Universitat Ramon Llull

TESI DOCTORAL

Títol: Community of Inquiry (COI) and Self-Directed Learning (SDL) in Online Environments: An Exploratory, Correlational and Critical Analysis of MOOCs. Introduction to Cybersecurity MOOC case study

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[ABSTRACT]

The purpose of this mixed method research is to present an exploratory, correlational and critical analysis of MOOCs (Massive Open Online Courses) understood as COI (Community Of Inquiries) and uncover the role that SDL (Self Directed Learning) plays within the mentioned framework. The research combines quantitative and qualitative data and together with a current literature snapshot adds insights in the field of online education and its new content delivery forms. Our findings show statistical differences between students taking different number of quizzes and their level of SDL (p=0.003). We present demographic information and students views related with the three presences in the COI (social, cognitive and teaching presence). Experts' views on MOOC designs and value are also collected. Our final conclusion points out that MOOCs are different content deliver environments from traditional online courses and they shape a different COI and attract different students profiles. Design improvements are also suggested to empower students to become independent learners and improve alignment in the course. Marzano's taxonomy is the suggested pedagogical approach to improve MOOC design and students' satisfaction.

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I would like to thank all my fellow co-workers at Excelsior College in Albany, NY, for their support during my research, their good suggestions and encouragement. Specially, I would like to thank the effort and hours spent helping me to my friends Dr, Jennifer McVay-Dyche and Dr. Karl Lawrence, without their support I could not have finished this research.

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And to my family, because they have always believed in my success.

Barcelona, October 2015

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INTRODUCTION

#1

Chapter 1: Introduction

- **Abstract**
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1.1- Abstract

This chapter presents the introduction to the dissertation. Introduces the personal motivation for the research, and the research model we will be following. Main probing questions, knowledge gap, current similar researches, main goals of the investigation, introduction to the research methodology, and research questions and instruments are also presented.

Resumen

En este capítulo presentamos la introducción de la tesis doctoral. Introducimos los motivos personales relacionados con el estudio, y el modelo de investigación que vamos a seguir. Las preguntas generales del estudio, el marco general de la investigación, estudios similares, y los objetivos principales de la tesis, el método de investigación a seguir y las preguntas a examen, así cómo los instrumentos usados son introducidos en este capítulo.

1.2.- Dissertation purpose

The research model that we will follow for this dissertation is presented in Figure. 1.1. This model provides a simplified overview of the entire research steps. Our stating point is the identification of the gap of knowledge in the field that we would like to explore, our research questions that will help guide this process, our fieldwork and instruments selected, what results and responses to our questions are we able to provide and our contribution to knowledge with possible limitations and future recommendations.

This introductory chapter aims to provide an overall description of this process and introduce the next steps of the research.

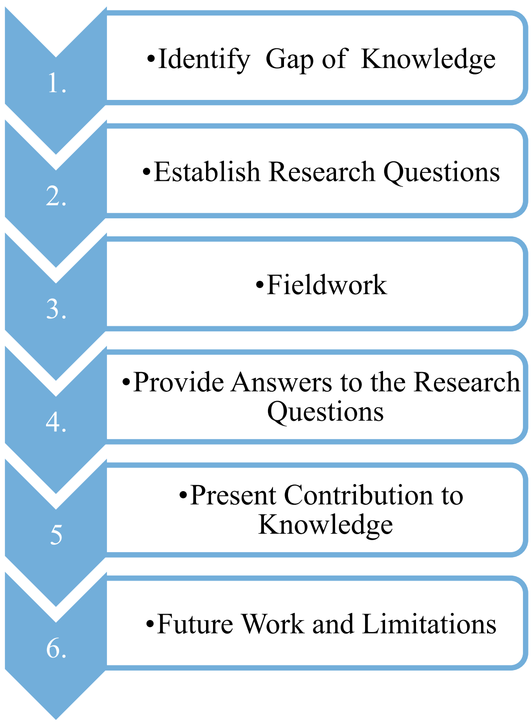

Figure 1.1. Bigger picture of research. Adapted from Leshem & Trafford, 2007)

1.3.- Motivation for the research

The following research work explores and explains my particular answer to the controversial relationship between MOOCs (Massive Open Online Courses)[1], completion rates, instructional design, and relationships with the main stakeholders.

My years as a Middle and High School teacher and adjunct faculty inspired and motivated my research. So much was happening around me: new gadgets were being developed, new games and applications were appearing almost every day, and as a natural result, technology slowly started to be a tool more frequently used in my classes, a common subject of my students' conversations, and a component of their personal relationships. The most frightening aspect, I must say, was to realize that my students weren't external to this revolution; they were participating, anticipating and creating demands for what was coming next.

I realized then that in order to move on and become more engaged with my students and their world, I had to become familiar with technology and all its constant development. I decided to pursue a master's degree in Education, Curriculum and Technology and complete it with a PhD dissertation with the idea of gaining a deeper understanding of the situation. What I didn´t know then was that this choice would lead me to change career paths and find my true passion. Having a Bachelor's degree in Physics gave me a very scientific background and vision, but soon, during my first years of teaching, I discovered that I was lacking an understanding of some important concepts: pedagogical

[1] We will refer to Massive Open Online Courses as MOOCs for the rest of the dissertation

methodologies, learning styles and taxonomies, competences, and personal goals and motivations, as well as how these key elements could enhance learning in different situations.

This is the central motivation of my dissertation: to humanize technologies and to explore how we could design and use applications to better serve learning and teaching.

It is my understanding that students need to be literate in technology as much as they need to know how to read, write, and communicate orally. It is our duty as instructors to offer guidance and help them to make their own decisions when they process information and use the numerous available devices. I believe that there is only one way of accomplishing these two goals: teachers need to act with confidence, and be flexible, mainly because of the volatility of our current situation, where new technology applications are spreading rapidly. My personal experience tells me that you only gain this confidence when you "feel" the subject, and it is then that you are able to transfer your passion and knowledge to your pupils. With my current research this is what I am trying to do … *feel* the subject matter, and add new insight to help improve our understanding of the current situation.

To explore and elaborate on this idea, we'll begin by examining some of the established literature on the topic. We are all familiar with some authors who call our students "digital natives," (Prensky, 2001; Thomas, 2011) when the truth is that a vast majority are just "surface learners" who know how to send emails and navigate through the Web, but are not able to use the computer as a learning tool (Donche, De Maeyer, Coertjens, Van Daal, & Van Petegem, 2013). The authors state that surface learning occurs more frequently in online environments, where there is a heavy workload, less learner autonomy and higher teacher control; therefore, there is interest in designing better courses that empower learner autonomy with less teacher control and the same workload.

New forms of content delivery are appearing lately. Some are in the form of open online courses that challenge the way our students learn and force some necessary changes in the way instructors approach teaching and content. The environment becomes a key piece of the situation and shapes the results and prerequisites. This situation combines my two areas of focus, science and education, and represents one of my major concerns and the main point of this investigation: how can we better design MOOCs to increase student success and completion rates while exploring MOOC takers' independent learning skills and their motivation to enroll in a MOOC?

1.4.- Knowledge gap

The particular aspect of research that this study would like to examine relates MOOCs, their design, and the learner's approach to content within this environment. Our goal is to assess the present situation and be able to suggest new applications and designs.

