

University of Tartu  
Faculty of Social Sciences  
Institute of Education  
Curriculum of Education Technology

Esther Sumba

A Journey Through MOOCs (Massive Open Online Courses), the Future of Education for  
Both the Corporate and Academic Sectors.

*Special Focus on the Corporate Sector and the Field of Information Technology*

MA thesis

Supervisor: Emanuele Bardone, PhD

### **Abstract**

MOOCs have redefined how knowledge is transmitted and acquired. However, as a fairly new form of Educational Technology, there is still a lot of speculation in regards to its impact, future and intellectual integrity within the world of online learning. This exposition will take readers through a journey to explore, analyse and justify the ground breaking disruption of MOOCs as a present day educational technology, its impact on career progression within the corporate sector, future outlook and the various critical issues surrounding Massive Open Online Courses.

The main mixed research study will spotlight interviews of self-taught tech professionals who have leveraged MOOCs to learn new technological skills e.g. Java, C++, etc., and successfully transitioned into technology careers by training via MOOCs. The main goal of this research will be to highlight the impact of Massive Open Online Courses on the acquisition of new technology skills, impact on career transitions in the technology field and the analysis of various MOOC platforms. Rarely, will most computer science and software engineering university programs equip students with all the technical skills needed in the corporate marketplace. Due to the huge skills gap that exists between university graduates and the needs of tech-focused organizations, most aspiring developers and technologists resort to MOOCs as a means to bridge those knowledge gaps. The results from this study, further backed up by statistics from secondary research studies on learning and hiring trends in the technical field, will reinforce the reasons as to why MOOCs are the future of education within the corporate sector, particularly the field of Information Technology (IT). It will also expose some key critical issues such as employer perceptions and course quality. The second qualitative research study will attempt to unravel the various self-regulation tactics applied by these professionals to succeed within the online learning environment. This study will highlight how finances, career change and career mobility act as key drivers of self regulation and also draw various parallels of the relationship between goal setting, mental resilience and extrinsic motivation as they relate to online learning.

**Keywords:** MOOCs, Massive Open Online Courses, Educational Technology, Self-Regulation, Tech Companies, Corporate Sector. Technology Field

## Table Of Contents

|  |    |
|--|----|
| Abstract .....   | 2  |
| Table of Contents .....  | 3  |
| 1. Introduction .....  | 4  |
| 1.1 MOOCs Definitions .....  | 4  |
| 1.2 Relationship between MOOCs and Learning Management Systems (LMS) .....                 | 6  |
| 1.3 MOOCs and Distance Education .....   | 7  |
| 1.4 The Emergence and Evolution of MOOCs Over the Years .....                              | 7  |
| 1.5 Analysis of Different MOOCs in the Market .....  | 8  |
| 2. Goals of Research Studies .....   | 11 |
| 2.1 Contribution of Research to the Field .....  | 12 |
| 3. Methodologies .....   | 12 |
| 3.1 Sample Group Background and Characteristics .....                                      | 12 |
| 3.2 Research Methods, Study I .....  | 13 |
| 3.2.1 Data Collection Process and Techniques, Research Study I .....                       | 14 |
| 3.3 Research Study II, Self-Regulation .....   | 15 |
| 3.3.1 Data Collection Process, Research Study II .....                                     | 15 |
| 3.3.2 Analysis and Interpretation, Research Study II .....                                 | 16 |
| 3.3.3 Recommendations of Analysis Methods, Research Study II .....                         | 17 |
| 4. Study I .....   | 17 |
| 4.1 Overview of the Results .....  | 17 |
| 4.2 Analysis and Discussions of the Results .....  | 19 |
| 4.3 Discussion I: Critical Issues of MOOCs .....   | 24 |
| 5. Study II .....  | 30 |
| 5.1 Overview of the Results (Interview II) .....   | 30 |
| 5.2 Analysis and Discussions of the Results (Discussion II) .....                          | 31 |
| 5.2.1 MOOCs a Key Driver of Self-Regulation .....  | 34 |
| 5.2.2 Self-Regulation and MOOC Completion Rates .....                                      | 35 |
| 5.2.3 Goal Setting In Self Regulation .....  | 37 |
| 6. Why MOOCs are the Future of Education: Quick Glance at the <i>Covid-19</i> Crisis ..... | 38 |
| 7. Recommendations for Further Research .....  | 40 |
| 8. Conclusion .....  | 40 |
| Acknowledgements .....   | 42 |
| Authors Declaration .....  | 43 |
| References .....   | 44 |
| Non- Exclusive License .....   | 48 |

## 1. Introduction

Academicians, learners and legislators should explicitly begin to embrace and come into terms with the possibility that in the coming 50 - 100 years, brick and mortar academic institutions of higher learning will be few and far in between or maybe even nonexistent. If anything, the current crisis sparking from COVID-19, otherwise known as the *Corona Virus*, has caused disruptions in global economies due to the closure of schools, organizations, borders, churches etc. and changed the way human beings interact with each other and the digital space. The closure of schools and organizations has more than ever highlighted the need for both academic and corporate sectors to fully implement digital learning tools to manage, distribute and store knowledge using online platforms. Massive Open Online Courses popularly referred to as MOOCs, are online course content which are hosted on digital platforms which may be open source or non-open source. MOOC platforms are an absolute game changer and one of the greatest educational technology innovations that have emerged within the past few years. This claim can further be validated by the perilous season which the world is currently experiencing, particularly as it relates to the closure of schools, higher learning institutions and corporate organizations. The world is in need of a stable consistent digital strategy which will enable learners and employees to access information from the comfort of their own homes and away from the previously accustomed traditional formats. MOOCs have also shattered down the walls of elitism which have previously existed in education by making courses from Ivy League institutions and world-class professors available to the masses.

### 1.1 MOOCs Definitions

MOOCs commonly referred to as Massive Open Online Courses emerged around the late 2000's era (2007/2008) and have since enjoyed massive popularity within the past few years. MOOCs could loosely be defined as a model of delivering interactive courses online by providing (often) free and open enrollment to users typically spread out across different geographical regions. These courses can be structured within a course or unstructured and run within a flexible period of time allowing learners to self regulate. Course formatting is structured to allow some level of collaboration through chats, forums, videos and social media. Courses may take the form of

professional courses, certifications, college credit or personal development.

For a more technical definition, the Academic Association for Contemporary European Studies (2020) defines MOOCs as “a large-scale digital course designed to appeal to and engage with a wide audience on a subject of general interest”. MOOCs happen to be multidimensional in the sense that they can cater to students, employees, entrepreneurs, retirees and many other categories of learners. They are an *equalizer* in the sense that they have made courses available to the public from the so-called elite institutions. Participants of the courses may already be knowledgeable experts in the field or novice’s who are just starting out to acquire knowledge within that domain. MOOCs are distinctive in the sense that they bring all levels of learners together. This may explain the reason why in some digital circles, MOOCs are referred to or compared to Interdisciplinary studies. There are several other arrays of MOOC definitions which may assist readers to develop a 360 bird view perspective. Some of these definitions include:

- Wikipedia (2020) defines MOOCs as “A massive open online course is an online course aimed at unlimited participation and open access via the web”.
- Tracey (2013) an online learning expert from eLearning Industry defines MOOCs as “ a course of study made available over the Internet without charge to a very large number of people”
- Kurt (2018) of EducationalTechnology.Net expounds in her article that there are two types of MOOCs: xMOOCs and cMOOCs. While xMOOCs “are based on traditional course structures and make use of established teaching approaches and materials”, cMOOCs “are based on connectivist learning models that privilege collaboration as a form of active learning”. In this latter model, students are tasked with identifying, gathering, curating and uploading course content.
- Universidad de Alicante (2013) states that a MOOC is a “course with the option of free and open registration, a publicly-shared curriculum, and open-ended outcomes.”

From most of the core definitions given, it can be concluded that MOOCs consist of the following core characteristics:

- Little to no entry requirements (Open Enrollment)

- Courses are typically free but learners may pay a small fee to obtain certification
- Self paced learning
- Multiple rounds open all throughout the year
- Demographically and geographically diverse groups of learners
- Courses not only taught by academicians but also subject matter experts

### **1.2 Relationship Between MOOCs and Learning Management Systems (LMS)**

In the field of online education, Massive Open Online Courses and Learning Management Systems are often confused and even interchangeably used to mean the same thing. However, these two terms have two separate meanings. Learning Management systems are the cloud platforms which host online courses whereas MOOCs refer to the actual course content hosted on the LMS platforms. LMS systems are used to create and deliver online instructional courses within regulated settings e.g. schools, companies etc and are very rarely open sourced unlike MOOCs which permit open enrollment and can accommodate hundreds or even thousands of learners. In fact, most LMS systems are used by single institutions unlike MOOCs which host several institutions. Another major distinction is the regulation of content. LMS systems which are typically used to host institutional content e.g. university, whose curriculums have been vetted before approval and launch. MOOCs on the other hand are very lowly regulated and infamous for allowing poor quality unvetted content which may explain the low course retention and completion rates (The critical issues segment of this paper will get into more detail).

This discussion further brings up the question of whether an LMS can also be a MOOC. Depending on a few factors, some LMS systems can qualify as MOOCs. One major factor is whether the LMS is open source or not. Open source LMS platforms which allow anyone to design and offer courses through their platform can also be referred to as MOOCs. Integrated web-based platforms which can be customized to provide open source courses are becoming increasingly popular. Users can create interactive courses, upload videos and explore many features all within the same platform. For example, popular MOOCs provider EDx provides a cloud platform to launch courses and also facilitates the creation of courses thus serving both as an LMS system and MOOCs. Other smaller less known vendors whose platforms can serve as

both are Atutor and Coggnio.

