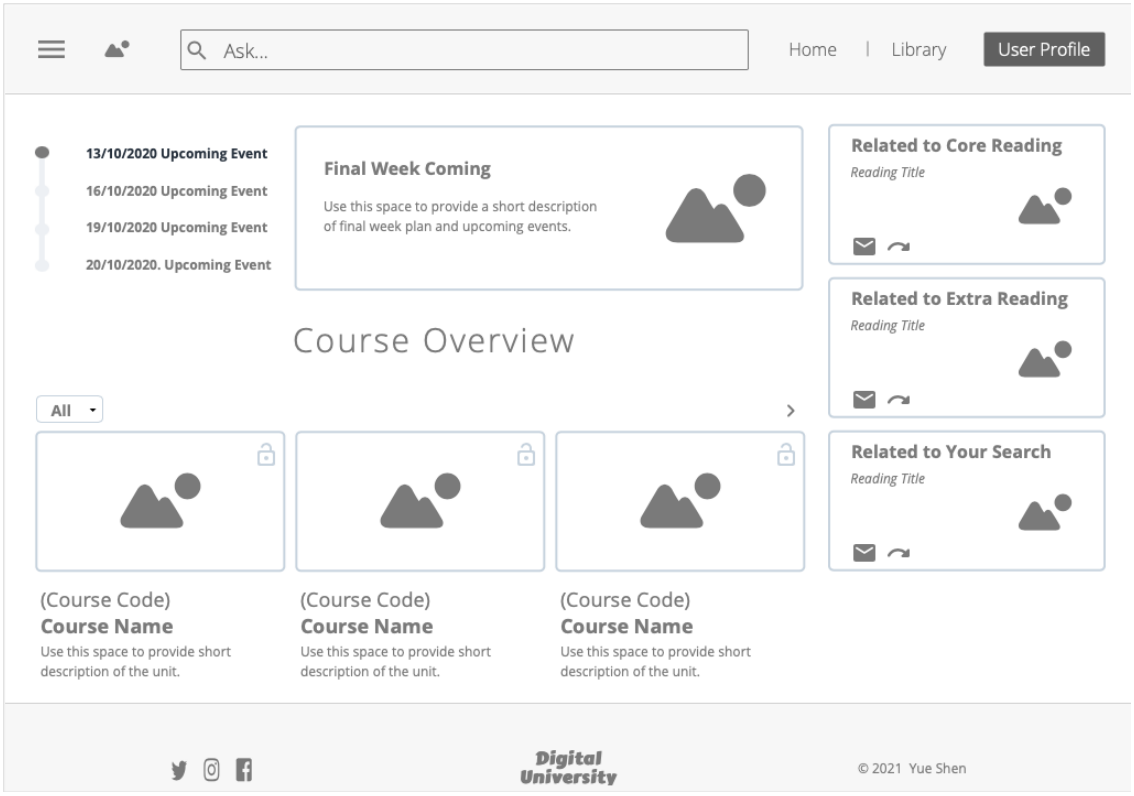


Illustration 4: Wireframe for the drop-down suggestion menu of the Search bar

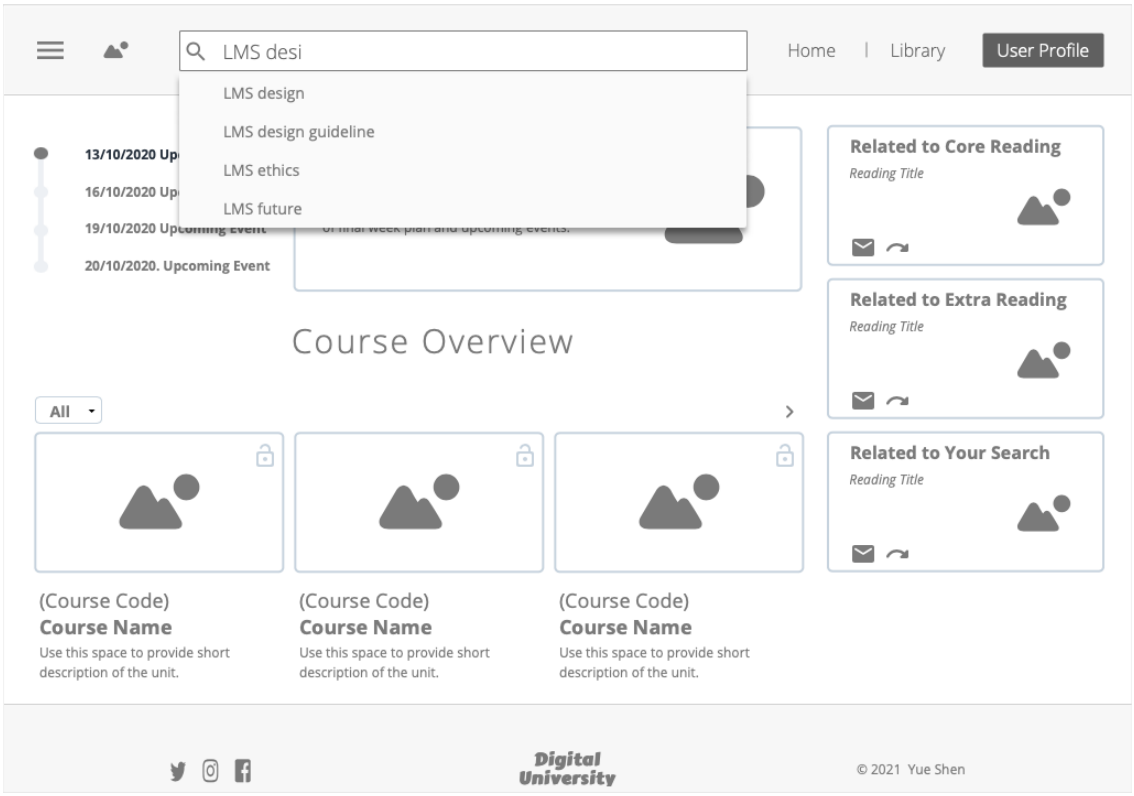


Illustration 5: Wireframe for SERPs 1

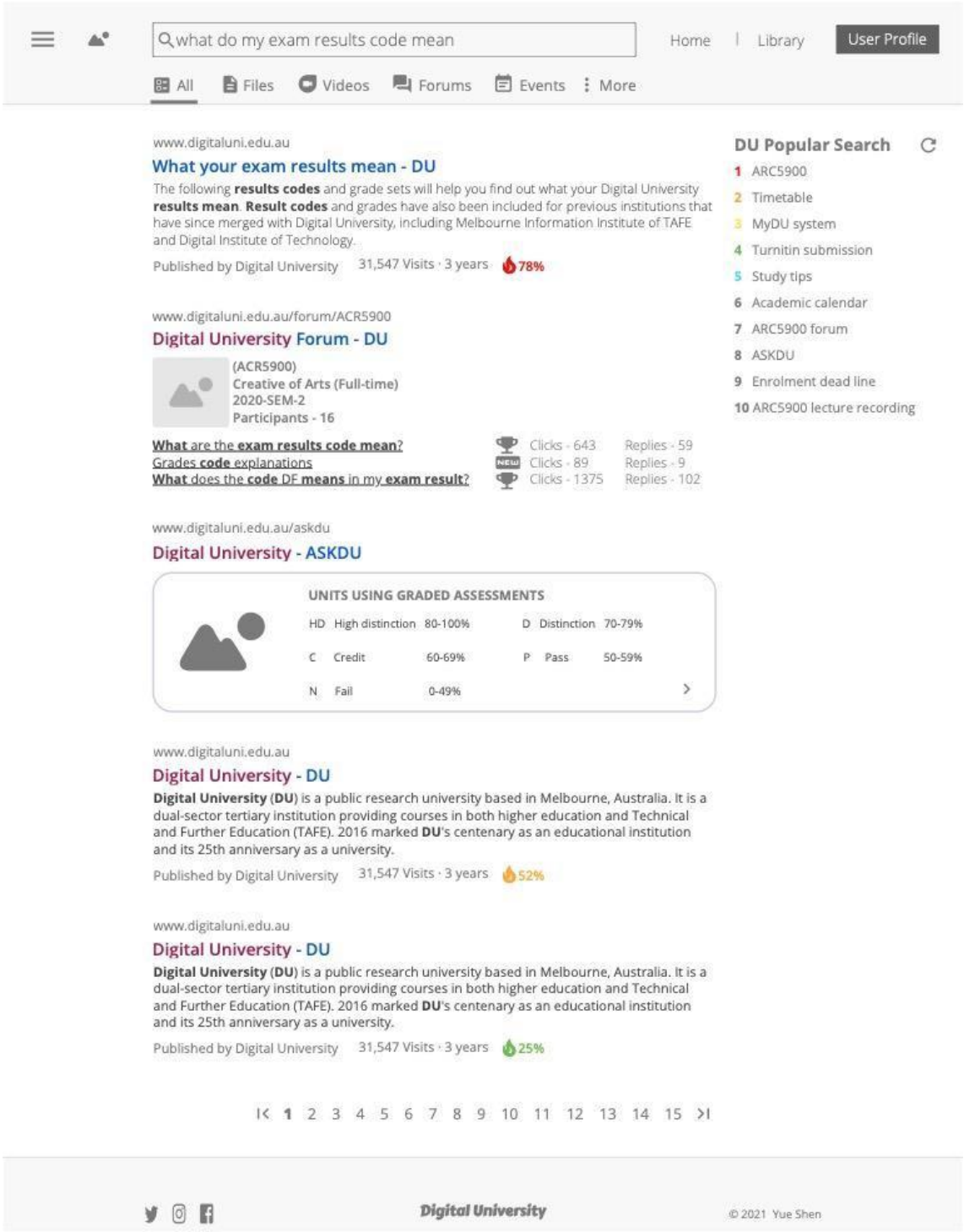
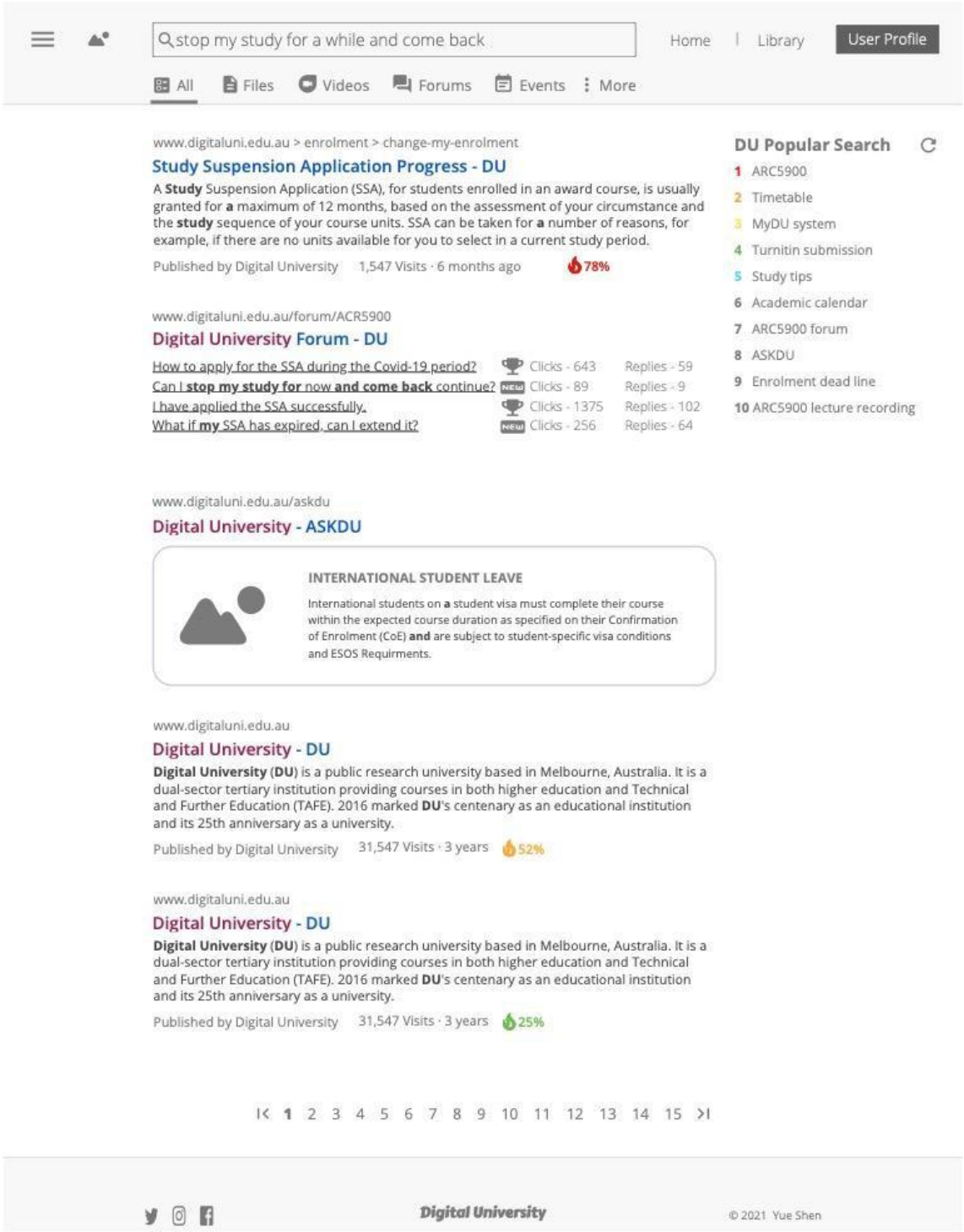


Illustration 6: Wireframe for SERPs 2



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Appendix

Interview transcripts

I=the Interviewer P=the Participant

Participant A

I: Can you please tell me your age, your gender and your area of study?
P: My age is 26 years, and I'm a male and I'm studying Master of Science (Computer Science).

I: Ok, so usually like, when you want to learn something, if you want to learn something online, which website, or App, or platform would be your first choice?
P: So, I use, most of the time YouTube is very convenient for us because the people who have, who are giving their YouTube videos also give some relevant links through which you can go and read more documents. And YouTube videos compared to other videos like videos from Online Academy, or Udacity there are videos on like, there is one more, via Lynda, there are a few subject topics which you can go and study. So, they are actually the people, we can see the visual, like how they're explaining or writing the stuff on the whiteboard or the electronic board etc., so it's better and easier to understand, when compared to the lectures which you get in the university. And also like every person has their own set of ideas which you can listen to, it gives us more, wide area to write when you are given an examination, so you have more points to mention in the examination answer.

I: So today when you use YouTube, what topic were you trying to study?
P: So, I was trying to study three topics. One was recommendation system, the one which you use for recommending movies on Netflix or anywhere and recommending online shopping. The other topic was, that was a classifier topic, it's like a labyrinth. You use two models, prediction models, based on the data, the analyser data. And the third one was information retrieval from website, like when you do a Google search or something, so hold the documents or the links where you present it was based on other query within the Google search, so that

was on recommendation system. So how to build an information retrieval system or rather, something based on that.

I: And did you feel you achieved your goal with YouTube?
P: Yeah! So, I achieved my goal with the respect to information retrieval and recommendation system because the explanation was a bit more clearer like if I compare it to my LMS. So, we have the slides, and the same slides are playing in the video, also along with the audio of the lecture, but there is no visual of the lecturer explaining that how exactly this one works, writing on the electronic board, something to see exactly, what is what and that's where YouTube or other websites are a bit different when compared to LMS. We even see videos from the Ivy League universities, there are the professors explaining on the electronic board how it is going on. So, every topic we get more clear when compared to LMS. LMS there is only the audio and the slide video. There is no other part included in the LMS. And depends on the professor also. But most of it is like this only, so you get the audio and only the slide video.

I: So, you mentioned you like the videos on YouTube…
P: Yeah.

I: So, can I understand as you prefer the form videos more than just slides and texts?
P: Videos in form of representational videos, not just like in LMS we have only the slide videos. The slides are just getting played and the lecturer is speaking. So, the videos which have the lecturer himself/herself explaining on an electronic board that hold the formula is getting directed everything step by step, that makes me more, get more clear idea of how to reach to a conclusion of a topic, instead of just listening and seeing, that we can do on our own also, we won't be getting any extra material by that. So that's why I prefer other videos, actual videos.