MOOCs have become more popular and well known since the first one was offered in 2008 by the University of Manitoba. The term MOOC distinguishes a particular type of online course delivery; MOOCs are courses that are offered for free, online and on a large scale.

The instructional approach is different from a traditional face-to-face class, and even standard online courses. For example, no effective teaching time is allocated for the students; self-paced and independent learning are encouraged and used as teaching-learning methodologies (Haggard, 2013).

There are ongoing discussions and unanswered questions surrounding MOOCs effectiveness and appropriateness for higher education and in for-credit programs (Brinton, Chiang, Jain, Lam, Liu, & Wong, 2014). Their value and impact on learning is also questioned from pedagogical and curriculum design perspectives. Course completion rates are also a major concern within this learning environment, being around 20% on average.

Efforts to study and understand this new phenomenon are starting to appear, and different approaches and frameworks are beginning to be applied to MOOCs (Kop, Fournier, & Mak, 2011). In particular, our study will use the COI framework (Garrison, Anderson, & Archer, 2000) to investigate students' perceptions of teaching, social and cognitive presences. Other studies have already used this approach to research key elements in large online courses

(Swan & Ice, 2010), but it has not been applied particularly to MOOCs, nor used to gather data about all three presences in the same course. The COI[2] framework states that constructivist-learning experiences occur when three key components are present: teaching, cognitive and social presence. We will also introduce SDL[3] as a fundamental key piece within the COI, explore SDL's relation with the other presences, and see how SDL impacts students' success within MOOCs. We use the term "teaching presence" to define how the instructor is involved in the design and use of cognitive and social presence with the goal of facilitating learning (Anderson, Rourke, Garrison, & Archer, 2001). Similarly, "social presence" is the student's ability to present themselves to the group and interact with the other members (Rourke, Anderson, Garrison & Archer, 2001), and "cognitive presence" is the ability of participants to construct knowledge and interact with content through discourse and communication (Garrison, Anderson, & Archer, 2001). Our approach is to rigorously study all three key elements of this framework within the MOOC environment to see how SDL interacts with the different presences and what role each of them plays within the COI.

Now that we have established the research framework and introduced the concept of MOOCs, we would like to clarify three main i[2]deas related to the knowledge gap:

- How did we identify the present gap?
- Why do we think that it exists?

[2] We will refer to Community of Inquiry as COI for the rest of the dissertation

[3] We will refer to Self Directed Learning as SDL for the rest of the dissertation

- Why have no other researchers investigated this issue before?

By answering these three questions, we hope to show the uniqueness of the study

1.4.1 Identification of the present gap

I was first exposed to this new online content delivery during my work as the instructional designer for the first MOOC developed at Excelsior College, in Albany, NY. It was clear from the beginning that MOOCs offer possibilities for study and improvement. A holistic approach to this phenomenon seems to be the most appropriate, as the field is still very young. Only a few studies look at MOOCs from an all-inclusive perspective (Nkuyubwatsi, 2014), therefore more holistic research is suggested to further enhance our understanding of this new phenomenon.

We believe that the research we present in this dissertation will add new information to the research field and will help to understand MOOCs through the COI framework. This situation offers the possibility to better understand content delivery by studying the design taxonomy for this online course; in particular, Marzano's taxonomy will be explained and used for the MOOC design. The proposed framework also sparks the idea of exploring SDL competence in MOOC takers as a better approach to understanding the idea of presences within the online community.

Educational taxonomies are frameworks created to easily classify items measuring the same educational objective. Educational objectives are the final goals of the education process; they indicate the level of knowledge and understanding that students are expected to reach as a part of the learning process. Historically, there have been different proposals and approaches used in creating these taxonomies (Bloom, 1956; Simpson, 1966; Anderson & Sosniak, 1994; Marzano, 2001). Each of the taxonomies classifies the learning domains from simple to complex and from concrete ideas to abstract conceptions. Mastering the first levels of these classifications is a prerequisite to moving up and gaining understanding of more complex domains. Particularly, Marzano's taxonomy (2001) focuses on three domains from simple to complex: Cognitive, Metacognitive and Self. Within the Cognitive domain the students are able to retrieve, comprehend, analyze and use new learned concepts. Within the Metacognitive level, the students are able to set their own goals, monitor their own learning process, and track clarity and accuracy. Within the final domain, Self, the students are able to examine importance, efficacy, and their own emotional response and motivation.

Designing MOOCs under Marzano's educational taxonomy framework would target students' self-skills and facilitate their own independent learning. MOOCs involve a high degree of SDL skills and autodidaxy (Haggard, 2013), therefore a deeper study of this competency will provide insights about the relation between the taxonomy and the MOOC design. Our desire is to suggest the use of this taxonomy as a best practice for MOOC instructional design.

The concept of SDL is understood as the learner's ability to guide his or her own learning (Hartley & Bendixen, 2001) and includes different perspectives and models related with different authors (Song & Hill, 2007). It has been described as a goal, a process, a teaching method or a mere learner characteristic (Candy, 1991). It is also known as the Inquiry Method or Independent Learning (Knowles, 1975). Hiemstra (1994) argued that SDL does not mean learning in isolation, but instead having students set their own goals and be independent learners. SDL is also considered a lifelong inclination to learning and knowledge acquisition, meaning that a learner with this characteristic will continue to learn throughout his or her lifetime (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014). It is with this idea that we will explore SDL competence as a key element together with the other presences within MOOCs.

1.4.2.- Reasons for its existence

Research on open educational environments is still in its early years. The vast majority of research so far has originated from institutional reports that did not offer the methodological or statistical rigor needed to publish in peer-reviewed publications (Belanger & Thornton, 2013; McAuley, Stewart, Siemens, & Cormier, 2010), therefore rigorous research within the field is still increasing.

Research relating MOOCs with social and teaching presences needs to become more theoretical and offer new views within the online learning framework. The focus is now shifting because the concepts of communicating within small groups and peer-to-peer interaction are not applicable within these environments. Focusing on individual characteristics rather than group behaviors seems to be an ongoing topic of investigation, but it needs to be further explored to offer more rigorous data and analysis (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014). Relating MOOCs with SDL possibilities is just starting to emerge as a possible solution for MOOC takers (Fourier, Kop, & Durand, 2014). The teaching role within MOOC environments needs to be redefined, as the traditional online models don't fit the current instructor-student interactions in these courses (Garrison, Cleveland-Innes, & Fung, 2010).

Articles relating MOOCs, cognitive presence and design indicate that more research should be conducted to tie knowledge construction and personalized learning together. There is still a gap within this research that needs more evidence on how knowledge can be constructed with the help of instructional design. Marzano's taxonomy seems to be an appropriate framework to approach these issues (LeClair & Ferrer, 2014).

1.4.3.- Other similar research

There is increasing interest about the MOOC environment, and similar research is starting to take place. Some of it is related to possible pedagogical framework approaches to the phenomenon. We can find Andersen and Ponti (2014) suggesting a participatory pedagogy approach to MOOCs where students learn through informal networks and can co-create content. Some challenges arise due to the different expertise and background of the students. Online communities present in MOOCs appear to be the channel by which students become independent learners and shape their own participation.