### **1.3 MOOCs and Distance Education**

When we think of distance education, we often think of the internet as a catalyst. However, distance education originated long before the emergence of the internet. Based on the Association of Educational Technology and Communications (2001) study, distance education originated in the 1800's at the University of Chicago. Early television, telegram and radio were used to deliver instruction via means of correspondence to reach students who could not physically participate in the classroom. The technological revolution which led to the rise and spread of the internet led to the evolution of distance education into online education. According to the journal, "Keegan (1980) identified six key elements of distance education which are:"

- Separation of teacher and learner;
- Influence of an educational organization;
- Use of media to link teacher and learner;
- Two-way exchange of communication;
- Learners as individuals rather than grouped;
- Educators as an industrialized form"

There is definitely a huge correlation of these elements as it pertains to MOOCs and modern day distance learning which has been heavily influenced by technology. The only element which has slightly evolved in regards to MOOCs is the "Influence of an educational organization".

Corporate organizations, curriculum designers, college professors and professionals who are experts in their field of study offer MOOC courses independent of any ties to an institution. The technological revolution which led to the rise and spread of the internet led to the evolution of distance education into online education. In today's world students, employees and entrepreneurs can access courses online from the comfort of their own homes, institutions and other public places such as airports. This next segment will take readers on the evolving journey of MOOCs over the years.

### **1.4 The Emergence and Evolution of MOOCs Over the Years**

There are several theories and speculations regarding the emergence of MOOCs and the original

pioneers. As much as several conspiracies continue to float around, Dave Cormier, a University of Prince Edward Island professor is credited to have coined the phrase ‘MOOC’ in 2008. Cormier was referring to Professor David Wiley’s (Utah State University) online course which was free and available for anyone to participate, despite their educational or professional backgrounds. Based on McGill University’s (2012) website, the main theory asserts that the phrase MOOC was coined in reference to a course developed by Stephen Downes and George Siemens entitled *Connectivism and Connectivity Knowledge* in 2008. Even though 25 students attended the class on the campus of the University of Manitoba, about 2300 students attended the class online. One of the goals of the course model was to observe “interactions between a wide variety of participants made possible by online tools so as to provide a richer learning environment than traditional tools would allow.” The study was quite a success. However, the big revolutionary break for MOOCs came in 2011 when Stanford University offered an online course known as ‘Introduction to Artificial Intelligence’. The course recorded an online enrollment of 160,000 people making it the worlds largest class gathering ever known. The two Stanford professors of the course, Sebastian and Peter, enjoying massive success to the extent of leaving their faculty positions at Stanford University, went on to establish one of the largest and most successful open source MOOC platforms, Udacity.

By the spring of 2012, Massachusetts Institute of Technology (MIT) began to offer an online course on circuits and electronics through its internal platform MITx (later renamed to EdX). Again, a record breaking 120,000 students from around the globe registered for this course. By May 2, 2012, MIT and Harvard University which are both ranked as world class institutions announced that they would be launching a joint project known as EdX. The courses offered would be open source, free and available for learners from around the world. Ever since 2012, several MOOC platforms have emerged in the market. During a viral interview with *Wired* (2012), Sebastian Thrun the founder of Udacity was quoted saying “He imagines that in 10 years, job applicants will tout their Udacity degrees. In 50 years, he says, there will be only 10 institutions in the world delivering higher education and Udacity has a shot at being one of them.”

### **1.5 Analysis of Different MOOCs in the Market**



The field of massive open online courses is continuously getting saturated as more and more companies continue to innovate Massive Open Online Courses. However, as in any industry there still remains several key players who dominate the market. The forces of supply and demand are heavily influencing the MOOC market as more institutions and experts are launching their courses online to cater to the growing popularity of courses.

Different categories of MOOCs cater to different categories of learners based on their specific learning and developmental needs. Some of the largest players in the market of MOOC technology are edX, Coursera and Udemy. Other upcoming notable online course providers include Udacity, Code Academy and Khan Academy.

One of the biggest consumers of massive online courses are aspiring technical professionals. In fact, at least 30% of most courses offered through the key players are technically centered courses focused on software development, mobile apps, artificial intelligence, engineering, data science and many other fields within technology.

Dawal Shah (2019), the founder and CEO of class central conducted a research with his team based on the popularity of MOOC platforms by field in order to compile a comprehensive list of top MOOC platforms. The list was compiled after running an analysis of more than 60,000 online course reviews featuring courses from 53 universities based in 18 countries. The most highly ranked free introductory level courses taken by learners were from the fields of technology and engineering. Some of the highly reviewed universities that offered technology courses through either Coursera or edX were:

- University of Michigan via Coursera. 7200 ratings (Course: Programming for Everybody - Getting Started with Python).
- Rice University via Coursera. 3151 ratings (Course: An Introduction to Interactive Programming in Python, Part 1)
- University of Stanford via Coursera. 350 ratings (Course: Intro to Machine Learning)
- Massachusetts Institute of Technology via edX. 122 ratings ( Course: Introduction to Computer Science and Programming Using Python)

Paul (2020) of the famous JavaRevisited blog recently ran a study to compare two of the largest and most popular technical course providers, Coursera and Udemy. Based on his study “While

Udemy has more courses, Coursera's courses are often well structured, especially machine learning ones. Coursera also allows you to learn from top universities of the world, and their certificates generally hold more value because they are offered by top universities along with Coursera.” Among the top universities offering courses via the Coursera platform are the Ivy leagues such as Harvard, Stanford, Massachusetts Institute of Technology and Brown University. Students who in normal circumstances would have never had the opportunity to attend these institutions can now enroll for courses and obtain certificates. These certificates can often be linked to individual LinkedIn profiles whereby recruiters can publicly view them, which is an added advantage for job candidates. Overall, his conclusion was that Coursera was a better choice for candidates who were looking to launch into the technical field.

The below table displays the top MOOC platform rankings based on the number of student enrollment (Adam, 3 Jan 2019).

| <b>Platform</b>  | <b>Founding Partners</b>   | <b>Students*</b> | <b>Offerings and Details</b>  |
|------------------|--|------------------|---|
| Coursera (U.S.)  | Stanford University, University of Pennsylvania, and John Hopkins University | ≈37 million      | <ul style="list-style-type: none"> <li>- Paid subscription model</li> <li>- Offers an iMBA</li> <li>- Partnered with Google, World Bank, CISCO, BCG, Intel</li> </ul>   |
| edX (U.S.)       | Massachusetts Institute of Technology, Harvard University, and UC Berkeley   | ≈18 million      | <ul style="list-style-type: none"> <li>- Not-for-profit and open source</li> <li>- High partnering fees</li> <li>- Partnered with Microsoft, IBM</li> <li>- Lecturer-centric</li> <li>- Offers micro-masters</li> </ul> |
| XuetangX (China) | Tsinghua University  | ≈14 million      | <ul style="list-style-type: none"> <li>- Facilitates self-produced content by students</li> <li>- Focuses on interactivity and blended learning</li> </ul>  |
| Udacity (U.S.)   | Stanford University, Google, Facebook,                                       | ≈10 million      | <ul style="list-style-type: none"> <li>- Commercial revenue model</li> </ul>  |

|                       |                 |               |  |
|-----------------------|-----------------|---------------|--|
|                       | AT&T            |               | - Offers a Nano-degree program<br>- Partners include BMW, Amazon, IBM                              |
| Futurelearn (England) | Open University | ≈8.7 million  | - Student-centric<br>- Top 200 universities can access<br>- Partners with specialist organizations |
| >28 other platforms   | Varies          | ≈13.3 million | - Platforms are considered 'Regional' and 'Country-specific'                                       |

Fig 1

MOOCs can also be grouped by focus area. For technology courses, Udacity, Coursera, Code Academy and edX are among some of the popular platforms. LinkedIn Learning and Go Skills are mostly known for business courses while Alison, PMI Online and edX have great project management course offerings.

## 2. Goals of Research Studies

This thesis will feature two research studies, research study I (main research study) and II (mini-research study). The main goal of research study I will be to unravel the impact of Massive Open Online Courses on the acquisition of new technological skills, their impact on career progression among technology professionals and the analysis of various MOOC platforms.

Research Study I contains four questions which are:

1. How much of your currently pre-existing technical knowledge was acquired via MOOC platforms?
2. Name the top MOOC platform you used to acquire most of your technical skills.
3. What was the quality of the courses taken? (Select either Poor, Average or Good)
4. What impact have MOOCs had on your professional career journey (role changes, salary raises, promotions etc)?

Research study II will focus on self-regulation and the study results will also be supported by data from secondary research.. The study will collect verbatims from 3 professionals (also featured in research study I) with the goal of uncovering the various tactics which they use to self regulate and the reasons as to why they are motivated to self-regulate and self-direct, within online learning environments. This short research study will pose only one question which is:

1. What tactics do you use to self regulate yourself within a MOOC learning environment?

### **2.1 Contribution of Research to the Field**

Several research studies on MOOCs have previously and continue to be conducted. However, most of these studies seem to have a focus on academic rather than corporate contexts. In my research, I have come across very little to almost no research data from the corporate sector, particularly the field of information technology. Most studies on MOOCs currently address topics such as process models, completion rates, adult learning, policy, social inclusion and other academic and socio oriented focus areas. This research study will expand the efforts of MOOCs research by providing useful data from the IT corporate sector which can either be used to design improvement programs or act as a stepping stone into further research.

## **3. Methodologies**

### **3.1 Sample Group Background and Characteristics**

The original research plan consisted of interviewing and collecting data from at least 10 professionals within the field of technology throughout March and the first week of April, but these plans were disrupted by the current Covid-19 crisis. One repercussion of the crisis on this research is a much smaller sample group consisting of only 5 professionals.