I: Do you feel like, is there any design feature of YouTube that actually helps you to achieve your study goal?

P: No, I don't think there's any design feature separate because I guess LMS also holds that. So, I don't think there's much separate. Just the way people are explaining on the YouTube, the way it is being explained, that is the difference.

I: What is your general impression of LMS?
P: My general impression is it can improve. It can improve in the form of presenting the study material towards the students because we get the study material only with respect to the topic and the slides that we have, so we have the slides and the topics, we don't get any extra material or any extra references to go and do search for other topics. So that's where LMS lacks.

I: Do you feel like any particular design feature of LMS is not satisfactory?
P: No, I think it is satisfactory enough for LMS, whatever we have, it has all the features. But those features, when the content added to LMS that could be improved. Those content could be improved.

I: If your friend wants to learn something, where would you recommend them to go?
P: I would, basically I would send them to start from LMS, and then note down the topics which (he or she) has not particularly an idea and then go and search on the Internet where you can get more visual idea of that topic. So preferable, would be like, Online Academy or Udacity or YouTube, depends on the topic. So that's it.

I: So, have you ever heard of the term Massive Online Open Courses?
P: I have, like not exactly I heard that term but something relevant to that like, I actually forgot the name of, there is Udacity, there is one more there are free courses. So, the website is called Coursera. So here if you do the course, you'll get the certification also when you've done it. And there are some types of examination. And this is all free content and it is mostly like, these courses are mostly taken by the professors from, either they are from the research industries or organisations like Google or Facebook or from the very privileged universities

like the Ivy Leagues. So, we get more content here. And we can actually search topic-wise rather subject-wise. So, it is like if you search a topic you get more detailed videos. It is a bit more organised compared to what we have on LMS. So, if you are taking a topic you can get subtopics also. So, we will get more detailed idea of what our content is.

I: So, you said it is a bit more organised than LMS…
P: Yes, you can say that. If they are going into one topic, then they are covering all the subtopics of that. So basically, LMS has only those topics which is covered in class, not apart from that.

P: Is there any other reason that you think it's more organised than LMS?
I: Emmm, there is no other reason. The only thing is as I said before, there is a visual representation of how the things are being explained. That part we don't get in the LMS.

P: You mentioned that this online course website, they provide like certification. Have you gotten any certification from them?
I: No, I haven't done any course completely from them, so I haven't. But yeah, if I feel any topic has to be studied and I'm not getting any, so Coursera is the one where we get mostly all the topics, so I'll just start the topic. So, if I have produced certification like if I take up any course or any topic or any subject wise in that, it will require a month or two time for to cover up that complete topic. So, I don't know, adjusting that with the university timing side, a bit more…but more so because we do all the topics are not covered and not important for university course. So, we don't go through all the course content which is on Coursera. We only go to the content which is important to us.