Some current articles have started to challenge the idea of social presence as a pillar for a good learning experience; we aim to conduct a deeper study of this presence and create a better definition for the situation (Beaven, Hauck, Comas-Quinn, Lewis, & de los Arcos, 2014).

Two student characteristics, self-regulated learning and self-organization, had been explored to see if they enable students to be active agents in guiding their own learning within MOOCs (Irvine, Code, & Richards, 2013; Kop, 2011;

Waite, Mackness, Roberts, & Lovegrove, 2013). Particularly in Kop's (2011) article, we can see that students classify themselves as Self-Directed Learners even within discussion forums. The article concludes that for networked learning to be successful, students need to be able to direct their own learning, and more research in this area is recommended. Studies on students', teachers', and content roles within MOOCs are also raising the possibility that new literacy and pedagogy approaches might have to be explored (Stewart, 2013). Connectivism and exploration of learner experiences are trends within MOOC research (Tschofen & Mackness, 2012), and learner autonomy seems to be a variable that needs to be further explored.

Other researchers have presented results on students' retention rates and completion, time on tasks, frequency of access and use of resources showing that engagement seems to be lost after the first few weeks of a course (Seaton, Bergner, Chuang, Mitros, & Pritchard, 2014). We would like to expand on and explore this situation and add new data about student engagement and motivation when taking MOOCs.

To our knowledge, there has not been any effort towards designing MOOCs using Marzano's taxonomy; therefore our research should be a novel application of such a possibility.

While there are a high number of studies concerning MOOCs, we are not aware of any holistic research that studies MOOCs using the COI framework approach, exploring teaching, social and cognitive presences, incorporating Marzano's taxonomy research and guiding the discussion towards a SDL optimal path for students taking a MOOC. This situation leads us to present this thesis as a novel investigation that relates MOOCs, stakeholders and design.

Table 1.1 summarizes the current gaps in knowledge that we would like to further study:

Table 1.1
Knowledge gaps

• Relate MOOCs with social and teaching presence
• Explore individual traits instead of group behavior
• Teaching role redefined
• Relate knowledge construction with personalized learning and Marzano's taxonomy
• Better definition of social presence
• Exploration of learning experiences
• Add new data on students engagement and motivation

Now that we have established that there is a knowledge gap that we would like to investigate, we present the goals of our investigation.

1.5.- Purpose of the investigation

This investigation approaches learning with technology from an active point of view, where students learn by setting personal goals and directing their own learning. We will take a constructivist approach toward studying the MOOC within the COI framework (Garrison, Anderson, & Archer, 2000). We have designed two generic probing questions that will guide our investigation and will shape the research questions and the chosen instruments.

Our probing research questions deal with the role that SDL plays within the COI in MOOC environments and their designs (see Figure1.2). Particularly:

- Main probing research question: **What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?**
- Secondary probing research question: **Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?**

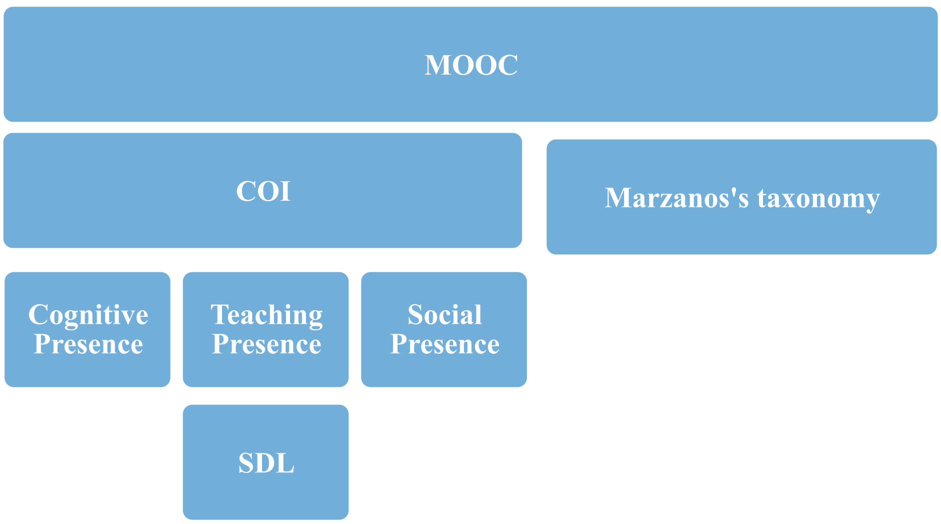

Figure 1.2. Depiction of the research.

Figure 1.2 shows a visual representation of our idea for the research framework. In this context MOOCs are understood as COI with an extra key element, SDL, besides the know presences, and where MOOC is designed following a particular learning taxonomy. With this idea in mind and to answer the probing questions, we will pursue a mixed method research approach and follow three main lines of investigation to address our central research goals, as follow:

First, we aim to understand MOOCs, MOOC takers, and their motivations to enroll in such courses. We are also interested in exploring how the students perceive the three presences within the COI framework.

Second, we will explore the possible cause and effect relationship between MOOC takers' independent learning styles (SDL) and their completion rate. Finally, we would like to reflect on real-life practice and promote changes by studying current MOOC instructional design and proposing improvements.

We believe that these lines of investigation will help us add new information related to our students' learning processes while enrolled in MOOCs, and will help deepen my understanding of the current educational situation and application of technology in online learning.

These are the main motivations and justifications that lead us to pursue our investigation**: "Community of Inquiry (COI) and Self-Directed Learning (SDL) in Online Environments: An Exploratory, Correlational and Critical Analysis of MOOCs. Introduction to Cybersecurity MOOC case study"**

1.5.1.- Research questions

The fundamental research purpose of this investigation is to explore MOOCs and MOOC stakeholders, and to present a holistic view by conducting an exploratory, correlational and critical analysis. The specific objectives of this investigation are:

- Describe current profiles of MOOC takers and depict MOOCs as COI spaces. (Exploratory analysis)
- Analyze the correlation between completing a MOOC and the degree of SDL readiness. (Correlational analysis)
- Analyze experts and MOOC takers' opinions on MOOC design and quality, identifying and assessing key factors (processes and practices) that could help to better design and deliver future MOOCs. (Critical analysis)

In order to reach these goals, we would like to articulate five main questions as the basis of our investigation (see Figure 1.3):

Exploratory analysis questions:

1a. What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC?

1b. How is the MOOC COI perceived and experienced by MOOC takers?

i. Cognitive presence

ii. Teaching presence

iii. Social presence

Correlational analysis question to further explore social presence:

2a. What is the SDL readiness levels of MOOC takers?

2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?

Critical analysis questions to further explore cognitive and teaching presences:

3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI?

3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?