In his book (Creswell, 2003) highlights a core characteristic of a meaningful sample:

"...intentionally sample a group of people that can best inform the researcher about the research problem under examination". My target population group consists of 5 professionals presently working within the field of Information technology in Berlin, a city reputed to be among one of the top technology Startup Hubs of Europe. Even though the selected sample group is relatively small, I made an attempt to diversify the sample to my best capability by including both new

(interns) and experienced professionals (2-3 years experience). Two of the professionals were software developer interns - fresh in the field of technology, while the other three software developers had gained some experience working in the field.

A few characteristics of the selected targeted group which may help readers to understand their backgrounds and make meaningful interpretations of the data are:

- The interviewed individuals are not holders of any Information Technology degrees (Computer Science, Software Engineering, Computer Systems, Information Systems etc.). 3 professionals are holders of business degrees while the other 2 hold Political Science and Linguistics degrees.
- All 5 of the developers interviewed are self taught developers who have used the multiple resources available (MOOCs, YouTube videos etc) to sharpen their skills and 2 of them have attended technical bootcamps which typically last between 2 to 6 months.
- All the interviewees have experience acquiring knowledge by taking various MOOC courses via platforms such as Coursera, Udemy, edX and many more.
- 3 of the developers used in research study I will also feature in research study II.

### **3.2 Research Methods, Research Study I**

This study has used a Mixed Methods Approach - a combination of both Qualitative and Quantitative Research methodologies for data collection, analysis and interpretation. In any mixed methods approach ‘‘The data collection also involves gathering both numeric information (e.g., on instruments) as well as text information (e.g., on inter- views) so that the final database represents both quantitative and qualitative information’’(Creswell, 2003)

The interviewed sample group were presented with a total of four structured questions. The Qualitative nature of questions 2 and 4 of this particular study seek to uncover specific trends and patterns in the acquisition of knowledge by professionals within the technology field, by studying past events and approaches. They are dynamic. Qualitative Study approach ‘‘Is one in which the inquirer often makes knowledge claims based primarily on constructivist perspectives (i.e., the multiple meanings of individual experiences, meanings socially and historically constructed. with an intent of developing a theory or pattern) or advocacy/participatory perspec-

tives (i.e., political, issue-oriented, collaborative. or change oriented) or both” (Creswell, 2003).

To further break down Qualitative study, (Leonard, 2019) in her exposition mentions the 6 types of Qualitative Research which are Ethnographic, Grounded Theory, Historical, Phenomenological, Case Study and Narrative models. The Qualitative portion of this particular study falls under the Historical Model, a qualitative research approach which “describes past events in order to understand present patterns and anticipate future choices.” Questions 2 and 4 will allow the selected sample group to highlight their past and present academic journeys and the resulting data will assist in providing generalizable insights which are parallel to industry trends.

On the other hand, questions 1 and 3 from this study are quantitative research questions. Quantitative Research is a methodology whereby the data collected is numerical in nature. These two questions aim to measure attitudes, uncover preferences and rate behaviors by presenting a range of options to interviewees. “The information collected is analyzed using statistical procedures and hypothesis testing.” (Creswell, 2003). The collected data can easily be converted into numerical values that can statistically be analyzed. Unfortunately, the data collected from the target group of 4 professionals, is too small to apply any sophisticated data collection techniques or software such as QDA Miner, Node XL, NVivo and Stata.

### **3.2.1 Data Collection Process and Techniques, Research Study I**

This study has deployed interviews as a data collection technique. Interviews can be employed using a number of techniques ranging from ‘informal chats’ arranged as ‘vox pops’ or a more highly structured transcribed format (Creswell, 2003). Though the research employs the use of structured questions, the interviews were conducted using the former tactic (*Informal Chats*) to capture the target groups preferences, perceptions and behavior. The face to face interviews were conducted at the end of February during two different tech meet-ups, which are popular within the Berlin technology startup scene. These interviews were conducted on an individual basis except for one interview whereby 2 people were interviewed at once due to time constraints. and their responses were recorded on paper.

One drawback of interviewing 2 or more people at the same time is that the dominant personality

may influence the responses of their counterpart. While analyzing the responses of the two personas interviewed at the same time, I noticed that the second interviewee's responses *piggy backed* on the first interviewee's responses e.g. Inferring to phrases such as 'Just as 'Persona X' said, I think.. Etc. This denoted that their response was obviously influenced by the other party. Nevertheless, conducting interviews was the most convenient method of collecting data because:

- It is the fastest way to collect data. During interviews, data collection from the target group is instant/immediate compared to other forms of data collection such as questionnaires and surveys.
- Making the desired amendments to research questions on a *as-per-need* basis is much easier since the questions are real time.
- The face to face interactions with the target group facilitates the observation of facial expressions and body language which may be useful in data interpretation.
- The researcher can filter and extract only relevant information from verbatims

### **3.3 Research Study II, Self-Regulation**

As previously mentioned under research goals, this short research study collected verbatims from 3 professionals with the goal of uncovering the various tactics applied by MOOC users to self-regulate within the online learning environment.

This particular question was added mid-study to the 4 questions previously featured in research one, thus explaining the reason why data was collected from only 3 professionals. In this research interview, I posed a question to 3 self taught software developers who heavily rely on online courses to acquire their skills, to expound on their self regulation/self-directed learning tactics.

The posed question was **“What tactics do you use to self regulate yourself within a MOOC learning environment”**.

#### **3.3.1 Data Collection Process, Research Study II**

Since the goal of this study seeks to uncover or make sense regarding a specific phenomenon, self-regulation in this scenario, a qualitative approach was applied in data collection. ‘The

emphasis in qualitative analysis is “sense making” or understanding a phenomenon, rather than predicting or explaining. A creative and investigative mindset is needed for qualitative analysis, based on an ethically enlightened and participant-in-context attitude, and a set of analytic strategies.”(Bhattacharjee, 2012)

The interview conducted falls under the “fact finder” category. Based on the Qualitative Methods handbook (2020, p., 41), this method “.. is used when some information is already known and there is a need to gain a more in-depth insight.”In this scenario, it is already known that the interviewees are regular MOOC users and the data that I am collecting falls within accessible parameters.

To offer a little more context, their verbatims were captured and recorded on paper. Only the relevant information needed for this research was extracted from the verbatims, which have also been slightly paraphrased to reflect more clarity.

### **3.3.2 Analysis and Interpretation, Research Study II**

To interpret these verbatims, I applied Content Analysis which from this perspective can be defined as “the systematic analysis of the content of a text (e.g., who says what, to whom, why, and to what extent and with what effect)” (Bhattacharjee, 2012). It is also important to note that the verbatims collected here are subjective and are strictly personal opinions rather than facts. To further break down the content analysis, Sentiment Analysis which is ‘-a technique used to capture people’s opinion or attitude toward an object, person, or phenomenon.’ has been employed in the interpretation of data. As previously mentioned, the verbatims capture the individual experiences of each interviewee. These experiences happen to be unique to each individual and there isn’t a correct or incorrect response. The responses can either be positive, negative or neutral.

One major advantage of this method of data analysis is that interviewees are more likely to provide honest responses because there are no wrong or right responses. Interviewees are excluded from the fear of retaliation, bias and other research distractions. Data analysis is also much easier for researchers who don't have to make further analysis or categorize data based on preferences. The major downside of this method of data collection is that for large samples, a lot



of work may go into extracting and editing the verbatims to obtain the most accurate/relevant information. There is also a possibility for interviewees to steer off the discussion topic.

### **3.3.3 Recommendations of Analysis Methods, Research Study II**

In the event that I was working with large sets or a significant amount of data, applying Grounded Theory to analyze text data would have been a more appropriate technique. This theory can best be described as “an inductive technique of interpreting recorded data about a social phenomenon to build theories about that phenomenon” Glaser, B. and Strauss, A. (1967). The process of analyzing data involves categorizing text data segments into sets of either concepts, categories or (and) relationships. “The researcher examines the raw textual data line by line to identify discrete events, incidents, ideas, actions, perceptions, and interactions of relevance that are coded as concepts”. For instance, in the event that I had collected verbatims from 6 professionals with varying opinions, I would try to identify, connect and draw parallels between the different or similar perceptions and ideas provided by the employees before grouping them into categories. However, the current target group size of 3, does not provide capacity

## **4. Study I**

### **4.1 Overview of the Results**

The following are the results of research study I interviews.

- For research question 1, the posed question was **“How much of your currently pre-existing technical knowledge was acquired via MOOC platforms?”**

60% (3 out of 5) of the interviewed persons stated that they acquired MOST of their knowledge via MOOC platforms such as Coursera, edX, Udacity etc. Other resources used were books, YouTube videos, tech-meetups and blogs by other developers in the field. The other **40% (2 out of 5)** developers had previously attended coding boot camps whereby they went through intensive study sessions and attained most of their technical knowledge. However, they still used MOOCs to supplement their knowledge.

When making these interviews, I encouraged the interviewees to avoid making statistical references e.g. 50% or 80% etc because there was no way for them to statistically proof those percentages. I therefore encouraged the use of words such as *Most* or *Majority*.



Figure 2

- For research question 2, the posed question was “**Name the top MOOC platform you used to acquire most of your technical skills**”

80% (4 out of 5) of the interviewees stated that Coursera was their top to go platform for coding courses. The remaining 20% (1) rated edX as their top to go platform.

There were no options presented during the interview e.g. Coursera, Udemy etc. This was an open ended question.



Figure 3

- For research question 3, the posed question was “**What was the quality of the courses taken? (Select either Poor, Average or Good)**”

80% (4 out of 5) of those interviewed felt that the MOOC coding courses were of good quality. (Variable: Selected Platform).

There were only three options provided and interviewees were to choose either one of them (Poor, Average or Good)



Figure 4

- For research question 4, the posed question was “**What impact have MOOCs had on your professional career journey (role changes, salary raises, promotions etc)?**”

100% (5 out of 5) of the interviewees felt that MOOC courses equipped them with the necessary skills to switch their careers and pursue junior/internship roles within software development.