I: Can you tell me roughly when you study like, if we just do YouTube, MOOCs like the website you told me, Coursera or Udacity, and LMS, do you have like a rough percentage of time that you spend? For example, do you spend like 30 percent of time on YouTube, 40 percent…?

P: So, most of the time if it is just the studies and assignments. So uh, if uh, if I consider the assignments, then most of the time I will be going on YouTube or online academy or Coursera, Udacity to search more content because we are to gather more knowledge to add to ours. And if you consider just the from an examination point of view to study for examination, the more time is consumed with respect to LMS and then a short time for you to go, so that we can get a clear idea of the topic. So, we don't because here on the LMS we spend more time on the LMS because we don't have to go apart from the topics which have because they won't be covered in exams. So, we just concentrate on exams, so LMS is more relevant to exam times. Plus, those topics you can just search it. So, no extra topics we don't require. So, there'll be less requirement of you too.

I: Okay. I see. But do you have like, just for you, because you, uh, apparently you want to pass all your exams, but you also want to develop your, like general skills. So, do you have a percentage of how much time you spend on YouTube at home? How much on LMS?
P: So, I would say I spend like 60 to 70 on YouTube, Online Academy and Coursera combined. And 40 percent also, like 40 percent or less, on LMS.
I: Okay. I've noticed while you were watching YouTube videos, maybe also course recording on LMS, you didn't really turn up the sound. So, is it like because you felt that the sound isn't that important?
P: No, actually with speaks it's not that fine. That was the reason. I'd prefer using earphones. Are we allowed to sound? I kept the sound less, but it was important to me. Obviously, the sound is important.

I: Okay cool. Um, and another theme I've noticed is you choose to go into LMS and Udacity, but you keep going back to YouTube.

P: Yeah. So, so I, I was going back to LMS and the lecturer slides just to see like what topics has been mentioned if I have an opportunity to write down notes, I will be like taking, the topic from the LMS or the lecture slides and then listening to only that part from the YouTube and understand on that part because that

content is lacking on the LMS that's showing on YouTube. And so Udacity, I didn't log into it actually. So, I will be logging in searching for that topic is specifically and then see what we do. So, what relevant we do there. Um, but I won't be listening to complete video because on YouTube basically we get most of our content and even the Udacity, Online Academy or Coursera they also have their short videos on YouTube. So, I get the idea of what we are there and what has been done or so.

I: So, in general, what's your impression of websites like Udacity and Coursera?
P: So, I feel Coursera is more relevant to us and Udacity is relevant, but it was like basic topics. Also, in Coursera, we get some industry-based knowledge also so when we get industry knowledge, we get an idea of how in practical these algorithms, these topics are being applied to. So that is why Coursera is more relevant at this point of time. Maybe for other students who are not at masters' level they would say that Udacity is more relevant. So, it depends on the experience level as well as your study level.

I: So, when you go to LMS with a study goal, do you feel you can always fulfil your goal?
P: No, no.

I: Can you tell me why?
P: So, because fulfilling goal will require more content than what we are getting on LMS. LMS is just like okay these are the courses, and these courses has these many topics and only that had to be computer, but our topic is… if we take a topic like knowledge is unlimited, we can get a number of things on them. So just achieving a goal would be like just passing those down, I guess LMS is sufficient, but if the goal is to pass the exam, a full understanding of how the subject is and also the practical application of that subject, then I guess elements lacks there. So, you need more than LMS.

I: When you use LMS, what do you feel about the time you spend on it? Do you

feel you spent too much time to find what you were looking for or like just…?
P: So LMS, my LMS contains mostly lecture slides and lecture videos, lecture captures. So, there are like not that much effort. I would say that I don't spend too much. Doing assignments like we are to just keep cross checking from LMS, and Upgrades have from the other discussion groups. So, discussion group is one good feature of LMS where we get to interact and ask as many questions. So, any number, any students can reply who's taking up that subject. So, we get relevant reply also. And if you are facing issue, you get more prompt response in LMS. Sometimes in fact there's response on them so we get more clear idea. So, in former discussion group LMS is yeah, is a good thing to help us in those areas.

I: I think YouTube also has a comment feature?
P: Yeah, but you are not sure when you will get a reply and from whom you will get a reply. So, and even the comments like there could be people who are not actually studying those subjects so we can't actually rely on those, those people like if they are commenting with other comments or not, they are there anyway. While in LMS, in fact there is to monitor. So, if someone gets a wrong reply, they can correct it. They can also give a better response on LMS so that is like, yes, this is the correct response. So, we can rely on this.

I: So how about Coursera and Udacity, do they have this feature?
P: Yeah. So, they don't have like a comment section. There are like some discussion like you can raise some topic, but it won't be that prompt or… because everyone, because these are public resources so everyone is (about) their concentration on a topic or their perspective. It would be different from our perspective, if we are looking from an examination point of view or from a study point of view. We won't be looking up to that much knowledge that really quick. So, on public forums like this, so people will be answering as per their perspective, not as per our perspective. So, there it could be different. It can be relevant, or it cannot be. While in LMS, it is like mostly whatever. So, everyone has the same perspective. If you are doing assignment everyone knows this is what is required in that assignment. So, in that respect that is better.

I: So lastly, I want to ask about your emotions. How you feel while in the past half an hour while you were using YouTube?
P: So, I feel more confident when I studied from YouTube. I got more positive vibes while studying topics there, because I…I already attended lectures, so again doing the same lecture capture is kind of like ok, I already know that these things are covered in lecture, there is nothing new that will happen there. But on YouTube or in other websites, I see the videos, I get the knowledge there, so those things are unknown to me with respect to a particular topic, so I get an opportunity to learn more. So, it is a positive response what we got on YouTube. Starting from there.

I: So, what is your feeling towards LMS? You mentioned that you feel like you are repeating your effort?
P: Yeah.
I: Is there any other feelings?
P: So apart from repeating, there is a content limitation on LMS because there are only covering the things that we covered in class. It is like a repeating kind of stuff. That's it.

I: How about when you use Coursera and Udacity?
P: Coursera and Udacity, independent of the academic point of view. So, they are just, they want to cover a topic. So, it is like we can expect something more than what is required so that helps us to understand in a better way. So that's great.

I: So, can you describe your feelings towards, when you use them? Like you mentioned confidence or positive or …?
P: In using Udacity, Coursera also, I feel confident depending on the topic. Maybe there could be some topics for which there are not good lectures on there. Maybe LMS, the lectures which are covered by faculty would be better there. All depends on who's taking up the course, but most of the time you find it like those topics

covered on the public forums are more good or more content, they carry more content.

Participant B

I: First can you tell me your age, your gender, and what study are you doing?
P: I'm 22 years old, female and I'm studying radiography at XXXX (major metro university 4).
I: So, it's like a bachelor's degree or…?
P: Yeah, Bachelor of Science.
I: Cool. So, can you tell me what's the name of the website that you were just using?
P: The… I was using Radiopedia and YouTube and just google images.
I: So how did you find out about the first website?
P: Radiopedia? Um, I heard it from a couple of my friends that we are doing same course as well and also, I have found that like during my studies at home that the information on there, like matches what my lecturers say. So, I've found that it's probably the most reliable source to use.

I: How long have you been using it and how often you use it?
P: Um, and I've been using it since this year. I 'm in my third year now, nextyear actually. So, I've been using it since probably the first semester. I'm sorry, what was the second question? Uh, how often? Probably whenever I'm studying for this particular subject, I always go back to that.
I: so really, really quite often?
P: Yeah, quite often.

I: Is this website, according to my observation, is it like mostly text-based that they don't have videos?
P: Yes. This one is mostly text. I think they do have a few images but not many images on here. So, it's kind of like a textbook. Yeah.

I: If it's possible, do you hope that they could provide like videos and interactive content?
P: Yeah, I think it'd be easier if they had images to support the text because it's

better off for like for me, I learn visually so it might be easier for me to understand that in other people as well instead of having to do with images and trying to match up like what the text is about.

I: So, what's your favourite form of content? Texts or illustration? Videos?
P: Probably illustrations because I can because my courses are a lot about, like X-rays and getting it right and stuff. So, it's probably easier if I look at images to understand what like I need to do.

I: So, uh, why isn't video your favourite form of communication? Because you just said pictures are your favourites. So why you prefer pictures over videos? Like do you prefer to study by looking at pictures or watching the videos?
P: Videos. I like watching videos for like positioning of patients, like what I was doing before, but I think pictures are like faster and easier to just look at.
I: I've noticed that when you study, you use separated screens. So, it's like, on part of your screen you watch a video or read the text and the other part that you use to take notes. So, do you always study like that?
P: Yeah, I always study like that because I think it's easier to stay focused rather than always like swapping from one screen to another and it's easy to like to have a separated screen to compare like what you're doing and just like, even if I'm copying text to make sure that I'm copying the right thing.
I: At the moment, in general, do you think it's easy to operate separated screen?
P: Yeah. Uh, I just, I think there's a lot of technology that allows you to do split screens, but I just do it myself. Like it's really easy. Yeah.

I: And do you think like for website designers, like they can make any change to make it easier for you to work with separated screens? Like for example, if, if like for example on YouTube people put like vertical videos instead of horizontal ones, do you think it will help?
P: Um, maybe not vertical videos because then the quality probably won't be as great. I don't really mind what they have now. I think it works for me.

I: And during the session I've noticed you're not really using your university's learning management system. So, can you tell me why?
P: Um, I feel like, like the stuff that they give us, I mean like the websites, like library website and stuff, I don't think it's very helpful for me. Um, so I usually just need like whatever's online because I feel like it's a lot more beneficial to me when I study.