Questions 1a and 1b are complemented by questions 2a and 2b to further explore social presence and by questions 3a and 3b to further explore cognitive and teaching presence:

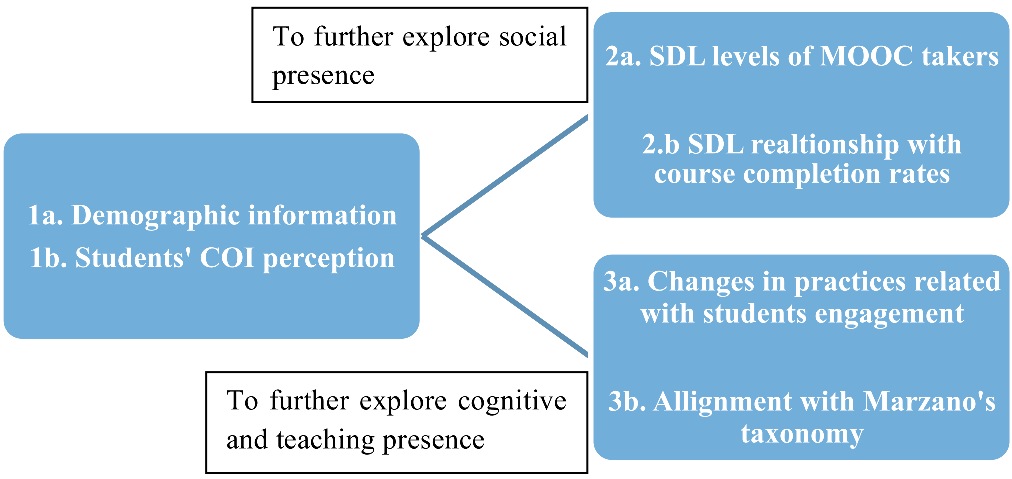

Figure 1.3. Main goals of the investigation.

In the following section we are going to briefly explain the methodology and instruments of the investigation, establishing the main theoretical framework.

1.6.- Methodology and description of the investigation

Now that our main study questions have been identified and defined, we would like to explain the paradigms that will act as the frame for our investigation. Since we propose to describe, analyze, and assess MOOCs, with the goal of identifying good practices related with SDL, Marzano's taxonomy and COI, the mixed method research best fits our purpose. The research questions have been designed under the "hybrid- multiparadigmatic" idea and all of them need both quantitative and qualitative data to be fully answered (Tashakkori & Creswell, 2007).

In Table 1.2, we have summarized our framework for this investigation. We have used Guba and Lincoln's (1994) paradigmatic viewpoint in qualitative research, Latorre's (2004) paradigmatic synthesis, and the mixed method research classification suggested more recently by Onwuegbuzie, Leech and Collins (2010), to create our own categorization.

Under the mixed method research paradigm we have chosen a questionnaire to measure SDL readiness of MOOC takers, which allows us to collect quantitative data. Our demographic and motivation questionnaire and COI survey will led to a qualitative study under an interpretative point of view, while the students' interviews and experts' focus groups will give us insight to be able to critically promote change and suggest new MOOC designs and best teaching-learning practices.

Table 1.2
Research Paradigms

Central Probing Research Questions:

1. What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?
2. Could MOOCs designed using Marzano's learning taxonomy empower student's SDL skills and make them more successful in these open environments?

Mixed Method Research			
	Interpretative Exploratory	**Positivist Explanatory**	**Critical Theory**
Characteristics	Understand and interpret reality	Explain reality and cause-effect relationships	Reflect on reality and promote change
Methodology	Qualitative study	Quantitative study	Action research
Methods/ Instruments	Instrument A: Demographic and motivation questionnaires for MOOC takes Instrument B: Community of Inquiry survey	SD Instrument: SDL readiness scale questionnaire	Instrument C: Focus group Instrument D: Student interviews
Participants	MOOC takers	MOOC takers	Instructors, instructional designer and faculty program director MOOC takers
Goals of the Investigation	Describe current profiles of MOOC takers and depict MOOCs as COI spaces	Analyze the correlation between completing a MOOC and the degree of SDL readiness	Analyze experts and MOOC takers' opinions on MOOC design and quality, identifying and assessing key factors, (processes and practices) which could help to better design and deliver future MOOCs
Research Questions	1a. What is the demographic information of MOOC takers and why are they motivated to take the MOOC? 1b. How is the MOOC COI perceived or experienced by MOOC takers? • Social presence • Teaching presence • Cognitive presence	2a. What is the SDL readiness levels of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?	3a.How can we change processes or practices that specifically facilitate student engagement in a MOOC COI? 3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?

This study involves the first MOOC offered by Excelsior College in Albany, NY: “Introduction to Cybersecurity.” This MOOC was first offered in January 2014 and then for a second time in September 2014. This class is an xMOOC, meaning that it consists of a fixed format and duration. The course has eight modules that are each one week in length. Each module has the same format, and is made up of video lectures from experts, module notes, a PowerPoint presentation, two discussions, a self-check interactivity and a quiz.

For this research, the Cybersecurity MOOC takers are our study sample, drawn from the entire population. In this situation we can work with two types of sampling: quantitative cluster sampling and qualitative sampling (Gay, Mills, & Airasian, 2006). We used quantitative cluster sampling when we selected the group of MOOC takers we wanted to investigate, instead of particular individuals. In this case our cluster is the MOOC, purposely selected from all the possible ones. We also used qualitative sampling when we selected individual students and experts to be our key informants and help us understand the phenomenon under investigation.

The research will follow the methodological sequence suggested by Perez-Serrano (1994):

1. Research context
2. Content structuration
3. Selection of the instruments
4. Assessment of the situation and suggested solutions

1. Research context: Involves collecting general information about the setting where our investigation will take place. In our study we will research the MOOC as our learning ecosystem.

2. Content structuration: Involves the identification of the knowledge gap that we would like to address, and the statement of the study questions. It also involves the elements that will be used to make decisions and the agents and conditions that will make the research successful. A panel of experts evaluated the instruments.

3. Selection of the instruments: Involves the methods of data recollection. As we mentioned before, reflecting our mixed method of research, we use five instruments, three of which we developed ourselves. The goal is to amass both quantitative and qualitative data.

- Instrument A: demographic and Motivation Questionnaire and Instrument B: COI Survey, target students' personal information and motivation to take the MOOC. They also give us information about students' perceptions of the learning community within the course.
- Instrument SD: The SDL Readiness Scale Questionnaire will provide information on the self-directedness levels of MOOC takers. Our goal is to compare the levels with completion rates and see if there is a direct or inverse relationship.
- Instruments C and D: experts' focus group and student interviews will give us information about the personal opinions of the main stakeholders involved in the creation and use of the course. Our main goal is to identify best practices and challenges, and suggest possible solutions and new designs (see Table 1.3).

Table 1.3
Instruments

Questions	Self -Developed Instruments	Instruments from Literature
1a. What is the demographic information of MOOC takers and why are they motivated to take the MOOC?	Instrument A: Demographic and Motivation Survey	
1b. How is the MOOC COI perceived and experienced by MOOC takers? • Social presence • Teaching presence • Cognitive presence		Instrument B: COI Survey
2a. What is the SDL readiness levels of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?		Instrument SD: SDL Scale Questionnaire
3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC Community of Inquiry?	Instrument C: Student interviews	
3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?	Instrument D: Focus group questionnaires	

4. Assessment of the situation and suggested solutions: Involves the analysis of the study and suggestions for the future. We try to connect the analysis of the literature with our personal framework and understanding of the situation and we compare our findings from this study with other current studies. This cross-verification of our findings with the conceptual framework will suggest future lines of investigation.