The verbatims of the interviewees were varied but they all denoted the same thing, that MOOCs have been very instrumental in their learning journeys.



Figure 5

#### **4.2 Analysis and Discussions of the Results**

This section will discuss the results of the study and also address various issues surrounding the quality of courses, employer perceptions and technology infrastructure. The discussions will also delve into the various ways in which MOOC providers are countering these challenges and the projected future outlook surrounding these issues.

##### **Research Question I**

Based on the results from research question 1, it can loosely be concluded that MOOCs have become an essential channel to master skills for professionals looking to switch into different fields or gain new skills for career acceleration within the field of Information Technology (IT). Compared to most traditional learning models MOOCs save time, money and infrastructural adjustments. Before MOOCs, most IT professionals who desired to switch careers either enrolled for a masters degree or enrolled in a university to gain a diploma or certification. These two options take time, financial resources and in fact there is no guarantee that upon graduation, a student will have gained practical skills needed in their field of pursuit. For instance, It takes an average of 2 years to complete most graduate degrees. Another hurdle is that graduate degrees are not cheap. In fact, based on US statistics, graduate school is one of the major contributors to adult debt in countries such as the US. More and more people are coming to the discovery that it is possible to acquire skills without enrolling for a traditional academic degree. Even better, most companies have scrapped off the degree requirement for software developers. As one recruiter (Krumrie, 2020) sums it up,

“I can tell you in the IT space that education is not that much of a big deal – most clients want to see experience. I tend to see education only playing a part when the client is hiring someone as a full time employee and they are required to meet some educational levels (such as a bachelor’s degree).”

Based on the above statistics from this research and other secondary data, this indeed, is the new future of recruitment for IT jobs. Within the past few years, Coding Bootcamps have also been becoming an increasingly popular option. A Coding Bootcamp is “a short-term, intensive training program that teaches students practical and job-ready tech skills. They are cheaper and faster than traditional education and often include career support for graduates.” (Crabtree, 2020). The most recent development in this sector is the emergence of Online Coding Bootcamps which utilize the MOOC format of learning. In fact, most course owners of these courses also run the same courses on mainstream MOOC platforms. Some of the popular Bootcamps include Code Academy, Code Works, CareerFoundry and many more.

One major reason why many professionals are now settling for MOOCs rather than traditional education from brick and mortar institutions is due to various infrastructural and logistical issues. In this next subsection, we shall examine one reason why MOOCs are a convenient option for the modern day professional looking to master new skills or switch careers.

### **MOOCs, a Key Driver in Countering Urban Sprawls/Infrastructure Challenges**

As part of the larger global economic crisis, more and more employees are being forced to work for longer hours in order to counter the rising costs of living. This also means less time for concentrating on other life aspects e.g. recreation, evening classes, professional development, fitness etc. To counter these challenges, more and more working class citizens are turning to online learning as a coping mechanism.

In addition to long working hours, infrastructural challenges have severely contributed to the rising fatigue rates of employees. Most big cities in the world are currently experiencing rapid migration rates i.e. the movement of people from rural or suburban areas into cities. The massive influx of people into cities has caused large urban sprawls leading to high population rates which have in turn led to massive traffic jams. As mentioned by Willingham (2019) in a CNN article

regarding traffic rates in the US, researchers found out that commuters waste an average of about 54 hours per year stalled in traffic. While “Commuters in the 15 most-congested cities spent an average of 83 hours stuck in traffic in 2017, in Los Angeles, the most congested metro area, stalled traffic robbed commuters of an average of 119 hours that year.” Unfortunately, most working class citizens now spend much longer periods of time trapped in road traffic congestion leading to enormous time wastage, delays, loss of productive energy, stress plus other harmful physiological and psychological consequences. These changes in lifestyle are more than a clear indication that traditional modes of receiving knowledge via the physical classroom will soon be phased out.

In fact, if the mentioned conditions are not handled timely with a sense of awareness, they may lead to overall poor health. Based on Novaco (2001), “A useful concept in understanding commuting stress is ‘inter-domain transfer effects,’ whereby the psychological consequences of environmental conditions in one life domain (home, commuting, work, or recreation) transfer to another, either positively or negatively (Novaco et al. 1990, 1991).” It is almost safe to assume that gone are the days whereby employees would leave the office at 5pm, drive less than 30 minutes across town to attend evening university lectures and then proceed home to spend time with their families or do recreational activities.

Putting into consideration the above shifts in lifestyle changes, the world should begin to embrace this form of educational technology as a means to an end. Online MOOCs platforms, whether open source or within private domains aid in reducing stress levels obtained through modern day hectic lifestyles since the courses can be accessed from the comfort of an individual's residence, traffic, office or even at the airport. Students can make the best use of their time by reading, doing assignments or simply reflecting on knowledge shared while stuck in traffic. Most major MOOCs providers in the market have ‘Learn on the Go’ apps through which learners can access lessons, download videos, access forums and even take assignments. For instance edX has a learn on the go app available on Android and iPhone through which learners can access courses and download videos to watch offline.

Technical courses offered via MOOCs are a popular option for current and aspiring professionals

looking to get into the field. However, there is still a long way to go in order for MOOCs to be fully embraced within the tech corporate sector. Will tech based employers fully embrace the validity of MOOCs as being equal to knowledge acquired via traditional means? The *Critical Issues* section will address the main elephant in the room, *Employer Perceptions*, and the various ways in which technology companies and other stakeholders are navigating these critical issues.

### **Research Questions 2 and 3**

Based on the results, Coursera emerged as the top to-go-to platform for aspiring and present developers. Some of the world's best and respected universities such as Duke and Stanford are currently using Coursera to host their online courses. The platform is well curated and carefully audited to provide some of the best courses in the form of single courses, series and full degrees. The other platform which proved to be popular is edX, which is popular for business and project management oriented courses. However, several technical courses including full degrees at the bachelors and masters level are now among the course offerings. For instance, the University of Austin and Georgia Technical University offer full masters degrees in the fields of technology on edX at subsidized costs. Microsoft and other fortune 500 companies are also currently using edX to host their certification series for various professional courses. Due to the reasons stated above, the quality of courses offered is top-notch. Learners are not limited and have the flexibility to learn from several different platforms and resources such as videos, physical and virtual technical meetups.

Over the years, there have been several criticisms regarding the quality of some MOOC courses especially from smaller MOOC providers. Majority of providers have made some major strides in addressing concerns regarding quality. More of this topic will be discussed in the Critical Issues section under '*Course Quality*'.

### **Research Question 4**

Based on research question 4, 100% of the interviewees felt that Massive Open Online Courses have equipped them with the necessary technical skills to pursue or change their careers. As earlier highlighted above, getting a college education is getting more and more expensive and the period of time it takes to pursue the education is longer. As a result, more people are turning to

other creative solutions. Several MOOC platforms have implemented Micro-Masters programs whereby learners can take a series of graduate level courses within a set period of time (usually very flexible) from some of the top schools. A quick glance at the edX (2020) landing page for Micro-Masters programs states that

“MicroMasters programs are a series of graduate level courses from top universities designed to advance your career. They provide deep learning in a specific career field and are recognized by employers for their real job relevance. Students may apply to the university offering credit for the MicroMasters program certificate and, if accepted, can pursue an accelerated and less expensive Master’s Degree.”

These certificates can be used for accelerated career mobility especially within the field of technology. Based on the website, learners from these programs have either been accepted or are currently working in leading technology and consulting companies such as IBM, PWC, GE and many more. The list of companies keeps growing and growing as more and more companies become receptive to MOOCs. Upon successful completion of the program and payment of fees, students receive a graduate level certificate issued directly by the school. Learners also have the option of pursuing a full blown masters degree if they desire. This model is much cheaper, flexible for learners and allows students to practice self-directed learning. Another major advantage of this model of learning is that students can select the targeted skills which they need to pursue e.g. Java, Kotlin, Python etc based on their learning needs and career outlook. For instance, a Software Tester looking to break into Software Development can make intentional decisions on which programming language they need to learn and proceed to pursue the certification. A full blown degree program with a set curriculum does not offer learners this level of flexibility.

In a research study published on edX to uncover whether MOOCs can truly boost your career (Wan, 2015), Daphne Collier who is Coursera’s co-founder revealed the results of a longitudinal study jointly conducted by University of Washington and University of Pennsylvania which revealed that “Overall, 72 percent of respondents reported career benefits, and 61 percent said they enjoyed educational gains.” The target group was first requested to identify either under career builders looking for acceleration and pay rises or learned looking for academic credit.

More than half of the sample group were looking towards building their careers. Most technology professionals pursue MOOCs with this intent.

However, is this the same reality for technology professionals or aspiring technologists based in primarily rural areas and developing countries? Inequality of resources is a major threat to literacy and MOOCs advancement within the technology sector. In the next subsection *Critical Issues of MOOCs*, I will address this threat and the various ways in which to navigate internet inequality and make MOOCs accessible to all present and aspiring technology professionals. Based on the survey results from the 4 questions further backed up by data from secondary sources, it is quite evident that MOOCs are now a popular way to gain new skills and professional mobility within the IT corporate sector. From the research, we have also examined some of the top MOOC platforms and the quality of courses offered. However, there are still a lot of threats and weaknesses which need to be addressed in order for MOOCs to thrive and be the frontier lead in online learning. As any new innovation particularly in the field of technology, MOOCs are not exempt from various challenges ranging from regulatory, to legal and ethical issues in nature. Over the years, critics of Massive Open Online Courses have conducted public criticism campaigns highlighting various issues surrounding the credibility of courses, quality of courses, accreditation, employer perceptions and many more.