I: Okay. Can you tell me more about why you're finding it not so helpful?
P: Um, I don't think there's much content on there. Um, other than like my technician rights or something like that, I would use that for when I listen to lectures and I'll just take points from this. I did the same thing. I put like the um, the lecture notes on one side and my notes on the other and I just kind of copy. But um, in terms of websites for me, I didn't really use, like I don't feel like it's useful at all.

I: Okay. And so, what's your general impression of universities' learning management system?
P: Um, as in the content they have or…?
I: Yeah, also like the way they organize their information and is it easy for you to use…
P: Em yeah, at the moment I think, I forgot what we were using, let me just double check. I think they do organize it pretty well now. We use CANVAS I think for XXXX (major metro university 4). So, it's pretty organized. It's like in weeks, in lectures, numbers and all that. So, I think it's good.
I: But do you feel like they have anything that you would like them to improve, like any?
P: Um, probably not. I don't' think so.
I: Okay. So, you're pretty happy.
P: Yeah, I'm pretty happy with it.
I: Yeah. That's cool then. So okay, let's go back to YouTube. So, once you search for something, you're going to be given a list of videos. So how do you select which videos you are going to watch?

P: Um, I usually look at the amount of views that it has and once I initially picked like the one with the most views, once I click on it, I'll just check like the rating, like if it's a lot of thumbs up or thumbs down. So that kind of gives me an indication of like if the video is good or bad to me and then I'll just go down the list, this kind of thing.

I: So, I noticed that you have found like a, there's like an information inconsistency across different, like a video isn't the texts that you're getting. So, what's the problem? Can you, can you tell me what exactly…?
P: What I've done before? So, it was um, the positioning of the patient, like so some Text was saying to position them like 45 degrees. Some were saying less, some were saying more. So, I wasn't too sure, like what the correct information was that I just highlighted to my notes to remind myself to ask my lecturer because I think that maybe they're the best source to go to because they are actually professional and everything so they will know what the best thing to do is.

I: Does your university's system have like an online community where students from your major, they can like this, they can post questions and discuss it?
P: Um, we do have a, um, of like discussion board that we can tap in for different subjects. But I don't think… we didn't really use it. I feel like people are more like, they tend to ask their friends rather than like go online and ask like everyone else in the course, that kind of thing.

I: So, I noticed you went to Reddit.
P: Yeah…
I: So, do you use, do you usually go to that forum?
P: Sometimes I do because um, there's a lot of people like actual professionals, he qualified, they go on there and they can reply to like posts that students make. So, I think that it could be reliable because yeah, like they're actual professionals and I'll say I like reading like what other people have to say, like, like different techniques and stuff that other people use. I find it interesting.

I: So, you would rather go to Reddit than your university's formal discussion board?
P: Yeah, I think I'd rather go and read it than actual hold discussion. Yeah.

I: So apart from the reason that you just mentioned, like in the university, people rather ask their friends, is there any other reason why you prefer Reddit than the university one?
P: I think maybe I kind of feel shy going onto the university page and ask them questions. Like I think if it feels like anonymous or something, it might be easier for people to not feel shy, like to ask something that they might feel like it's like silly to ask or something.

I: So, is it like when you ask something on the university discussion board, like they are going to show your name, so everyone's going to see it?
P: Yeah.

I: And also, do you feel like it might take a bit longer for you to go into LMS to locate the discussion board and then post something than to use Reddit?
P: Um, yeah, I think it's a bit longer because you have to write up what your question is and then you have to wait for someone to reply rather than like on reddit or on Google you find answers straight away. So Yeah, I've found that sometimes like when I don't know something and um, I can't find it on the Internet. I kind of get a bit lazy. Like I forget to ask or ask the next time because my interest is like not there anymore.

I: So, what's your general impression of YouTube?
P: Uh, I think it's really useful. I use YouTube, YouTube every day, like for everything. Like my general interests like makeup and all that and continues a lot for studying as well. So, I like watching videos. I feel like it's an easy way to learn.

I: Can you elaborate on that? Why do you think it's an easy way to learn?
P: Um, I think it's better like having a video to watch visually, visually and like

listening to someone talk rather than just sitting like with an open textbook and just reading it yourself. Yeah.

I: And does your university give you guys videos in the school system?
P: Um, they usually actually send us videos things on YouTube, say. But then it had like actual videos of other stuff that they send us links but that's not all the time but sometimes yeah.

I: Okay, but do they post videos only within the school's website and system? P: So, like for each of the subjects they do post, they kind of upload the video but it's from YouTube. If that makes sense? Let's just say you don't have to click on the link like it's already there. You just press play. Um, yeah, just…

I: And do you like to watch in this way?
P: Um, yeah, I don't mind. Sometimes when they do post, I do watch it, but then I find myself going back to YouTube and finding more videos. If there are better videos to watch. Um, yeah.

I: So, can I understand it as they gave you videos, but once you find something interesting you need to go to YouTube by yourself and search…
P: Yeah, I tend to go back to YouTube and search just to find out if there's any more that I can watch or depending on my level of understanding if I need to find something else that could help me understand it better.

I: Okay. So, can you tell me again, what was the topic that you were trying to study for?
P: So, I was studying how do you like do an X- ray of the spine, just the lower spine. So, I was trying to find out how to position the patient correctly to make the X-ray the correct picture and where to put like, um, if you saw it, it was like a light kind of like a box and then you're going to put it in the right spot kind of thing to make sure that the X-Ray is correct. So, it's very technical. So, we'll have to be like five centimetres above something or to kind of like that. So, I was writing

notes on where to position everything to make sure it's correct.

I: So, do you think you achieved your goal? Within the past 20 minutes with YouTube?
P: Yeah. I think I …
I: Or maybe like how many percentages of your goal you think you achieved?
P: Um, I think I did a pretty good job. I think with radiography it's time consuming to like study that. Um, yeah, I think I did pretty good.

I: Okay. And how about the website that you were using? Do you think it helped you to achieve your goal as well?
P: Yes, for sure. Um, it was good to compare different websites if sometimes I didn't understand something, so that helped for sure. And the videos helped too like um, so after I read something online, videos help to kind of strengthen what are written, kind of, yeah.

I: How would you evaluate your use of time with YouTube and the website you were using? For example, do you think you spend too much time, or do you think you spend the right amount of time or do you think information just gets to you really fast?
P: I think I spent a good amount of time. So, I just got what I needed and I kind used like the fast forward and go back button just when I didn't understand something. Or when like I felt like they are talking a bit too much, I kind of skipped it.

I: Okay. And do you think like any particular design feature of YouTube helped you to achieve your goal? Like maybe the search bar, maybe the video recommendation system, something like these?
P: I think maybe what you said before about the um, how I selected the video, with the views, the views and the ratings. I think that was helpful because I think that without that will be hard to find out what is a good video and what's not.

I: And do you think, is there any design feature of YouTube that you think can be improved to help you study better?
P: Um, I don't think so. I think I'm pretty happy with how it is at the moment. I haven't had any troubles.

I: Okay. So, um, no, I just want to ask you something about your emotion, like your general feelings while you were studying. So, before you go to YouTube to study, how do you feel? Do you feel excited? Do you feel like attracted or do you feel a bit bored or…?
P: Uh, I think when it comes to studying, I'm like Ugh, like kind of Lazy, can't be bothered. But once I start engaging with them then I think I'm okay. I just think of it like as something that I have to do, like to get a degree. And also, YouTube, um, I like going to YouTube, um, to study rather than searching online all the time. I like to go to YouTube. I tend to go to YouTube because there is a lot of videos and all that. So, I find it exciting. I like watching videos.

I: Okay, but what if you have to go on LMS to study or to do some students' administrational work, so what would you usually feel before you go there?
P: I don't really like going onto the, like XXXX (major metro university 4) or Uni. stuff because I feel like it's a bit unorganized sometimes. Not all the time that um, and maybe also I'm not like, the address, familiar with it. So, it's a bit difficult to search for things that I try to find. I find that YouTube is easier, you just type in the search bar and it comes up.

I: So, where you feel you're not familiar with the system, how do you feel? Do you feel like stressed or unconfident or…?
P: I'm, I just feel yeah kind of like wasting time. Like I'd rather just use something that's like will give me an instant result. Like YouTube, like searching in google or searching and all that.

I: How about after you use YouTube for studying, how would you feel? Do you feel satisfied? Do you feel happy?

P: I generally feel satisfied because I can usually always find what I'm looking for um, there's only a few times that like that'd be different video saying different things, but I think that's alright because obviously not everyone will have the same way of doing things. So um, I think that's what Uni. is for that kind of stuff to be able to go and ask them after to make sure what you've written is correct.

I: So, when this situation happens, what do you usually do? You try to watch more videos or go to other websites like Reddit?
P: Um, so usually I'll just watched more videos and if I'm getting still confused, I might go to different websites or if anything I'll just ask my friends.

I: And also, you mentioned in the end, you will take it to your lecturers.
P: Um. Yep. So usually, I'll ask my friends first and then if they're confused as well, then we'll ask the lecturers because I don't like to bother them too much.

I: So, when you ask your friends and your lecturers, do you ask them online or in person?
P: In person. Oh, my friends I'll ask online. Lecturers, I'll ask in person because I think it's easier if you still don't understand, you kind of let them elaborate on it.

I: And how do you ask your friends online? Do you use certain…?
P: Probably Facebook.

I: Okay. I think our last question is can you just think about maybe the last time you used LMS for any task, whether to study or to do students' administration, like the last time you used it?
P: I initially used it just to download lecture notes or watch online lectures or upload assignments and all that. That's all that I really need it for.