Visually we could represent this investigation as follows (Table 1.4). We have divided the investigation in two phases. Each of the phases and our choices will be explained in Chapter 3: Methodology

Table 1.4

Instruments and connection with research questions

	Probing Question 1 What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?	Probing Question 2 Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?
Research Questions	1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC? 1b. How is the MOOC COI perceived and experienced by MOOC takers? Cognitive presence Teaching presence Social presence 2a. What is the SDL readiness levels of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?	3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI? 3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?
Instruments	Phase II Instrument SD: Readiness Scale questionnaire Phase III Instrument A: Demographic and motivation information Instrument B: COI presences questionnaire	Phase III Instrument C: Student interviews Instrument D: Experts focus groups

After briefly reviewing the methodology and presenting the visual of this investigation, we will now introduce the general structure of the dissertation.

1.7.- Organization of the thesis

This thesis is organized in three main blocks: documentation, fieldwork, and analysis of findings. It is structured as follows:

- Documentation

In Chapter 2, we present a complete examination of the current situation in the form of a literature review. We review the COI framework for MOOCs, along with a brief history and a description of today's online environment. We also explore design taxonomies within MOOCs, particularly Marzano's learning taxonomy, as well as the SDL competence present in MOOC takers.

- Fieldwork

In Chapter 3, we present the fieldwork, methodology and data gathering. The goal is to start exploring some of the theoretical conclusions described in Chapter 2. Due to the characteristics of this investigation, we gather data to describe, analyze and assess the findings to provide answers to the study questions. We also descrive howthe MOOC was designed and implemented ad our study population.

- Analysis of findings

In Chapter 4, we present our findings for this study and all the data gathered. We introduce some preliminary conclusions and guide organize the data to be fully analyzed in the following chapter

In Chapter 5 we examine the answers to the research questions from the multiple viewpoints that characterize the research. We present the cross-verification of our findings with the framework and literature documentation.

In Chapter 6, we present the final general conclusions for the study, responses to probing questions, some unexpected results, and we will discuss the limitations of the present study and suggest future lines of investigation.

REVIEW OF LITERATURE

#2

Chapter 1: Introduction

Chapter 2: Review of Literature

- **Abstract**
- **Introduction**
- **The open educational movement: MOOCs**
- **Distance learning pedagogies**
- **cMOOCs and xMOOCs**
- **Learning Management Systems: MOOC platforms**
- **MOOC current research**
- **MOOC participants**
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- **MOOC designs: Bloom and Marzano's taxonomies**
- **MOOCs and SDL**
- **Research framework: COI in online environments**
- **Summary**

2.1.- Abstract

This chapter presents the literature review for the research. The main focus is to follow our theoretical framework: how COI takes form in a MOOC environment and what are the roles of each of the presences together with the course instructional design. Scholarly articles and other current studies had been explored and will give the foundation for our investigation

Resumen

Este capítulo presenta la revisión de la literatura relacionada con el estudio en cuestión. El objetivo principal es seguir nuestro marco teórico: qué forma toma la COI en los ambientes MOOC, y cuáles son los roles de cada una de las presencias, así cómo explorar el diseño pedagógico de el curso. Artículos de investigación y otros estudios recientes han sido analizados y nos dan la base para nuestra investigación.

2.2.- Introduction

This review of literature will provide a theoretical overview of current research, focusing on our selected framework to explain online COI, MOOCs, MOOC types, design matters, and MOOC taker's characteristics. The central questions we would like to investigate in this dissertation are:

1. How COI can be reached within MOOC environments,
2. What are the particularities of the three presences in a COI environment (teaching, cognitive and social)
3. How SDL relates and empowers the presences and
4. How can we design MOOCs to support learner experiences and sense of community.

Our investigation represents an application of a conventional research applied within a new field of investigation (Trafford & Leshem, 2008). By exploring what other authors have written about our research topic we aim to reflect on their conclusions and guide our own research towards new findings. We will also show how this review of literature draws our theoretical framework and shapes our decision regarding methodology and instruments. Our references will involve primary resources from well-known authors in the field as well as secondary resources that build up on primary research or that offer a different view or proposal. Supporting resources will be also used, as they provide complementary information on the topic or/and support findings. Current research in the field is summarized in the following table (Table 2.1), where the authors classified research focus in three main categories:

- Engagement, motivation and learning success.
- MOOC design and curriculum, and
- Self-regulated and social learning.

Quizzes, surveys, interviews, design based research and other instruments are used to collect data for the various studies, and the theoretical approach comprises a vast array of approaches: COI framework, social learning theory, adaptive learning design etc.

Table 2.1
Current research topics within MOOCs. Modified from (Gasevic, Kovanovic, Joksimovic & Siemens, 2014)

Category	Theoretical approach	Data	Instruments
Engagement, motivation and learning success	Flipped classroom Adaptive learning design Theory of planned behavior	Student demographic characteristics SAT scores Final grade scoring Course activity data Students performance data	Quizzes Pre, post tests Design –based research Surveys
MOOC design and curriculum	Community based learning COI framework Social theories Instructional design research	Case study data Assessment data Student active participation	Surveys Interviews Qualitative field work Post course surveys Open-ended questions Students background surveys

Category	Theoretical approach	Data	Instruments
Self- regulated and social learning	Self-directed online learning Social learning theory	Survey responses Course behavior data Discussion forum data	Critical discourse analysis Content analysis Empirical qualitative research

The authors of this data analysis research, Gasevic, Kovanovic, Joksimovic and Siemens (2014), state that social aspects within MOOCs have to be better studied. The massive scale and duration of these courses limits the type of social interactions that students can establish making these interactions less social becoming more utilitarian relationships (Garrison, Anderson & Archer, 1999; Garrison, 2011).

Teaching presence emerges as a key element for MOOC students to be able to establish a successful cognitive experience within these courses. Design should emphasize this presence by adding direct instruction, course facilitation strategies or other means for the instructor to be present within the course (Fischer, Kollar, Stegmann & Wecker, 2013; Garrison, Cleveland-Innes & Fung, 2010; Gasevic, Adesope, Joksimovic & Kovanovic, 2015). MOOC design should also incorporate elements that facilitate knowledge construction, authentic and personalized learning and elements to enhance student experience; there is still research within this aspect of MOOCs that could be pursued as well.

The idea of assigning roles to students and creating smaller communities to make interactions more doable it seems not applicable to MOOC environments. The main reason being the heterogeneous group of students we typically have in a MOOC, and their different particularities and knowledge levels (Anderson & Dron, 2011; De Wever, Keer, Schellens & Valcke, 2010). More research on how to create community within massive learning environments is encouraged as well.

The study of SDL competence in MOOC students is also an important concept. Having higher levels of metacognition and individual learning skills could help being successful in these environments, but the support system for this skills to develop and maintain is different in MOOCs than traditional online environments, (Abrami, Bernard, Bures, Borokhovski & Tamim, 2011). Therefore more research should be added in this field. There are still discussions around the place MOOCs should have within higher education, and what their evolution will be in the future is still being debated (Porter, Graham, Spring & Welch, 2014).

After establishing the current state of the research in the field as our baseline, we would like to present the outline for this literature review, (Fig. 2.1):

We will introduce the concept of MOOC environment and types, as well as main challenges and current research. We will relate MOOC settings with an appropriate instructional design approach by introducing Marzano’s taxonomy instead of Bloom’s and we will explore the idea of studying SDL within the COI in this open online environment. Finally we would like to show the relation of the COI presences plus SDL in student success when taking MOOCs.