### **4.3 Discussion I: Critical Issues of MOOCs**

In his Guidelines for Interpreting Critical Issues report (Verveka, 2020) defines critical issues as “topics that deal with resource problems and their need for solutions that relate to the safety of the visitor at the resource site or relate to resource protection and management issues” In this context, these critical issues are crucial and will determine the survival or failure of the phenomenon at hand. The critical issues segment of this paper will address various infrastructure and credibility issues which will answer questions such as ‘Will the corporate sector fully embrace the validity of MOOCs as being equal to knowledge acquired via brick and mortar institutions? What are employers' perceptions towards MOOCs? Are the courses offered quality?

#### **I. Employer Perceptions of MOOCs**

Majority of MOOCs platforms users are made up of adult learners who are either taking courses



to learn a new skill, change careers or gain professional acceleration. With the rising costs associated with obtaining a college education, re-enrolling for a second degree or an advanced degree is not a suitable option for the majority of people. Kerr and Powel (2019) published the average costs of getting a US bachelor's degree in the US News Education portal. Public In-State students paid an average of \$10,116/yr, out of state students paid an average of \$22,577 while private university students paid an average of \$36,801. Most students graduate with high amounts of college loans meaning that pursuing further studies in a university would result in more debt. Therefore, the majority of professionals opt for short affordable courses via MOOC platforms. However, how do employers in both the private and public sectors perceive MOOCs?

Massive Open Online Courses are a fairly new concept and not all sectors have embraced the MOOC train. In most countries, the government sector is usually preceded by the private sector in terms of adapting to new technological innovations. For instance, most government, state and N.G.O jobs follow very conservative and stringent policies when it comes to recruitment processes. It is very unlikely that a government or county job ad that specifies that prospective applicants should hold a Bachelor's degree in either Economics or Political Science, will compromise and take a business graduate who holds an 8 weeks Political Science Certification from an online course. Most public service and non governmental organizations (NGO) job adverts will rarely compromise on their requirements to accommodate applicants who may not meet requirements but exhibit potential. Non-governmental organizations such as the United Nations (UN) have hiring platforms designed to automatically weed out candidates who do not hold masters' degrees for level P4 and above positions. Academic degrees are mandatory for job applicants.

However, the private sector is more flexible and open when it comes to its recruitment practices, especially for digital roles. CNBC journalist Connley (2018) highlighted 14 major corporations which no longer require job candidates to hold an academic degree. The strength of a job application is determined by past experience and skills. IBM's Vice President of Talent, Joanna Daley verified that about 15% of IBM's employees based in the USA were not 4 year degree holders. In her words "... instead of looking exclusively at candidates who went to college, IBM

now looks at candidates who have hands-on experience via a coding boot camp or an industry-related vocational class.” This new approach has been adapted by several fortune 500 companies with solid reputations such as Google, Microsoft and Publix. A college degree is no longer viewed as a standard of competence or a reflection of a candidate's productivity. Talent development workforce in these companies are well aware that a huge number of college degrees fall short when it comes to practical skills. For instance, in a standard Bachelor of Computer Information Systems course, students typically take 2-3 programming classes. While the rest of the other courses focus on other IT components such as cyber-security and IT project management. For any aspiring student who desires to enter into the field of programming, these 2 to 3 courses will not be sufficient for any entry level role. Most students end up taking online MOOCs or enroll for coding bootcamps to supplement the knowledge acquired via the degree. Mayyina (2016) of StackOverflow Tech blog published a developer survey study which revealed that “56% of developers in fact do not have a college degree in computer science or related fields. The most popular way for developers to learn is by “self-teaching” in some way (69% of respondents told us they were at least partially self-taught; 13% said they were *entirely* self-taught).” We can therefore safely conclude that MOOCs bridge that skills gap and more and more companies are discovering this.

Even though most employers within the digital sector have been receptive to MOOCs, other sectors are yet to catch up with the trend or are slowly catching up. With the current rapid shifts in digitalization especially post *Covid-19*, the outlook 3 to 5 years from now is certainly bound to be much better.

## **II. Course Quality**

The course quality of MOOCs is highly critical as it affects course completion rates, course perceptions, reputation and the overall learning experience of students. “Two main factors influence how we might assess the quality of a MOOC: purpose and perspective. By purpose we mean the reason(s) the MOOC has been developed and facilitated. By perspective we mean who is measuring the quality.” (Commonwealth of Learning, 2016, p. 4). As of present, there is no clear accreditation body that handles the accreditation and course quality of MOOCs. In fact the

majority of MOOC platforms/Online Learning platforms usually allow individuals who are experts in their field to create, host and sell courses through their platforms. However, how do the platforms determine whether an individual is an expert in his/her field (Job Title, Professorship Status etc)? Does it mean that if one is an expert in their field, that they have the required instructional design skills to create quality courses? There are 3 stakeholders at play here, the course instructors, MOOC companies and the learners. What makes the quality analysis process a little more complex is that course takers are usually not necessarily within the same academic level, what may be quality to one is not necessarily quality for another learner and all learners have different goals. Some academic, some professional and some for purely personal development. The learners perception of course quality may be different based on the above and several other factors.

As an online course enthusiast, (Morrisson, 2013) was very excited to take a 'Fundamentals of Online Education' course on Coursera. As she narrates, the course began on a Monday and so did all the problems. From technical glitches which made some course content unavailable due to delays, vague assignment instructions, collaboration issues due to different time zones and communication issues. For instance, in the assignment message board, the instructor wrote'' *To gain a deeper understanding and perspective on the topic, I recommend you participate in a discussion with several of your peers. Given the large group, we suggest students form smaller groups*'' . This is a very vague instruction for a course, provided that there are learners from different academic backgrounds, levels and parts of the world. Alternatively, the professor could specify the required minimum per group based on the total number of course participants so that all students can be paired up, e.g. maximum of 4 students if the course has 16 participants.

Secondly, the students were to do this through a mutual Google Sheets document. However, it seems that some student(s) who may not have been proficient with the platform, deleted entire rows and columns, moved users and eventually, users would get a Google Server Error, due to multiple people trying to access the document at the same time. This all happened due to terrible course planning which failed to identify the possible risks and set up appropriate measures. Eventually, the platform temporarily suspended the course (but later restored) due to multiple

complaints from students. The above and many other stories expose the dark side of online courses. Personally, I have been very excited to take a few online courses, but quit midway due to completely unengaging and poorly designed courses.

On the bright side, most MOOC providers have recently made major strides to improve course quality. A lot of the major MOOC providers such as edX, Coursera, Udacity, Code Academy and many more have internal course auditors, instructional designers and online course specialists to ensure that courses are thoroughly audited for quality and properly designed before launch. Taking a look at Coursera's website careers section, there are several jobs listed under course design, visual research, content editing and the like who specialize in designing and creating meaningful learning experiences for learners. Another thing that has contributed to improved course quality is that a huge number of courses now offered on MOOC platforms are offered by reputable universities e.g. Stanford University, University of Michigan, Harvard etc and reputable organizations such as Microsoft. Most often, these organizations have already audited course qualities before launch since poor reviews may affect the reputations of their institutions. Top professors in the field are also very conscious about maintaining a good reputation and would not risk the reputable damages of offering poor courses. We now have full degrees, diplomas and series certificates now being hosted on these platforms and their quality is the same as what you would find at any brick and mortar institution. The future is bright.

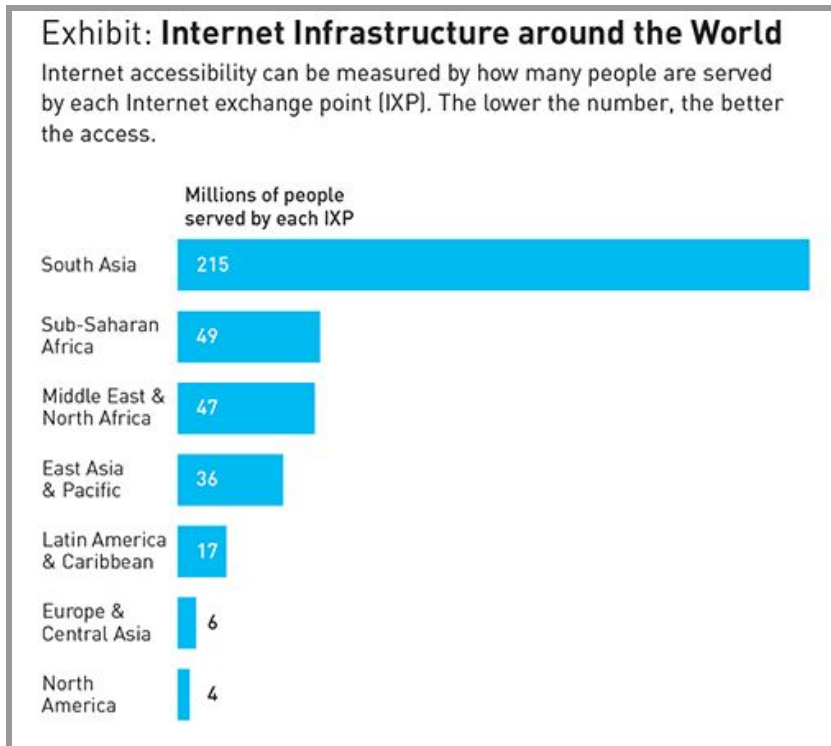
### **III. Poor Technical Infrastructure, a Threat to MOOC Literacy**

The lack of internet in several developing countries and rural areas (including those of developing countries) is a huge threat to digital inclusion and technology as a whole. A huge segment of the world population have been marginalized from technology due to poor internet access or lack of internet. Based on (Lally, 2018) report published in the Borgen Project Internet Access Project, "The average American spends nearly 24 hours a week on the internet, which is an increase of 250 percent from internet usage in the year 2000. In contrast, over 4 billion people in the world are without internet access. Out of this number, 20 countries account for 75 percent of the people without internet access." This is quite disheartening considering the fact that low earning populations have the potential to become one of the biggest consumers of Massive Open

Online Courses due to the low costs and low entry barrier policies. Populations which live on less than \$10/day have the capacity to save and acquire a MOOC certification as opposed to a university degree which costs thousands of dollars.