I: And usually after using the LMS, what's your general emotion? Do you feel happy, excited or…?
P: I think just neutral. I think it's just a platform for me to just like download, like

when I said like just to download lectures and all that. So yeah.

I: Okay. If one of your friends come to you and say they want to study something online, where would you recommend them to go?
P: Probably YouTube. Yeah. Probably YouTube or just do Google or like the Radiopedia website or just websites that I need to study.

I: Can you tell me the reason why you point them to YouTube or Google?
P: I think it's reliable and it's easy to find what you're looking for, I think. Yeah, search bar and yeah.

I: Okay, thank you very much.
P: Thank you.

Participant C

I: Okay, so first can you tell me what study that you're doing?
P: I'm studying education in arts and I'm majoring in history, ancient history and archaeology and a minor in French.

I: That's cool. So, what exactly is the topic that you were trying to study today?
P: Um, today I was looking at Ptolemaic Egypt or history in general, but mostly Ptolemaic or ancient Egypt.

I: I forget the first question. Can you tell me your age and your gender?
P: Yep, I'm 22. I'm female.

I: Cool. So, what would usually be your first place to go to if you want to learn something online? And why?
P: If it's to do with that particular topic, I'll probably just go to my lectures, my lecture notes. Um, and then after that I'll see what is provided and if I can't work that out then I'll do something else. Might be a video, Podcast or something.

I: So, what is your general impression of YouTube?
P: Of YouTube? Um, I think it's really interesting because there's a lot of different things. You can find just about anything on there. If it's, you know, Ptolemaic Egypt, ancient Egypt to going to, you know, how to boil an egg. You can find everything on there. So, it's, I think it's really interesting. It's really handy, I guess.

I: Um, like how often do you use YouTube to study?
P: To study? Em not so often. Probably because I can't use any of it as an academic source unless it provides me with a link to something and then maybe um, but if I just want to just listen to something whatever, yeah, I think a lot of it…particular like the channel I was looking at, like that kind of history, would be really good for the younger learners, so high school or something. So, it could be good as a teaching resource rather than to study.

I: So, for you to study, your favourite place to go to study is still your university's page?
P: Yeah.

I: Okay. Um, so do you think you achieved your goal with YouTube in the past 20 minutes?
P: Um, I think I've had some really good resources. I'm not sure if I would use them for an assignment or anything, but just a good, yeah, like a handy resource. Yeah.

I: So usually how do you select videos from YouTube?
P: Well, I'll generally look at who posted them because if you find one's like the history channel, um, BBC or something, it's probably a bit better than XX (Participant C) from XX (Major Australian city 1)… posting random stuff on YouTube. Um, and if … I don't know, it depends, you know, on how the video looks like in the thumbnail even, um, and what the little description says underneath or even there is... this is the name of the channel, so that was casual or history or clearly all they do is just history and I'm sure the videos are not really interesting. Other than that, you can also go for like funny ones. So, you feel like a short history of the world, I guess. And that's like, it's a very funny video but it's all accurate. It's just. Yeah. Silly.

I: I noticed that at the beginning of the YouTube session you found like someone's lectures on
YouTube and you don't…it seems that you didn't really like it?
P: Yeah, it was really weird to see someone else's lecture on YouTube, but I know that he'd filmed it, but it just seems really strange. It was like, oh, it's just his lecture. Um, but emm it's not a bad resource. Not bad. It's just really weird to look at, oh, this is just strange, and I expect you to see like a documentary or something on there (but) it's just some guy talking.

I: So, you don't actually expect lectures on YouTube? You actually, you are more looking for something fun?
P: Something fun or like a documentary rather than someone's lectures. Yeah.

I: You're looking for someone's documentary is it because it's usually not provided from your university?
P: Yeah. Documentaries generally aren't. Um, that's generally take-space resources.

I: So, can I understand it as when you use YouTube, you want to find something fun but also the content is useful for your academic study?
P: Um, it can be, if it's, if it's a decent source, but if it's not, then it's just, it's handy just to keep things refreshed in your head or to keep, like a bit of maintenance on dates and things like that. Do you want to find something fast? It could be a really good way to keep that.

I: Okay. You constantly scroll downtown on YouTube, so are you looking at other people's comments or are you looking at the list of recommended videos?
P: A bit of both. Like if you see someone's comments, like this is incorrect, blah, blah blah, then you know that this is not a really good video. Um, and then if you look at the recommended videos, if they have nothing to do with the video, well that you picked, then it seems really strange that why would they be there if it's not related. Um, but if it is that way you can find something, you have a good comment and you know, it's pretty good video or if you have related videos then you can be like, oh, well, that's good. Um, this is clearly related and there's some more sources for you to look at.

I: Once you open a video, what makes you decide that you don't like it, you want to go out?
P: I'm just a, I'm not, it just depends. Like they had the timeline videos on that, which time I mix a lot of things, but they annoyed me because they really dramatized, and they have a lot of the acting and stuff. But if you're looking for

something academic, you don't want to sit there through some weird little production. Um, you just want to get to the facts, and you know, what you're looking for. Yeah.

I: So, once you open a video, what makes you think you like it, and you want to watch it? Is it because, I saw this video you watched, is it because they have a good production of anime or is it the editing or is it the setup of the presenter?
P: Em, I don't know. I think if it sounds not too formal but, but it's accurate and if it's not like a little play or production or whatever, but it's actually explaining things that happened, I think that's really good. I'm like, if you look at my notes, I talk like an idiot in my notes, but I know what I'm saying. Like I've always stayed like this is the dates, this is what happened. But um, it's more accessible in that way, like it's easier to understand but not but not dumb, if that makes sense?

I: Yeah. So how often do you use your university's website to study?
P: Um, particularly when I'm doing an assignment, um, use them or just…?

I: When you're doing your assignment, or when you just study, like anytime you need to study?
P: Um, quite often because they'll provide links to things that you can use to help with your assignment and then or if you're just studying or whatever. Um, and then from there you can find more related sources. Um, or I'll go over the lectures again because I find like going up to them really helps that refresh everything or I just sort of just go and just Google for sources on Google scholar, like. Yeah.

I: Okay. How often do you log into your university's website? Everyday? Once a day? Once a week?
P: During the semester. Once a day. They provide updates on …stuff. They'll email you the updates or something. Um, outside of the semester, not quite as much at the moment because we haven't had internet in our house. Not now. But once we get Internet, I'll probably start checking it a lot more.

I: And how often do you go to Google Scholar?
P: Whenever I'm doing an assignment, like every day.

I: A few times a day?
P: Yeah. Yeah.

I: How about YouTube for study?
P: Not so often, uh, not, not for assignments or anything but if I just sort of casual, casual study. Probably a bit more. And we came up with scholarly sources. It's probably just… Yeah. Or like I like to listen to podcasts as well because I can just put them on in the car while I drive.

I: Where do you usually listen to podcasts from?
P: From Spotify. Yeah.

I: Alright. So, what's your general impression of your University's website?
P: They just updated it the other day and I don't really like the new one, but I think that's just because I'm not used to it. Um, it's pretty good. There's always a resource on there for you. Like there's always something for you to use. The layouts, it changes like every semester. So, I have no idea what's going on in every semester. But once you get used to it, it's fairly easy to find out where everything is. And I said there's always something there for you to use, so it's good.

I: But like how much time does it take you to get familiar with the system?
P: I think it depends on the update. Like that one's a really weird one, I didn't like that at all, actually.

I: So, what happened to the last update?
P: I don't know how to do… it looked like that and it was just really strange.

I: So, it's really, really different from when you last logged in?

P: Yeah! Um, I remember one of the girls from my class was saying she didn't like it the new one. Then I was replying I haven't seen it yet, so I don't know. I don't like it. I don't like it either. But it's, it's not that bad. Like I'll get used to it and then it'll be fine. But then as I said, because you get links to other resources and then the other resources don't change, the layout doesn't change, so that's good. Consistently.

I: SI don't understand what exactly did they do to your webpage? What changed?
P: It just looks different. Like different. Yeah.

I: It's just different and you feel you need some time to get…
P: to get used to it, yeah.

I: Does it make you feel confused?
P: Yeah, it did. It really thrilled me when I went on. I was like ohhhhh, ok. Normally it looks completely different. I don't know what they're doing, but I used to similar. My high school website uses similar, like it's through Moodle. My high school website used a similar one, so I know how to understand it, I know how to use it.
I: Apart from being confused, when you are suddenly given a new design, what other feelings do you have?
P: Um, it crashes a lot.

I: So, you kind of, you don't trust it?
P: I trust it like this. There'll be times when I go to submit an assignment and then it won't let me add it and things like that. And then I have to email and say yeah. But it's mostly just things like that. If I tried to upload or download something, For actual things on there, it's pretty good.

I: Okay. So, about the links that they provided you and do you have to copy and paste and put it in Google or is like hyperlinks that you can just click and go into the places?
P: Just the hyperlinks.

I: That's awesome. Do they link to YouTube?
P: Emmm, occasionally, not very often. Most of the time it's to let museum websites or like JSTOR, um, and other sort of things like that or news articles a lot of the time because people are always digging up something in archaeology. So, I like news articles and it'll link to, oh, we found this grave, we found this tomb...they are pretty good.

I: Do you hope that they could give you links to good YouTube videos?
P: I think actually that would be pretty useful just as a, if you guys need a refresher, here is something that might help you. It actually could be pretty good.