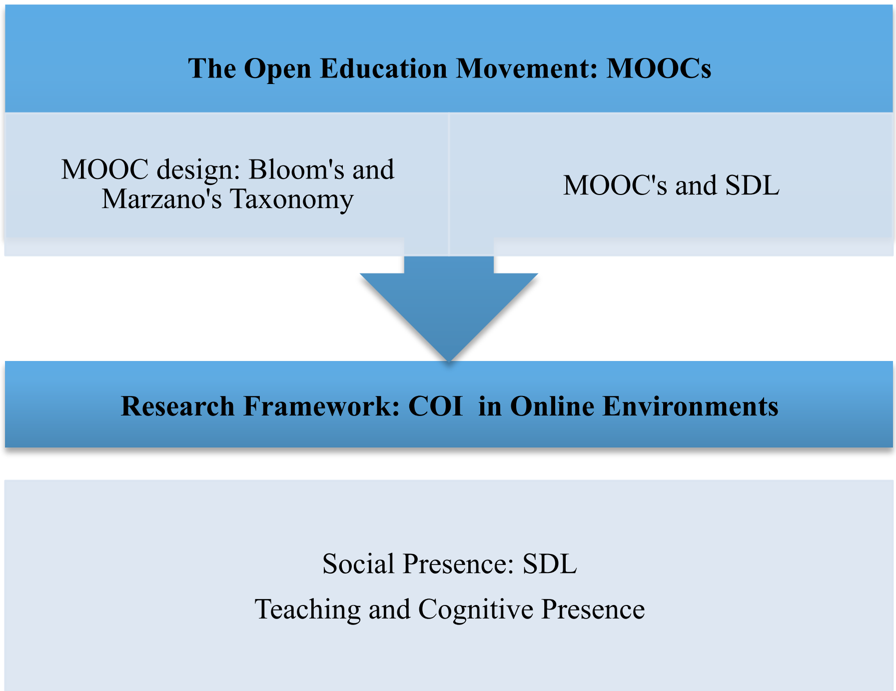

Figure. 2.1. Structure for the literature review

2.3.- Open education movement: MOOCs

Due to the novelty of this field, there are limited peer-reviewed researches on MOOCs; therefore experts recommend making connections to the better-known field of online learning (Kennedy, 2014).

Online learning in higher education has been well explored during the last 20 years and there is a vast body of scholarly research in eLearning, open education and independent learning environments (Adams, Yin, Vargas-Madriz & Mullen, 2014). However, MOOCs due to their open and high enrollment characteristics seem to be a different phenomenon on its own. Research is still exploring different existing online learning models and MOOC environments seem to be better explored as courses somehow related with traditional online learning, but also showing novel particularities (Breslow, Pritchard, DeBoer, Stump, Ho & Seaton, 2013).

MOOCs are Massive Open Online Courses, free of charge and open to the public. No prerequisites or other conditions are applied, making them appealing to adult learners with different backgrounds, interests and education levels. From a current research review (Kennedy, 2014), three main MOOC characteristics have been identified: openness, barriers to persistence and design models.

Firstly, “openness” relates to the usage of open technologies and software, open content, open access and open environment where participants share knowledge. Secondly, “barriers to persistence” refer to the problems students encounter while taking the courses that prevent them from completion. These barriers are related with technology expertise, English knowledge (if MOOC is offered in English), course structure, and time constraints (Rodriguez, 2012). Different student profiles, ages and backgrounds that lead to different learning objectives and motivations to take the MOOC are also important variables that affect course completion rates and persistency. More research within these areas is encouraged (Fidalgo-Blanco, Garcia-Peñalvo, Sein-Enchaluce 2013).

These authors hypothesize that the lack of homogeneity within students' backgrounds and level of education is a major component of the low completion rates. Designing activities and course content for very different consumers is a challenge for instructional designers and field experts that may have to be better explored. The mentioned research presented a proposal for a personalized learning program, presenting activities and resources to students grouped by similar background and education level, de-massifying the MOOC.

On the other side, there are authors that question the usefulness of measuring student success by looking at completion grades, mainly because of the initial openness and the difference in initial motivation levels (Alraimi, Zo & Ciganek, 2014). This thought opens the door to other ways of tracking and measuring student success.

Lastly, related with the third MOOC characteristic, "design models", there seems to be two main models within MOOC's: a connectivist model targeting lifelong learners (cMOOC) and another model applied to post-secondary education similar to traditional online courses. (xMOOC).

The first created MOOC (now classified as a cMOOC) is known to be Siemens and Downes' open online course offered in 2008 by the University of Manitoba in Canada. Besides having a 25-cohort group for the course, the professors opened their online class to everybody interested and for free. The conditions were that no credit was granted for the course, instead the focus was just in learning and in increasing the richness of connections, discussions and interactions among the students (Cormier and Siemens, 2010). As a result 2,300 students signed up for the course, and the MOOC phenomenon started. MOOCs of this type became known as cMOOC's, (connectivist) where interactions are a fundamental part of the learning process, and they are taught and designed under the connectivist learning theory.

Connectivist is one of the three known distance-learning pedagogies and together with the other two models (cognitive-behaviorist and social-constructivist) shapes our present understanding of online learning environments (Rodriguez, 2012). These three theories share the idea that knowledge a) resides within the individual and b) it is an entity by itself that can be created or modified by the learners (Siemens & Downes, 2005). These two characteristics are questioned within Web 2.0 learning environments, because of the un-ubiquity of knowledge and the multiple perspectives that make it more dynamic than before.

2.4.- Distance learning pedagogies

We are going to describe the three pedagogies that best fit online environments.We are not mentioning constructionism (Paper, 1980; Paper & Harel, 1991) because students are not constructing anything tangible or programming a language to obtain results like Paper suggested with his Logo studies. MOOC's are mainly for consumption of resources and students learn by accumulating knowledge.

2.4.1.- Connectivist pedagogy

Connectivist pedagogy proposes that learning occurs when autonomy, diversity, openness and interactivity happen. The students are able to remix and repurpose concepts towards the creation of new knowledge, while moving forward within the context of the course (Anderson and Dron, 2011). Autonomy provides the students with control over their learning outcomes and content selection and students are able to decide what is relevant and interesting for their own learning needs. Diversity refers to the variety of resources (people and content) and opinions that the student will be exposed to in this type of decentralized courses and information is presented in a variety of formats and fashions. Openness relates with the ease of use and access to information through diverse technology tools. Interactivity explains the connectivity with information and other students. This happens continuously and it is an ongoing process that builds community within the group.

This pedagogy approach appears to be a good way of designing an open online environment where students can repurpose some of the content and create meaningful ways of learning, but on the other side, it poses a challenging situation for instructors to manage and coordinate due to the size of the groups and the interactions between students, instructor and content. It is also challenging from a design standpoint, creating assignments that allow this type of freedom and ownership, poses some challenges as well (Rodriguez, 2012). Under this pedagogy learning communities are understood as nodes that unite individuals and content establishing a two way communication. This suggestion is in line with the idea that knowledge does not reside in one central location; on the contrary, it is a dynamic entity that students organize and filter.