The current *Corona* crisis has exposed the inequality gaps in education. With the closure of schools and institutions of higher learning, most students have been forced to virtually learn from home via Zoom and other Learning Management Systems (LMS) such as Moodle, Blackboard etc. However, for a large number of students in developing and rural communities, learning has completely come to a halt. Most of these students lack internet and hardware e.g. laptops, tablets, to learn from home.

The below diagram, retrieved from Strategy Business (Darwiche, Herzog and Samad, 2016) is an exhibit of the Internet Infrastructure in the world. It was originally published by the International Telecommunications Union. Based on the below diagram, we can see the number of people served by each Internet Exchange Point (IXP). For instance, in North America, a single IXP serves a population of 4 million people whereas in South Asia, one IXP serves 215 million people. The fewer the number of people served, the much better the internet connectivity. The South Asia areas with higher IXP numbers suffer from poor internet connectivity. The same for the Carribean, Africa and the Latin American regions. This in turn affects online learning activities. Learners are unable to access online courses or any other form of online learning.



**Figure 6**

Several organizations within the development, advocacy and internet access rights sectors are tirelessly working to bring internet equality into the world, with the most focus being on developing countries. Some of those organizations include Dot Connect Africa, World Internet Freedom and the Digital Advocacy Center. Governments and local authorities have also joined the fight to boost internet connectivity in these countries by collaborating with telecommunication providers to establish more data centers. Access to the internet will empower communities to achieve education which is one of the key tools of poverty eradication and development. If these marginalized communities can access the internet, they can access online courses in technology, the digital arts, modern technology agriculture and many more, which can in turn help them to access job opportunities, transition into the technology field, gain entrepreneurship skills and many other practical skills essential for thriving within the digital economy.

## 5. Study II

### 5.1 Overview of the Results (Interview II)

The posed question to three of the developers was “**What tactics do you use to self regulate**

**yourself within a MOOC or online learning environment’’. As earlier mentioned, the verbatims have been slightly adjusted in order to reflect the most relevant information, meaning that only the relevant verbatims have been extracted . The below are verbatims obtained from each interviewee.**

**Software Developer 1:** When signing up for any MOOC course, I also immediately pay for the certificate. The fact that I spent money, keeps me motivated to finish the course.

**Software Developer 2:** As a previous hotel management professional, I was eagerly looking to switch from the field and get into software development. I hated my job and the thought of staying longer was quite unbearable. This kept me motivated to take my online courses and learning journey seriously.

**Software Developer 3:** I am a junior front end developer currently learning .NET and Java language frameworks because I strongly believe that developers with these set of skills are more marketable and have better paying opportunities available.

## **5.2 Analysis and Discussions of the Results (Discussion II)**

Based on the research results, the below three reasons emerged as the key drivers for self regulating among online learners.

- I. Financial expenditure
- II. Motivation to change careers
- III. Sharpening of skills for career mobility

The highlighted reasons for self regulating among the 3 interviewees seem to have a common denominator which is, Extrinsic Motivation. This can be defined as ‘‘an external factor pushing you to do something in hopes of earning a reward -- or avoiding a less-than-positive outcome.’’ (Bernazzani, 2017). From the responses, it is quite evident that reluctance to loss of income, hatred for a job and desire for a promotion are the main reasons which motivate(d) the interviewees to take their MOOC courses seriously and complete the courses.

Another common denominator among the received responses is the existence of a professional goal. These goals helped the interviewed developers to self-regulate. A lot of research studies have shown that learners with the intention to obtain a credential for professional purposes had higher completion rates than those who merely took courses for self-fulfillment or non-academic knowledge. There are several studies that have been previously conducted to highlight this. In addition, a lot of secondary research data from various sources have been incorporated into the below descriptions to draw various parallels between the findings. I will briefly expound on the 3 key self-regulating factors mentioned above and also address the threats or critical issues of self-regulation such as low completion rates.

### **(i) Financial Expenditure**

In Lederman's (2019) study of Why MOOCs Didn't Work published by the Inside Higher Education website, one key observation mentioned from the study is ‘‘..One of the big knocks against MOOCs since their beginning was the low rate at which students completed the courses, even as defenders pointed out that many students took MOOCs for knowledge or edification, rather than for a credential’’. Learners were more likely to gradually fizzle out of courses if they lacked a professional or academic motivation. The second article by Greta (2019) published by The University of Michigan's Record News website, highlighted studies which revealed that MOOC learners tend to be very motivated and 10% more likely to successfully finish courses whenever a course offers certificates of completion for a fee. The research used data from more than 70 courses offered by a public university on the MOOC platform Coursera. Based on data from 2012 to 2016, the researchers found out that ‘‘the engagement and course completion statistics are much better for paid users who receive a certificate upon completing the course.’’ Supporting the verbatim by developer 1, it can safely be assumed that learners who invest money towards MOOCs certification are much more likely to outlast learners who take courses for free.

The social-economic backgrounds of individuals play a huge role on whether they decide to pursue the paid certificate or the free option. Depending on course popularity or prestige rankings of the university offering the course, most courses typically offer certificates starting at a low of \$29.99 and a high of \$599 for consecutive course bundles. While \$29.99 may be a



decent offer for most learners based in the western/developed world, this may not particularly be a reality for learners based in developing countries. For instance \$29.99 converted to my native country's currency is 3000 shillings which is quite a substantial amount of money to about 30% of the population which lives on less than a dollar a day. Due to the financial weight, a learner based in a developing country would be much less likely to abandon a course they have financially invested in. Based on an article featured in University World News (2016), several research studies conducted by the University of Washington across Colombia, Philippines and South Africa were carried out to prove that developing countries have higher MOOC completion rates. One key observation - "Many people assumed that in developing countries, MOOCs would only be used by the rich and well-educated," said lead researcher Maria Garrido, research assistant professor at TASCHA. "We were excited to find that this is not the case. Many users come from low- and middle-income backgrounds with varying levels of education and technology skills." This was despite financial challenges, poor internet connectivity and other infrastructural challenges.

**(ii) Motivation to Change Careers and (iii) Sharpening of Skills for Career Mobility**

The number of professionals who desire to switch careers for various reasons has significantly increased over the years. Technological revolution has emerged several digital careers e.g. Social Media Managers, 3D Printing Experts etc, which did not previously exist 10 or 15 years ago. With the skyrocketing prices and longer time periods invested in pursuing higher education, most career changers opt to pursue new skills via MOOC certifications. For instance, a Bachelor of Arts in History graduate who plans to switch to a Digital Marketing based role, can pursue digital certificates such as the 8 weeks Digital Marketing Certificate offered by the Digital Marketing Institute (DMI) rather than re-enrolling into a university to take a Bachelors in Marketing. Majority of MOOC courses have very targeted curriculums which fully immerse learners into the practicalities of a topic. With continuous practice, most learners master the desired skills within short periods of time. In fact for skills such as programming and data analytics, the possibility of learners gaining a much better understanding of course content is much higher than if they pursued the skills via universities which place heavy emphasis on theory. Switching careers is definitely not an overnight process and is dependent on several

factors but the 3 interviewed developers are proof that MOOCs are a vehicle through which learners can use to change or accelerate their careers.

MOOCs are also a great tool to facilitate intra-company transfers. Intracompany transfers occur whenever employees change positions within one company. Most companies have internal support programs or structures to support employees who desire to transfer their skills within the company. It is much cheaper for the company as it saves the downtime which would otherwise be spent hiring for replacement candidates and the employees are more familiar with company policies and culture. It is not uncommon to see a systems analysis department employee moving into the audit department after pursuing either a masters degree or some short courses.

Professional certifications often pursued via MOOC platforms such as the Project Management Professional (PMP) or Salesforce Architect can internally propel employees' careers and justify promotion requests.

### **5.2.1 MOOCs a Key Driver of Self-Regulation**

MOOCs or any form of online learning, often require a high level of self motivation and discipline from learners. Many learners often come face to face with the struggles of online learning such as difficulties with psychologically absorbing information within non-regulated environments, procrastination, poor or low collaboration, difficult tasks, demotivation, difficulty separating school and home life plus many more. Most successful online students have mastered the art of self-regulation in regards to their learning and the factors that impact their learning. Applying the proper self motivation and self regulation strategies are key to successfully thrive in any MOOC environment.

For instance, Youtube users Ellevlog and Osariemen Anne Omorogbe recently left comments under a viral TEDx video by Anant (2014) discussing why MOOCs are the future. Ellevlog went ahead to write,

‘‘I'm currently in university. I go to my classes and daydream while the professor talks, then I go home and try to teach myself the material. I don't have the attention span to sit and listen to someone lecture me. I think that moving towards a world where people can learn with a pause button is promising.’’

Omorogbe stated that, ‘‘Technology has really advanced learning especially for those with short attention spans. Big Ups Anant’’

Ellellevlog and Omorogbe highlight and represent a huge segment of modern day learners who remain unfavored by traditional classroom approaches. Educators have to confront the reality that not all learners within a classroom setting are at the same intellectual and psychological level and not all learners can self-regulate or self-direct at the same level. Online learning may be a great tool to accommodate students with learning difficulties such as ADHD, short attention spans and hyperactiveness.

The MOOC environment, if well utilized, is a great tool of equipping learners to self regulate. Learners are fully in charge of when, where and how they will accomplish tasks. The biggest challenge however is that these courses attract diverse types of learners with different study and behavioral characteristics. Various research studies have uncovered the correlation between various learner groups and course completion rates. Adult learners, who most often have already previously acquired some form of education (diploma, bachelors, masters etc) experience the highest completion rates. Most of this group of learners often take up MOOCs in order to switch careers, accelerate their careers, upgrade their skills or for other forms of professional development. The common denominator of these groups of learners is that they are fuelled by their motivation to accomplish often, very well defined goals.