I: Towards the end I think you found a guy's channel that you think it is pretty good. How did you find it? Did someone recommend it to you, or did you find it yourself?
P: Ah the crash coast history one, I'm like, just came up when I looked up ancient Egypt. Um, and then I noticed that it had like a playlist of this whole channel. So, I clicked on that and I had 40 something videos and every video just had a different focus. I think that's a really good idea. So that was really good. I'm like, that's a really good one that could be used as a, as a refresher. That makes sense. You could just find what you're looking for. Yeah.

I: Okay. So, when you study, what's your favourite form of information? Is it text or pictures or videos or podcasts?
P: Um, oh, I don't know. I, I like podcasts I like unlike my lectures are pretty good because there's not really a hickey has the slides, but he explains what's on the slides to everyone at heart. So, it's good to listen to. Um, I think probably something that I can listen to is good.

I: Is it because you are driving?
P: Yeah, because I'm driving. I'm also like I'll have it on, I could work or something while I'm working. Um, and that way it's just something, you know, like when you

listen to a song and then you learn all the words but you're not really listening to it. It's that sort of thing as well. Like you just take it in, you are not really thinking about it? It's good. It feels like it's not studying, but yeah.

I: So, you're the kind of person that likes to do different tasks at the same time.
P: Yeah.
I: I see. So, do you feel you achieved your goal? You study goal, in the past 10 minutes using LMS, using your university's website?
P: Um, yeah. I think because I can access all the other like, oh, my old lectures things, I think that's really useful. Um, so generally I'll say that. Yeah.

I: And you mentioned that you have already downloaded all the lecture slides, apart from the lectures you cannot attend, how about those lectures that you have actually attended? When you go home, are you going to go through all the slides and recording?
P: I have, I've downloaded a lot. All the lectures from the semester. Yeah, I go through them quite regularly.

I: You must be a very good student! Okay. Um, is there any like particular design feature of your university's website that you would like them to change?
P: Um, not particularly. Um, I just have to get used to the new format and then that should be fine.

I: So, do you think they update too often?
P: They update fairly often, but I think that's, I don't think that's the university that does that. I think it's the actual website provider that does that. So, I don't really, it doesn't really upset me. It just, every time I log in on that, oh it's different. It's different this time. But you get used to it. It's not that hard.

I: And do you hope that they don't update that often?
P: Yeah, kind of. It’s good to just keep it consistent.

I: Um, so, uh, you, you said that apart from those websites that we're talking about, you don't really go to like a massive online open course where they provide you these lecture recordings from different universities. So, you don't really go to this kind of…
P: No, I don't really. Probably should, but I don't really.

I: And can you tell me why not? Why you are not that interested in them?
P: I just haven't really thought about it.
I: Okay. But do you want to look into that?
P: I might have a look into it and see what they have there. It could be pretty good.

I: So, if your friend wants to learn something online, where would you suggest them to go?
P: I think it depends on what they're learning, but probably YouTube is a pretty decent place to start, just because it can have the evidence or courses and everything, because you can find just about everything thing in there.

I: If your friend is from your level of study? Where would you suggest them to go?
P: Um, I think it depends on what they've done before and what they are looking to study, for an assignment or just casually. For an assignment, I'd probably say go to JSTOR and look the sources there. Um, but just casually just you could look up just about everything and you'll be able to find it and then it would just depend on what you're really into and what sort of level you're looking for.

I: And how would you suggest then to access JSTOR? Through your university's website or through Google?
P: uh, probably through google, through google scholar. You can just look up your subject on JSTOR and at the end it will find it for you.

I: Why do you prefer Google scholar?
P: It's just easy to use. You just type it in, and it'll find it for you. So, it's just very handy.

I: Okay. Um, while you watch universities' lecture recordings, do you lose focus? Do you get bored?

P: Um, I think it depends. Uh, um, I think it, I think it really depends who the lecturer is and what the subject is like that. Like the one that I had up for, that's my favourite lecturer. I think he's fantastic. So, I listened to his. I listen to his like all time. He was really interesting because a couple of other teachers who are really great. There's a couple of teachers who are really quiet that they don't have much. I just said for the ones like that, I don't want to really listen to it, but other times it could be no, I missed this lecture, I'm going to take notes. I'll just stay focused on it. I'm talking about itself.

I: Okay. Is there any like particular design feature of YouTube that you think is helping you to study?

P: I think the design feature of showing the recommended videos, like related videos. I think that's really handy because as I, if you can't, if you don't like the one, you're on, you see other ones that are similar or ones that have a similar topic but a bit different. Like it's really good to find them as well.

I: And in the end of the 30-minute session you showed me a webpage that you said you really liked. Is it like your faculty's page? This one you said with a lot of specific information.

P: Oh, so on there for the unit, the unit, the guy who runs the unit can't think of the word right now. He um, he provides a lot of resources that you can go to set in and then it links you to the library page and under the library it's separated by unit. So, the unit or the faculty. Yeah. So, then you can find your different things specifically related to what you're doing. And I think that's really good. Um, that provides some primary sources or things from, from history and things like that. Really, really interesting.

I: And they're usually texts or videos or links?

P: Generally, texts. Um, but some primary sources. So, like they'll have pictures

of pottery and stuff that they have from the time that you study, which is really cool.

I: Is it well organized? Is it easy to locate?
P: Yes, it's pretty easy to locate because it's because you go through your faculty, that's pretty good.

I: Okay. So that's it. Thank you.
P: Thank you.

Participant D

I: All right. So, uh, first thank you for letting me observe you study. Can you tell me your age, your gender and area of study and you're doing?
P: Yep. So, I'm 32 I identify as female and my area of study is psychology. So, I'm studying a Bachelor of Arts majoring in psychology.

I: Cool. Um, so what exactly is the topic that you were trying to study?
P: So just saying I was studying for um, the way that children acquire language and basic language development.

I: Okay. Um, you seem very familiar with YouTube. So how often do you use YouTube for study purpose?
P: Um, the strictly study purposes during semester, I reckon I would use it every day. Um, just to clarify topics or just to find other resources. So yeah, every day. Only during semester.

I: And like do you have like a roughly how many minutes every day?
P: Probably I study for a couple of hours every day. So probably only about 20, 30 minutes of that would be YouTube, depending on the video I find. And what study I'm doing.

I: Um, what is your like general impression of YouTube?
P: Oh, I use it more for entertainment purposes, but because I'm a very visual learner, sometimes I find it easier to use, especially for anything that involves like difficult, um, really difficult concepts. I just want like a really, really broken-down easy version. So, YouTube is really great for that.

I: I though you said you are a very visual way of learner. So, what's your favourite form of information? Is it text or straight illustration or radio?
P: Um, I prefer a video presentation. So, um, some of the videos I was watching just then was sort of like a Ted talk where it was a person basically delivering a

lecture and you can see them and hear them, and I can take notes. I find that form of learning way easier. Um, I struggle a little bit if I'm just reading large blocks of text and trying to take notes from texts. I just find that I don't retain information that way. I really need to have it spoken to me. So yeah, lectures and YouTube are really good for that.

I: So, what is your like general impression of YouTube, for educational purposes?
P: I wouldn't have it necessarily before I started studying again. Um, like in the last couple of years, I wouldn't have necessarily thought of it as a study tool. But then I think the thing that really changed my mind was Ted talks. So now with the advantage of like Ted talks, I think that YouTube has like so much educational information on it. It's just really difficult because obviously there's a lot of junk in there as well. Yeah. So, I don't think it's what I would necessarily think of immediately when somebody says research. But it's definitely something I use as a research tool.

I: You mentioned like, YouTube's videos have a lot of junks. So, when you are given like at least of videos on YouTube, how do you usually make a selection? Like I notice you were really fast. Like you, you went like skimming 40 videos.
P: Yeah.

I: And you decided what you like quickly. So, how do you usually make this kind of decision? P: So generally, I'm looking for things that are presented really well. I'm, if it looks like it's shot well and it has like that layer of professionalism, um, then I'll have a click on it. Some of the videos I looked at, were put together really professionally. So, for example, the ones by the way, say I'll also look for theorist names that I recognize. So, if there's a Ted talk present on that I've seen before, I'll click on it. And if it's come from a reputable source. So, something like the, there was like a school of medicine link that I clicked on. If it just looks like somebody put a video together themselves and I'll just pass straight over it.

I: So, you're looking for production quality?

P: Yeah, definitely looking for good production quality because that suggests if good effort has gone into making it. So, it probably comes from a more repeatable sauce.

I: So basically, production quality and refutable sources?
P: Yeah. Yeah, I definitely feel like people just view numbers and how many likes they get. I never look at likes. I always forget about likes. Even when I'm using YouTube for entertainment purposes, I'm not too impressed by likes and dislikes. Um, I will look at the views a little bit, but sometimes like you'll find a really great video that's very a repeatable Uni source and only has a couple of hundred views because it was just made for a set of students. So, view count can influence me a little bit. Like obviously if something has like 100,000 views then it's probably quite popular. But otherwise, view count doesn't really influence me as much as how professional the video looks.

I: So, um, do you think you achieved your goal of learning with the past 20 minutes with YouTube?
P: Yeah, definitely. I definitely think by especially coming from an angle where I haven't researched a lot of that stuff in a really long time, um, I came up with some really interesting learning, like just terms that I can then go off and further research. And that is sort of what I'll use YouTube more for. So, to clarify things or to sort of give me some ideas of other topics that I can look at to solidify my learning. But yeah, I definitely think through some of the videos that I was watching here though I was trying to narrate the process, so I wasn't as engaged then. I definitely learned things through YouTube.
I: Do you think you see any particular design feature of YouTube to help you to achieve your goal?
P: Um, I think because it's sort of made for like everybody as it were. Then there when you type in search terms, you generally seem to get videos that are specific to like, well for me it's specific to my goals because I generally won't. Videos is going to make a difficult topic a little bit easier to understand because YouTube is such a universal platform. Then I'll generally find things that are really, really

useful for that. So broad things and introductions and summaries and those sorts of videos. So yeah, I find that really useful.