Strengths and weaknesses of connectivist pedagogy

Abundant sources of information, not focused in one individual or a particular resource offers students different points of view and enriches course content. On the other hand it is a new way of learning for some students and they need to synthesize and use different technologies that might impair their focus on content. The course structure can also be loose and requires an extra effort form the facilitator to guide students through these type of approaches.

2.4.2.- Cognitivist-behaviorist pedagogy

Cognitivist-behaviorist pedagogy appears at the end of the 20th century, and it defines the action of learning as a change in behavior of an individual when responding to a stimuli (Anderson and Dron, 2011). This instructional design methodology was widely applied at the beginning of distance education history when teleconferencing was the only way to support distance learning. This methodology has its value when applied to situations of one-to-many or one-to–one communication, and it is usually teacher or instructionally designed.

Instructors, or the course design, guide students interactions including how they relate with each other and the content. This pedagogy applied to new environments such as MOOCs, establishes that learning objectives have to be clearly explained to help learners navigate through the content and reach clear understanding of the materials, in this sense the learning happens individually and it is student focused. This pedagogy is still being used today in xMOOC environments where content is the main focus of the design.

Strengths and weaknesses of cognitivist–behaviorist pedagogy

Courses that structure and deliver information under this pedagogy can adapt to a very large number of students, and adapt to scalability and low prices, but teaching presence is largely reduced and some of the social learning richness is also jeopardized.

2.4.3.- Social-constructivist pedagogy

Social–constructivist pedagogy derives from the work of Dewey (1916) and Vygotsky (1978) and views learning as a social task. Each learner constructs his/her understanding at the same time that interacts with instructor and other learners in the group (Anderson and Dron, 2011). Students gain new knowledge and build upon their pre-existing one to create new experiences; knowledge is gained individually but within a social environment.

Strengths and weaknesses of social-constructivist pedagogy

Online learning is based in communication, both synchronous and asynchronous, This pedagogy offers open learning for students and access to other means of content and social interaction, but it is very similar to traditional classrooms. Emphasizing communication adds pressure on technology and sometimes technology accessibility can be an issue.

A summary of the previously described distance learning pedagogies is provided in table 2.2.

Table 2.2
Distance Learning Pedagogies

Pedagogy	Strengths	Weaknesses	Type of MOOC
Connectivist	Different approaches to content and ways of delivering information Exposure to different ideas, points of view and resources	This way of delivering information can be difficult for some type of students Loose structure, needs structure Requires high instructor engagement	cMOOC
Cognitivist-behaviorist	Courses can adapt to very large number of students Adaptation to scalability and low prices	Teaching and social presences are low	xMOOCs
Social–constructivist	Similar to traditional f2f environments High emphasis on social presence	Technology accessibility is a key element	xMOOCs with an emphasis on community knowledge building

2.5.- CMOOCs and XMOOCs

Some currently offered MOOCs are most notably associated with the connectivist pedagogy, known as cMOOCs (cognitive-MOOCs) while the reminder are classified as xMOOCs (content-based MOOC's) (Schulze, 2014). xMOOCs align better with the cognitive-behaviorist or social constructivist pedagogies where the content and structure are fixed and defined by the content designer. The vast majority of MOOC's that are offered nowadays are xMOOC's.

The MOOC: Introduction to Cybersecurity, where this current research takes place fits this description as well. Therefore our research will be within the cognitive-behaviorist pedagogy approach. This approach suggests learning as an individual process and suggests some organized phases to capture learner's attention and lead them through the content (Gagne, 1965):

1. <u>Gain learners' attention</u>: this can be accomplished by offering some initial mini-lecture video, posting a probing question, summarizing last week's lesson or with some other strategies.
2. <u>Inform learner of learning objectives</u>: each lesson within the MOOCs should clearly state the main objectives of the module and how the students will reach them. Clarity will enhance course design.
3. <u>Present lesson materials</u>: each unit within the course should clearly state the materials that are required for the students to read, view, or visit.
4. <u>Provide guidance through materials</u>: the instructor has the key role of being present for the students, respond to questions and offer

suggestions on how to navigate the course, how to interact with content and with each other as a learning community.

5. Let the learner perform: during this phase students should explore and interact with content and each other. This part of the process is also key to success and requires instructor presence.
6. Assess performance: some activities within the course should be able to assess student evolution and understanding, quizzes, exams, essays, or other activity types could help with this element.
7. Enhance transfer opportunities: when students can apply what they are learning within their job environment and transfer some skills or concepts to another situation, meaningful learning happens. The design should emphasize this phase and support possible uses outside of the course setting.

The three COI presences (teaching, social and cognitive) are easily observable within this model as well (Anderson and Dron, 2011). When tasks are assessed and learning is guided through the course, students experience some degree of teaching presence, as the learning occurs mainly as an independent process.

Cognitive presence is related with how the learner interacts with content and makes sense of new acquired knowledge, therefore the structure and design of the course needs to stimulate learners' interest and keep them engaged through the course. Learning objectives have to be clear and correctly organized by difficulty; therefore following a learning taxonomy is recommended in this type of design.

Social presence is not as important within cognitive-behaviorist pedagogy as the other two presences, because learning is understood as an individual activity.

Research about the importance of social presence in online environments is still inconclusive in one way or other: this is, to demonstrate or not that learning is better when social presence is higher (Garrison, 2009).

Cognitive-behaviorist approach to design has strengths and weaknesses. It maximizes access and student freedom, and it is good and scalable for large number of students, but there are limited opportunities for social and teaching presence and it does not support some of the complexities associated with human learning (Anderson and Dron, 2011).

2.6.- Learning Management Systems (LMS): MOOC platforms

MOOCs are offered within Learning Management Systems (LMS). A LMS is an online platform that allows MOOC's and other types of online learning to be delivered. Different LMS's, specific to MOOCs, had been appearing since the creation of the first one, to give support to these types of online learning. The major ones in the USA being: Coursera, Khan Academy, Udacity and edX, (see figure 2.2)