### **5.2.2 Self-Regulation and MOOC Completion Rates**

This segment shall spotlight Course Completion Rates which are heavily influenced by self-regulating habits. When learners successfully self-regulate, course completion rates are high and when learners struggle to self-regulate, the opposite occurs and completion rates are dismal. If there is anything that threatens the advancement of MOOCs as an EdTech invention, it is the miserably *low completion rates*. (Murray, 2019) in his Financial Times Limited website article states the results of a study done by the Massachusetts Institute of Technology which highlights that ‘‘Online courses had an astronomical dropout rate of about 96 per cent on average over five years. The research, which studied people who both registered and viewed a course by MIT and

Harvard on their joint online learning platform, edX, also found that this figure had not improved between 2013-14 and 2017-18. A huge number of learners’. It seems that most prospective learners who enroll for MOOCs, are often overambitious and excited at the beginning, but the excitement gradually fades off as the learning progresses. However, we are going to examine some of the key reasons as to why a huge number of learners drop out of the courses and how this is influenced by the *intent or the key motivating factor* of the learners.

Most MOOC platforms give learners the privilege of accessing (commonly referred to as *Auditing*) course content without paying for a certificate. So what could be the reason for the miserably low completion rates? Some of the reasons are:

- A lot of learners struggle with self regulation and self directed learning, which are essential in order to succeed in any MOOC or online learning environment.
- Poorly designed course content which result in high course drop outs.
- Lack of engagement with course instructors and peers. Physical interaction with other learners may be key for certain categories of learners, particularly extroverts.
- Lack of a professional or academic goal i.e Taking courses for fun or knowledge
- Infrastructural challenges e.g. Poor internet connectivity especially in developing countries
- Due to lack of entry requirements, it may be difficult to gauge course competency levels. Some learners may find course content to be too advanced or too basic depending on their intellectual capabilities or academic level
- Poorly designed UI (User Interface) platforms which result in poor User Experience (UX) for users.

However, key stakeholders and executives in MOOC education have come out in defense of the dismally low completion rates. In an interview with the senior director of academics and research at edX Nancy, defends online MOOC courses by stating that ‘a better indicator of success is whether students who actually begin a course engage with it to a high degree’. She further asserts that ‘.. students can acquire knowledge and skills without formally finishing a course. “We don’t see completion rates being a goal,” she says. “People poke around to find parts of

courses that help them, not necessarily every module.” (Murray, 2019). Within the same report by (Murray, 2019), the senior director of Wharton School Online (University of Pennsylvania) highlights the fact that there are a lot of learners who may sign up for courses out of curiosity or just to access specific information but not with any intention to complete the course.

It seems that part of the reason why MOOCs are perceived to have a low success rate is the erroneous research studies and data interpretation by critics of online learning. Low completion rates are not accurate indicators of whether a course is successful or unsuccessful. Could it be that some of the learners felt that they obtained the necessary knowledge/achieved their goal before the course was over, or could not afford to purchase completion certificates, or the research studies are carried out by MOOC critics and are biased, plus many more reasons. There are too many disparities and factors which have to be taken into consideration when interpreting research data.

However, a lot of online learning platforms have become more intentional with their content and have acquired the services of curriculum designers and instructional design experts to innovate meaningful and scalable course content. These providers have the hope that the aesthetic experience offered by these courses will boost self-regulation among end users and hopefully translate to higher completion rates.

### **5.2.3 Goal Setting In Self Regulation**

A goal is the main pillar for any intrinsic human motivation and a necessary requirement for self regulation. In fact, goal-setting is the main component of self regulation as it affects task performance. In her research study of the relationship between goals and self regulation in learning, Gonzalez (2013) states that ‘‘ In order to self-regulate their learning, students need to use different strategies to plan, monitor, and evaluate their learning activities (meta-cognitive strategies), as well as to control their motivation and emotion (volitional strategies). Students’ effectiveness in their self-regulated learning process also varies depending on the academic environment and students’ personal goal orientations’’. When learners lack a clearly defined goal within any MOOC environment, demotivation is most likely able to take precedence over learning eventually resulting in abandonment and non completion of courses. Some decent

examples of goals can be:

- Morning people can set aside at least 1hr e.g. 7am - 8am, thrice a week to focus on completing a MOOC course.
- Busy working professionals who feel overwhelmed by professional and family responsibilities can set apart an uninterrupted 3 hours on a weekend morning to concentrate on courses.
- Creating a certification roadmap or vision board at the beginning of the year e.g. To gain a PMP and Digital Marketing Certification by end of 2020

### **6. Why MOOCs are the Future of Education: Quick Glance at the *Covid-19* Crisis**

The world is currently going through one of the biggest crisis situations ever witnessed within the 21st century. COVID-19, otherwise known as the *Corona Virus*, has caused disruptions in global economies due to the closure of major institutions such as schools, churches, businesses, organizations, airports etc, and changed the way human beings interact with each other. Due to efforts to contain the virus, schools and institutions of higher learning in most nations have temporarily discontinued traditional classroom learning in efforts to control the spread of the virus. Even though this may be a temporary catastrophe, the closures have forced educators and governments to rethink their digital education strategies and how they approach online learning. Several schools in developing countries which lack the financial resources to implement learning management systems are currently experiencing difficulties in supporting learning activities. Some students lack internet connectivity and hardware to support remote learning. This will force legislators and governments to restructure and re-align their educational policies in order to accommodate digital learning.

If anything, this crisis has exposed the digital divide that exists in the academic sector and is a wake up call to schools and institutions of higher learning to embrace massive open online courses platforms. The famous MOOC platform edX, currently hosts masters, bachelors degrees and university preparatory programs from some of the top universities from around the world such as Purdue, University of Texas at Austin, Curtin University and many more. Learners can login to the platform and access their respective university systems which have been synchronized to edX. Even with the current disruption, students enrolled via MOOC platforms

can continue to pursue their courses without disruption. I foresee a future whereby high school and middle school courses will be hosted on MOOC platforms. Quartz (2020), reported that between January and February, the peaks of the crisis in Asia, Coursera reported a 47% enrollment hike in China and HongKong while Vietnam saw a 30% increase.

Earlier in February, Class Central published an interesting article by Ma and Rindlisbacher (2020) which details how Chinese schools have now turned to MOOCs. Following the closure of schools due to the outbreak, many schools filed for either bankruptcy or were forced to transfer all learning to digital platforms. Establishments such as IT XDL (13 years old) and Mingxi (2016) did not have digital systems already set in place to migrate learners, so closure meant loss of business leading to bankruptcy. However, companies such as Squirrel AI were able to migrate their content to online platforms. Based on the article ‘‘On February 7, 2020, the Ministry of Education (MOE) issued instructions on the deployment of Higher Education Institution online teaching to enable students to resume their studies remotely, providing 24,000 online courses from more than 20 online platforms free of charge’’. Most universities in China will resume learning in the spring semester, but this will all happen online in the form of MOOCs, SPOCs and other forms of digital learning.

Most major MOOC providers such as edX, Udemy and Coursera have reduced course fees and created flexible structures to accommodate institutions of higher learning that want to digitally host their content during the crisis. Some of the notable waivers include:

- Coursera has temporarily waived fees for universities that use Coursera for Campus, to substitute their learning content. Universities in high crisis areas automatically qualified to access all 3800 courses free. Quartz (2012)
- A lot of MOOC providers have expanded their catalogues to accommodate additional schools that need to host their classes through their platforms
- Most courses on MOOC platforms are now selling at almost half price.

The crisis may be temporary, but the effects of the crisis especially in the education sector will forever shift the way we individuals and institutions alike approach learning.

## 7. Recommendations for Further Research

Due to time constraints and the current Covid-19 crisis, the number of research questions was less than previously planned, the target group size was much smaller which somewhat limited the scope of my research. My recommendations for further research would be:

- Larger target group size e.g 15 people, for more accurate predictions and identification of trends
- Diversification of the target group to include other digital professionals e.g. Data Scientists, IT Project Managers, Software Testers etc
- Inclusion of more targeted questions e.g. What programming languages likely to be taught online, availability of online resources to learn certain skills
- Delve more and explore descriptive statistics
- Monitoring of time periods used to master various technical skills via MOOCs e.g. 6 months
- Use of more sophisticated data analysis methods e.g. Coding
- Use of data visualization tools e.g. Tableau

## 8. Conclusion

The previous topics explored in this article have taken readers through an exploratory journey of the Strengths Weaknesses, Opportunities and Threats (SWOT) of MOOCs as a form of Educational Technology. Investopedia defines a SWOT Analysis as “a framework used to evaluate a company's competitive position and to develop strategic planning. SWOT analysis assesses internal and external factors, as well as current and future potential.” (Grant M., & Scott G., 2020).

The digital shift is here with us and is rapidly shifting the way we relate, work and learn. During this *Covid 19* era, Facebook Inc, Twitter Inc among many other technology companies have recently provided their staff with the opportunity to work remotely up to 2021. Most of these companies have also announced plans to make at least 50% of all their global workforce remote in about 5-10 years. This implies that company training's, workshops and seminars will all migrate online. A lot of academic institutions are also crafting and expanding their digital capacities. A lot of corporates are also now major stakeholders of MOOC courses. For instance,



edX currently offers courses from major corporates such as Microsoft, IBM, Amnesty International, Amazon and many more. The development sector is not lagging behind. The United Nations now offers its MOOC courses via platforms such as Uunitar and Dss. These courses are for the most part free, open to the masses and can be done from anywhere. Further affirmed by research study one in this article, the majority of employees within the technology and digital sectors are heavily relying on MOOCs to gain new skills and gain career mobility. As the online learning space continues to evolve, there is absolutely no dispute that MOOCs are an absolute game changer and indeed the future of education especially within the technology sector.