I: So, does it mean you do not really like the content?
P: Yeah, there's so much accessible content, like it's content that's made for everybody. So as a student learning about a topic that's really useful to me, it takes tricky things and makes them easy.

I: All right. Um, then how often do you use your university's Learning Management System?
P: Um, not very often, so I'll use it to access, um, and get lectures from it, but because there's not much new information uploaded to the specific LMS that we use, so I'll use it to get course readings and I'll download them to my computer, and I'll download the lectures and listen to them. But in terms of actually going back to the LMS, I don't do that very often.

I: Do you have an idea of roughly how often?
P: Um, I would probably check in with my LMS once a day just because it's also where I receive announcements and information like that. But I warned spend a long time browsing on it. So, I would probably only spend like 15 minutes on it, like every day unless I'm getting like a lecture or something. And then I would spend the duration of the lecture on there.

I: Uh, what is your general impression of the new management system?
P: Um, the LMS specifically can be a bit confusing. It can be really hard to find information on our LMS. And some lecturers don't use LMS very much. So, there's no new information being uploaded. So, it's kind of like I don't open bookshelf where you just take everything that you need at the start and then you don't really return there. The discussion boards on there are very useful either like sometimes they have exam inflammation, but generally speaking, I don't use the LMS very much. I use the library website a lot, but not the LMS.

I: Uh, so why you don't use the discussion board often?
P: Um, I just find that students don't tend to use it in my course or I'm also doing a major in criminology, but across all the subjects that I've done, the psychology students are the only ones that really seem to use the discussion board. But there's so much content to go through and so many irrelevant questions. It just feels like a waste of time. So yeah, I tend not to use it.

I: Uh, are you likely to participate on YouTube's comment sections?
P: I generally don't participate in comment sections either. Um, I posted a question on a video ages and ages ago and never got a reply because it was an old video. But yeah, I tend not to post YouTube comments like I think academically or otherwise in my entire life I've hosted maybe like three comments. So yeah, I don't use the comment section

I: But you do read other people's comments?
P: Oh yes. Sorry, I do read the other comments. So, as I was sort of doing before, I'll have a quick scroll through and see if anybody is like discussing what was in the video are challenging, what was in the video or anything like that. So, I will have a really quick scroll and then stop if I find something useful. But much like when I'm searching for videos, it's usually just a quick club cloak.

I: And do you feel, with the past 20 minutes, that you have achieved your learning goal with LMS?
P: I used the library websites. Um, the library is so much slower to use because it's this, sorry, much academic-based content. And especially when I'm looking for certain terms, it'll just direct me to studies. So, I do think that like I found some useful resources to use for later. But in terms of immediate learning then no, I probably didn't achieve much. Immediate learning

I: does it mean you feel you you needed longer time?
P: Yeah, I would definitely need to spend more time on the LMS and on the library website to study than I would on YouTube. The information is so immediate on

YouTube.

I: Um, so I remember at the beginning of the session I asked, have you ever used those free online open courses? And you told me you haven't.
P: Yeah.

I: So, can you tell me why?
P: Um, I just haven't, like, I don't know, like I'm guess I'm sort of aware of what's out there, but I don't have a great awareness of those sort of resources. So that's why I haven't access them. You will sense wants to learn something. I'll lie. So where would you recommend them to go? I would always recommend YouTube. So, I have had friends, especially doing psychology, some of the stuff that I talk about is really interesting to them. So, in that case, like say it was for the language acquisition task, I was just looking at it, then I would type in, you know, introduction to language and try and find a good link and then I'd send them the link to watch. So yeah, I would definitely direct them to YouTube rather than like a book or a library website or anything like that.

I: Okay. Um, you mentioned like on YouTube, like you do get discharged, I think it's very common for YouTube users. So how about um, LMS learning management system with the library website? Do you get distracted as well?
P: No, not really. Um, in terms of like just pure usage, if I'm just doing study, the distractions that I find on the LMS will be external to my computer. So, it's like checking my phone or something like that. Yeah. But on I'm like, Oh, do you using the LMS and the library website, there's no like other distractions on those specific like websites, but you still get like external perceptions from our other screens around me. Uh, you mentioned that you like to study at home a lot,

I: so, and also you mentioned, uh, you think the YouTube on your phone actually give you better content, better content then on your computer and what, why is that?
P: Yeah, I'm not quite sure. I just think because I'm like, I don't clear my cookies

on my case very often. So, I think on my laptop there tends to be like every single YouTube thing that I've ever looked at. And I'm using my laptop a lot more for like watching music videos and things like that. So, all my recommended videos on here, 10 like the way the interface is set up will tend to be for like my entire search history. And I feel like when I'm watching YouTube on my fire is the related videos a lot more related to the specific video and watching rather than taking my history it into account. I don't know if that's true, but I just know that when I've used my phone interface, I can click through videos rather than opening new tabs for quite a while. Whereas I really have to search a bit harder when I'm using my computer.

I: That's, I mean like, oh, your phone, the YouTube. Do you have the EP who I've got the APP. Do you think the huge who advocates you like a better recommendation?
P: Yeah, I think so. Like, um, no matter what sort of task I'm doing, I think the related content presented to me on the APP is a lot better than on the website.

I: That's, that's interesting. And like how do you use your phone to study more? Do you use your
P: I definitely use my laptop to study more. Yeah. So, I'm, if I'm watching a video on my phone, it's generally um, you know, something I pulled up quickly or a link or a friend has sent me. But I have an iPad as well, so I tend to watch YouTube on my iPad and on my laptop. I don't use my phone for YouTube very often.

I: And do you use your phone to study? No, not very often. You're on the IPAD? No, not very often. Why not?
P: Um, I use my iPad a little bit to study, but my phone screen is just too small. So, um, I'll generally carry my laptop or my iPad with me like wherever I go. But um, yeah, the screen on my phone is just too small to really like encourage me to study on it. So, it's the only cause this going is too small. So, I like the screen size. Yeah.

I: But I've had, has like a bigger screen.

P: Yeah. I use my iPad a little bit. Yeah. In retrospect, I definitely use my iPad like a little bit, just not as much as my laptop. I like my laptop because like everything's there. Like I can open up a word document and then type notes into it and I just find that a lot more fluid than using my iPad.

I: Have you ever tried to access like learning managements? They send library with your phone or iPad?
P: Uh, yeah. I've definitely been in situations where I need to look up something really quickly on the iPad, it's fine. I've accessed the LMS and the library just fine, especially because I have a keyboard attached to it. On my phone. Um, the user interface, it's just very difficult to navigate and especially trying to type on a phone. So yeah, I don't use my phone for that sort of stuff.

I: Okay. And can you tell me why do you think it's difficult to access than management system? What is your phone?
P: Um, the APP. So, I use an LMS app on my phone as well, much like a YouTube app and the APP always crashes. So, the APP isn't built very well, um, and it crashes and it's really frustrating to use. And what I use a web browser to access the LMS, it's just really difficult to navigate because they're not mobile optimized. So, you have to scroll around heaps just to find what you're looking for. Whether it's using something like YouTube for example, it is optimized for mobile boss. So, the whole experience is just a lot smoother.

I: Okay. So, let's go back to a laptop. Um, do you think any particular feature of learning management system or the websites was making you experienced on satisfactory?
P: Um, I find, so even though I've done like a lot of like classes on how to use the library website, I still find it really difficult to search for exactly what I need to find. So, if I'm searching for a particular theorist for example, um, like bs skin, I was one of the people that I started looking for because he was related to my topic. But if I type his name into like the author search and I'm trying to just find papers, it is written, it will come up with like a whole bunch of unrelated stuff. So yeah, I

just find the library website in terms of the user interface, it gives me too much stuff that isn't related to what I'm searching for.

I: You mentioned you, you, you, you even take classes to uh, what, what kind of classes? Like library classes.
P: So, um, when I first started skills, yeah, it was a library skill and a search term class. Um, I did back when, so previously I've studied, um, for graduate certificate and it was just all sort of research focused. And we had a class that taught us how to use search terms in on the library catalogue. And I went through it all and it all made sense. But then I feel like I try and apply those skills and I still don't get the same results on the library website. I just don't think it's optimized very well to have like a really easy like quick experience.

I: So, do you know how much time you're spending in those kinds of classes?
P: Um, not long. I think I probably took like three one-hour classes. So yeah, just like three hours.

I: But do this kind of classes help you to get into like learning management system?
P: I don't think so. I don't think it was really as helpful as I hoped it would be. I think that because it's so difficult to carry out a detailed search unless they are like very, very, very familiar with the website. It just, yeah, it wasn't that useful.

I: Um, you said any particular these of the learning management system that you really like? Actually, um,
P: I guess it is easy on the home page to click through the different subjects. So, I like the way it's divided into the different subjects. So that's, yeah, they feel what I find these,

I: oh, okay. Again, what's your general impression of learning management system?
P: Um, they're just often like a bit difficult to navigate. So, I know it's necessary. We need an LMS for Uni, but yeah, I think that sometimes there, yeah, just very

difficult to navigate.

I: So, which is easier for you to find information into boat learning management system?
P: Um, if I'm looking for really quick information, then YouTube is easier if I'm looking for stuff that's really, really specific to the course and I will probably go to the LMS.