### **Acknowledgements**

Special gratitude goes out to my target group for being very generous with their time, my fellow classmates from the class of 2020 for their support and company as we walked together through this journey and to my Thesis supervisor Emanuele Bardone who has been very supportive in reviewing my work and offering his generous expertise as needed.

### **Author's Declaration**

I hereby declare that I have written this thesis independently and that all contributions of other authors and supporters have been referenced. The thesis has been written in accordance with the requirements for graduation theses of the Institute of Education of the University of Tartu and is in compliance with good academic practices.

**Signature:** Esther Peninah Sumba

**Date:** 5.06.2020

## 10. References

- A Brief History of MOOCs.” *MAUT*, 16 Nov. 2015,  
[www.mcgill.ca/maut/current-issues/moocs/history](http://www.mcgill.ca/maut/current-issues/moocs/history)
- Adam, Taskeen. “The Future of MOOCs Must Be Decolonized - EdSurge News.” *EdSurge*, EdSurge, 28 May 2019,  
[www.edsurge.com/news/2019-01-03-the-future-of-moocs-must-be-decolonized](http://www.edsurge.com/news/2019-01-03-the-future-of-moocs-must-be-decolonized).
- Anderson, J., McDonnell, T., Moser, W., deHahn, P., Rohrlich, J., & Bindrim, K. (2020, March 13). Coronavirus: That's it, we're grounded - Need to Know: Coronavirus. Retrieved from <https://qz.com/emails/coronavirus/1818357/>
- Bernazzani, S. (2017, October 10). Intrinsic and Extrinsic Motivation: What's the Difference? Retrieved from <https://blog.hubspot.com/marketing/intrinsic-and-extrinsic-motivation>
- Bhattacharjee, A. (2012). *Social science research: principles, methods, and practices*. Tampa, FL: A. Bhattacharjee.
- Commonwealth of Learning (2016). Guidelines for Quality Assurance and Accreditation of MOOCs. COL. Retrieved from [http://oasis.col.org/bitstream/handle/11599/2362/2016\\_\\_Guidelines-QAA-MOOCs.pdf?sequence=6&isAllowed=y](http://oasis.col.org/bitstream/handle/11599/2362/2016__Guidelines-QAA-MOOCs.pdf?sequence=6&isAllowed=y)
- Connley, C. (2018, October 8). Google, Apple and 12 other companies that no longer require employees to have a college degree. Retrieved from <https://www.cnbc.com/2018/08/16/15-companies-that-no-longer-require-employees-to-have-a-college-degree.html>
- Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. London: Sage.
- Designing a Massive Open Online Course (MOOC). (n.d.). Retrieved from <https://www.uaces.org/resources/designing-a-massive-open-online-course-mooc>
- Ed Surge. Tony Wan, Sep 22, 2015  
<https://www.edsurge.com/news/2015-09-22-can-moocs-really-boost-your-career-findings-from-oursera-s-first-impact-report>
- El-Darwiche, B., Herzog, M., & Samad, R. A. (2016, May 31). Why Are 4 Billion People without the Internet? Retrieved from <https://www.strategy-business.com/article/Why-Are-4-Billion-People-without-the-Internet?gko=1ed7b>

- Ellelevlog (2014, January 27). Retrieved from <https://www.youtube.com/watch?v=rYwTA5RA9eU>
- González, M. L. (2013, January). Learning Goals and Strategies in the Self-regulation of Learning. *US-China Education Review*, 3(1), 46–50. Retrieved from <https://files.eric.ed.gov/fulltext/ED539959.pdf>
- Grant, Mitchell. “How SWOT (Strength, Weakness, Opportunity, and Threat) Analysis Works.” *Investopedia*, Investopedia, 2 Mar. 2020, [www.investopedia.com/terms/s/swot.asp](http://www.investopedia.com/terms/s/swot.asp).
- High MOOC completion rates in developing countries. (2016, April 15). Retrieved from <https://www.universityworldnews.com/post.php?story=20160414211758202>
- Krumrie, M. (n.d.). Do Employers Take Massive Open Online Courses Seriously? Retrieved April 7, 2020, from <https://www.ziprecruiter.com/blog/do-employers-take-massive-open-online-courses-seriously/>
- Kurt, S. (2018, November 10). Massive open online courses (MOOCs), Definitions. Retrieved from <https://educationaltechnology.net/massive-open-online-courses-moocs-definitions/>
- Lally, A. (2018, October 27). Internet Access in Developing Countries: A Tool for Sustainability. Retrieved from <https://borgenproject.org/internet-access-in-developing-countries-a-tool-for-sustainability/>
- Leckart, S. (2012, March 20). The Stanford Education Experiment Could Change Higher Learning Forever. Retrieved from [https://www.wired.com/2012/03/ff\\_aiclass/3/](https://www.wired.com/2012/03/ff_aiclass/3/)
- Ma, R., & Rindlisbacher, C. (2020, May 1). School's Out in China: Can MOOCs Fill the Gap Left by the Coronavirus? - Class Central. Retrieved from <https://www.classcentral.com/report/china-moocs-coronavirus/>
- Massive Open Online Course. (2020, May 11). In Wikipedia. [https://en.wikipedia.org/w/index.php?title=Massive\\_open\\_online\\_course&oldid=956036636](https://en.wikipedia.org/w/index.php?title=Massive_open_online_course&oldid=956036636)
- Mazzina, A. (2016, October 7). Do Developers Need College Degrees? Retrieved from <https://stackoverflow.blog/2016/10/07/do-developers-need-college-degrees/>
- MicroMasters® Programs.” *EdX*, 9 Oct. 2019, [www.edx.org/micromasters](http://www.edx.org/micromasters)
- Mora, S. L. (n.d.). MOOC (Massive Open Online Course). Retrieved from <http://desarrolloweb.dlsi.ua.es/moocs/what-is-a-mooc>

- Mora, S. L. (n.d.). MOOC (Massive Open Online Course). Retrieved from <http://desarrolloweb.dlsi.ua.es/moocs/brief-history-moocs>
- Morrison, D. (2014, October 8). How NOT to Design a MOOC: The Disaster at Coursera and How to Fix it. Retrieved from <https://onlinelearninginsights.wordpress.com/2013/02/01/how-not-to-design-a-mooc-the-disaster-at-coursera-and-how-to-fix-it/>
- Murray, S. (2019, March 4). Moocs struggle to lift rock-bottom completion rates. Retrieved from <https://www.ft.com/content/60e90be2-1a77-11e9-b191-175523b59d1d>
- (n.d.). Moocs and Distance Education. The Handbook of Research for Educational Technology and Communications. Retrieved from <http://members.aect.org/edtech/ed1/13/13-02.html>
- Nordmeyer, B., & Seidel, M. (2018, October 25). Types of Forecasting Methods. Retrieved from <https://bizfluent.com/info-8195437-types-forecasting-methods.html>
- Paul, J. (n.d.). Udemy vs Coursera? Which is better to learn Tech and Programming? Retrieved March 5, 2020, from <https://javarevisited.blogspot.com/2020/01/coursera-vs-udemy-which-is-better-for-programming-tech.html#axzz6G05mXWIL>
- Powell, F., & Kerr, E. (2019, September 9). See the Average College Tuition in 2019-2020. Retrieved from <https://www.usnews.com/education/best-colleges/paying-for-college/articles/paying-for-college-infographic>
- R.W Novaco (2017). Traffic Stress. Retrieved from <https://www.sciencedirect.com/topics/social-sciences/traffic-congestion>
- Shah, D. (2019, August 27). Class Central's Top 100 MOOCs of All Time (2019 edition) - Class Central. Retrieved from <https://www.classcentral.com/report/top-moocs-2019-edition/>
- Tracey, R. (2017, July 19). The Definition of a MOOC. Retrieved from <https://elearningindustry.com/the-definition-of-a-mooc>
- Veverka J. A. Guidelines for Interpreting Critical Issues. University of Freiberg. Retrieved May 2020, from [https://portal.uni-freiburg.de/interpreteurope/service/publications/recommended-publications/veverka-interpeting\\_critical\\_issues.pdf](https://portal.uni-freiburg.de/interpreteurope/service/publications/recommended-publications/veverka-interpeting_critical_issues.pdf)

Vulnerability Analysis for Transportation Networks (2017). Traffic Congestion. Retrieved from <https://www.sciencedirect.com/topics/social-sciences/traffic-congestion>

Willingham, A. J. (2019, August 22). Commuters waste an average of 54 hours a year stalled in traffic, study says. Retrieved from <https://edition.cnn.com/2019/08/22/us/traffic-commute-gridlock-transportation-study-trnd/index.html>

Non-exclusive licence to reproduce thesis and make thesis public

**I, Esther Peninah Sumba**

*(author's name)*

1. herewith grant the University of Tartu a free permit (non-exclusive licence) to reproduce, for the purpose of preservation, including for adding to the DSpace digital archives until the expiry of the term of copyright,

A Journey Through MOOCs (Massive Open Online Courses), the Future of Education for Both the Corporate and Academic Sectors.  
Special Focus on the Corporate Sector and the Field of Information Technology

*(title of thesis)*

supervised by

**Emanuele Bardone**

*(supervisor's name)*

2. I grant the University of Tartu a permit to make the work specified in p. 1 available to the public via the web environment of the University of Tartu, including via the DSpace digital archives, under the Creative Commons licence CC BY NC ND 3.0, which allows, by giving appropriate credit to the author, to reproduce, distribute the work and communicate it to the public, and prohibits the creation of derivative works and any commercial use of the work until the expiry of the term of copyright.

3. I am aware of the fact that the author retains the rights specified in p. 1 and 2.

4. I certify that granting the non-exclusive licence does not infringe other persons' intellectual property rights or rights arising from the personal data protection legislation.

**Esther Peninah Sumba**

**05/06/2020**