I: How do you generally feel like after using YouTube? Um,
P: I don't know. Or I don't know if it really changes the, that I feel if, I suppose the most salient example would be like if I'm watching a whole bunch of videos and I'd taken a lot of notes, like a really productive, if I've gone to YouTube to actually look for something and gotten distracted, I feel terrible. Okay. So, you have a power to actually change your mood? Yeah. Yeah, definitely.

I: Okay. But how about LMS after the 10 minute's session, what do you feel?
P: Um, probably just neutral. Like it doesn't really change the way I feel or anything. I find what I need and sometimes it's effective but because there's not like many resources on, there are many new resources. Yeah. It doesn't really change my feelings and use a Learning Management System, give you videos or links to videos, do suit, try to look up the credits, do still try to make sure they are good or you're just going to watch them?
P: No, I do watch them, but I still will. I'm like backcheck all the credentials and everything like that to make sure what I'm getting as factual and useful. Okay. Uh, last thing is, uh, you mentioned you usually wouldn't, if it's a long video on YouTube, you, you wouldn't watch the whole thing. If it's a short one you probably will. So usually how many minutes of a video you are you willing to watch? So, if it's a, so I usually wind up with a really long playlist. Like, because I have been heaps and heaps of links. If it's a video that's like less than three minutes, then I'll probably just watch it as soon as I open it. If it's more than that, I might watch a little bit and if I've decided that it's useful, I'll pause it and I'll watch it later. Okay. All right. I think that's all I want to know. That worries.

I: Thank you.

P: Not a problem.

Participant E

I: Can you tell me your age, gender and area of study?
P: I'm 30 years old, male, I'm doing a Master of Business Administration.

I: Can you think of a topic from your study that you would like to learn more about? Can you please tell me what topic it is?
P: I've been studying about Corporate Social Responsibility (CSR). It's a self-regulating business mode that helps a company be socially accountable.

I: What would usually be your first place to go to if you want to learn about something online? And why?
P: First of all, I'm going to collect my learning materials from my Learning Management System, MOODLE, to narrow down the range of learning and learning materials and to find, define the key content that I'm going to learn. For example, if I would like to learn more about the CSR, Corporate Social Responsibility, I prefer to search the key words on Google and briefly browse the definition, explanation and instances from some top-ranking web pages. Usually, I would not browse the result located after 10 pages, because usually they do not relate to the key words that I have searched. But sometimes, the definition makes me confused or I can't understand it clearly. So, I would search some short videos on YouTube related to the key words. Mostly I can find some easily understandable short videos. These videos are often presented by cartoon style.

I: What is your general impression of YouTube?
P: The first look of YouTube I feel the content is quite messy, but if you have an account, and the account has been used by yourself for a period, you will find the recommendation to be more and more accurate. Even if you didn't search for anything, YouTube can provide you some content based on your interest. Actually, when you search some key words on YouTube, especially when the key words are not very common or popular, you may not be very happy with the results. But I think it is reasonable because most of the content on YouTube are

User-generated, the unpopular content or field will have less content.

I: What is your general impression of YouTube for educational purpose?
P: Sometimes it's helpful, sometimes it's not. Because comparing to the popular content such as movie trailers or celebrity news, the educational content is not very popular on YouTube. It makes it hard for me to find the useful content sometimes. Also, because YouTube is a global platform, the educational content comes from different countries and different levels, sometime the content may not suit for me. In other words, the content is not what I am looking for. But sometimes you just find videos from your university's lecturers. I study at XXXX University (major metro university 3), but sometimes I find videos from XXX University (major metro university 2) or XX University (major metro university 1).

I: Do you think you achieved your goal with YouTube during the past 20-minute session?
P: Not really. I only have a brief understanding. Usually, I don't use YouTube for deep learning. Because you can only search the definition on the YouTube you cannot search the whole question on it. Even you would like to do that to search the whole question, you still cannot find the right answer for the question. Also due to the plagiarism policy you still cannot used answer directly from YouTube video.

I: Do you think any particular design feature of YouTube helped you achieve your goal?
P: Well, the search engine is good. I could get quick results when I search for keywords. The recommended videos could sometimes be interesting. But like I said, you'll have to use YouTube a lot to get good recommended videos.

I: Do you think any particular design feature of YouTube was making your experience unsatisfactory?
P: I'm not sure if this is a YouTube feature, because most of the content on YouTube is User-Generated content, so the level of content production and

production standards vary greatly, and the number of results you can get from searching for different content can vary greatly. This can lead to a lot of complex searches that don't get the answer you want.

I: How do you feel at the beginning of, during and after the YouTube session?
P: At first, I was very curious about using YouTube for learning, because I used to think of YouTube as an entertainment App. However, I found that many students also used YouTube to learn and then I tried to use it to search for the knowledge I wanted to learn. In the process of using, I found that the searched content looks very novel, not that the content is novel to me, but most of the videos are explained intuitively through animation. But what worries me is that many videos were uploaded several years ago, which makes me worry about whether the content I see is out of date or has some updates. After using it a few more times, I think it takes some luck to learn on YouTube, because you can’t always find what you want. Or the content is seriously outdated, you can only use it as a simple reference, not a key concept.

I: What is your general impression of LMS?
P: Most LMSs give me the feeling that the design is relatively old-fashioned. Both the interface and the overall user experience are inferior to the products designed by large technology companies such as Apple, Google and Microsoft. It may be a bit unfair to say that, but I think at least the current LMS should learn from the products of these companies. Pay more attention to the user experience, design and reform the existing LMS from the perspective of the customer's use needs.

I: How is your experience using LMS so far?
P: It doesn't feel very smart to use, and the functions are not very rich. It may be because the mobile app or website design is very smart and logical. They know how users think, and products designed according to users' thinking will naturally be favoured by users. For example, sometimes because there are so many functions in a website or software, I search for keywords to find the function I want. But now the search bar in LMS gives me the feeling that it is relatively

primitive, much like the search engine I remembered many years ago. It will only search the data whether the keywords you are looking for is contained in the data and will not associate more of the content you are looking for through keywords.

I: Do you think any particular design feature of LMS helped you achieve your goal?
P: Not really. Usually, I only use my LMS to download the study materials, including lecture slides and lecture recording. Or use my LMS to check the assignment and exam results.

I: Do you think any particular design feature of LMS was making your experience unsatisfactory?
P: In fact, many new functions can be integrated into LMS to help students learn more efficiently. First of all, the first point that made me dissatisfied was the student forum. I think this type of forum communication is very inefficient. Your message will often get a reply from others after a long time, and there may even be no reply. I cannot find the answer to the question I want to ask. Instant messaging software like what's app hopes to be added to LMS. Students and teachers are distinguished by their student ID or job ID, and online people can communicate immediately. Saving time also increases efficiency.

P: The second unsatisfactory point is that the search bar in the LMS often fails to find the desired results. The search mechanism that can only match keywords is a bit outdated. I hope that the search bar can give suggestions and associate content like Google. In addition, if you search, you can also search for the content in the video and lecture slides, which is even more perfect. For example, when you search for an academic concept, you will not only tell you which chapter the concept appears in, but also tell you that the lecture video about the concept mentioned it in the first few minutes.

P: Finally, it would be great if the lecture slide function in LMS became more abundant. Especially with the addition of the online note-taking function, students can directly record notes through a computer or other devices while watching

slides and save them in the cloud for personal reference later.

I: Do you think you achieved your goal with LMS during the past 10-minute session?
P: There are some but not comprehensive. I hope that more tasks can be accomplished in the LMS system. If I just download my study materials in the LMS, then in the past 10 minutes I have completed my goal. But I hope that LMS can help me accomplish more learning goals, especially some complex questions or learning tasks without clear answers. Whenever I encounter such a problem, it is difficult for me to find the answer quickly on the Internet. At this time, my thinking is that if I can communicate with my teacher or classmate, it would be great. Or I can retrieve the suggestions given by previous learners on such problems.

I: How do you feel at the beginning of, during and after the 10-minute session?
P: At first, I felt that this LMS could basically meet my needs, because I saw the course options neatly arranged in a conspicuous position. And each course has a progress bar to remind me how much I have completed, which allows me to have a very clear understanding of the progress of each course. There is also a calendar placed in the lower right corner, and key dates are also marked with special colours. This way I won't miss important dates like assignment deadlines.

P: But as I continued to use it, I found that some of the functions I needed were not arranged in a conspicuous position. At this time, I would like to use the search bar in the LMS, but as far as this LMS is concerned, its search bar is almost in an unusable state. Because this search bar is placed in the LMS, but it is only used to search for courses, and cannot retrieve the content based on the courses I have studied. Even if I want to find out which content has appeared in which chapter, it will not work.

P: After using it, my feeling is that there are still many areas for improvement in the LMS system. If more LMS designers, designers like you, can listen to the

opinions of users, it will have a great impact on the progress of LMS. Because there are many needs and great ideas that can be added to the existing LMS. Although I know this may be difficult, some features can already be seen in the products of many large companies, and I think this should be achievable.

I: Have you ever heard of Massive Online Open Courses?
P: I don’t know it well, is TED one of them? But during the quarantine period, I experienced a lot of online teaching. I believe that a more complex and powerful LMS system is needed for online teaching, because the existing LMS system hardly supports online teaching. Even if some of them can view course recordings, they still cannot complete real-time online teaching and interactive teaching functions.

I: Have you ever used Massive Online Open Courses? If so, how was your experience?
P: In terms of the few open online courses, I have participated in, these courses are just videos. You can only choose the video you like to learn, and you have no way to interact with the teacher or ask questions during the learning process. Because these may be recorded in advance, rather than real-time.

I: Thank you!
P: Thanks!