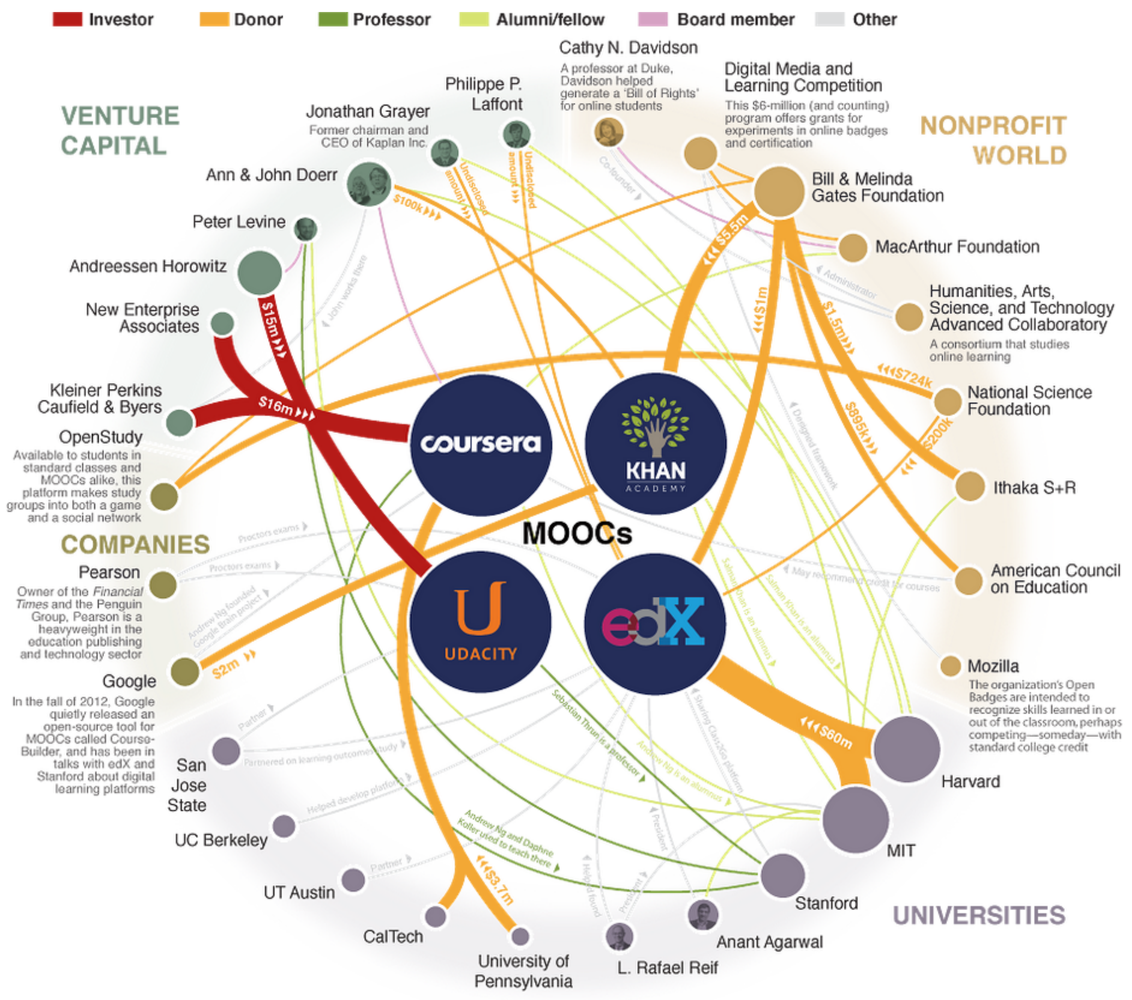

Figure.2.2. Infographic: MOOC Major Players. Retrieved from http://www.wiredacademic.com/wp-content/uploads/2013/05/MOOC_ecosystem.png

MOOC supporting LMS platforms can be classified with the private sector (Coursera and Udacity), non-profit organizations (Khan Academy) or non-profit spin-offs from universities (edX). A brief description of each LMS is provided below. During 2014, the number of universities offering MOOCs doubled from the year before and by December of 2014 four hundred universities in the United States where offering MOOCs (this is 22 out of the 25 top US universities). The total of courses doubled as well up to a maximum of 2400 (Shah, 2014). The top three subjects remain the same as past years: Humanities, Computer Science and Programming and, Business and Management.

2.6.1.- Coursera

Coursera is a for-profit company that partners with four major universities (Stanford, Princeton, Michigan and Pennsylvania Universities). In 2013 Coursera offered half of all the MOOCs, but it went to a third of the share in 2014, making it still the largest MOOC provider.

It offers some MOOCs for credit from the partner Universities; this practice facilitates the access to first year introductory courses deployed as MOOCs to some students that are still deciding what programs to pursue. Non-partner students are required to pay a fee to be assessed by the instructor and to have access to extra assignments.

Coursera has recently started its new program called *Specializations* as a revenue side for the company.

2.6.2.- Udacity

Udacity was founded from venture investments and is a for-profit company as well. Udacity offers the possibility of earning credit by taking a final exam in collaboration with Pearson and for a fee. The exams are starting to be accepted by Colorado State University as transfer credits. It now offers a Nanodegre Program presented as industrial credentials for current jobs in technology and starting to make revenue for the company.

2.6.3.- Khan Academy

Kahn Academy is a non-for profit organization that is principally funded by Melinda and Bill gates foundation, and it is a little different than the other platforms in the sense that it is a content aggregator and offers a free environment for students to learn at their own pace.

2.6.4.- edX

edX is a non-profit MOOC platform founded by MIT and it only offers MIT and Harvard courses. It receives funding from the National Science Foundation and the Belinda and Bill Gates Foundation. EdX has started the Xseries as training courses for industry audience and for revenue.

Table 2.3 summarizes similarities and differences between providers.

Table 2.3

LMS for MOOCs

	Coursera	Udacity	Khan Academy	edX
Type of Organization	For profit	For profit	Non-for profit	Non-for profit
Partnerships	Stanford, Princeton, Michigan and Pennsylvania Universities	Pearson	Unknown	MIT and Harvard
Is credit awarded	Some	Final exam	No	No
Fees	Students from partner universities pay for credit	Final exams can be taken for a fee	No	No

2.7.- MOOC current research: broad spectrum and diversity of results

Even though some Universities are starting to charge for their MOOCs, the majority are still being offered for free, making it very easy to sign up because there is no initial cost for the student. This economic advantage is related with the first main concern for instructors and institutions: the lack of economic consequences for students impacts the completion rates of these courses. The percentage of students that do not complete the courses is higher (around 20% more) than traditional online options (Thornton, Sinnott-Armstrong, Neta, Riddle & Ruiz-Espaza, 2013). Current research indicates that adaptive software could be used to improve MOOC completion rates in this type of courses, differentiated learning strategies for the students to chose (novice, learner, expert) and real-time feedback improves students success rates (Fidalgo-Blanco, Sein-Echaluce, Garcia-Penalvo, 2013). On the other side, this type of software is still under development and very costly.

The authors of this research state that personalized learning could improve completion rates, as this is a modifiable characteristic of MOOCs, in contraposition of charging for the courses that it is not in the essence of their design.

A second major concern raised by institutions is that this model is not economically stable. Creating a MOOC from scratch can be very costly, ($20,000 as average) and institutions are starting to wonder how could they receive revenue, or recover some of the initial investment. At the heart of the economic issue is that MOOCs are now being created for public consumption, which represents a deviation of its initial intention of dispersing quality knowledge and education to everybody and with no cost.

The main issues mentioned by students as reasons for their disengagement within MOOC environments are feelings of isolation in relation with the community of learning, and challenges with content and communicating with the instructor (Rovai, 2002). More research on social presence within the MOOC will help to better understand why the students have challenges with this engagement.

Therefore, we can find four main challenges for the future of MOOC's (Hill, 2012):

- Course completion rates
- Model revenue issues
- MOOC's for credit
- Student authentication

We will briefly describe each of the challenges below.

Higher education institutions are negatively impacted by low completion rates; their revenue, reputation and quality are challenged. Some authors advocate that increasing completion rates is a key variable that will be needed in order for this type of education to keep moving forward. Successfully addressing the issue of completion rates is a critical piece to sustain the future of MOOCs (Watters, 2012).

Other authors argue that comparing completion rates between MOOC's and regular online courses may not be appropriate, because there are many different variables that make the two scenarios dissimilar. For instance, paying college students versus independent learner taking courses for free and following their own interests. The intention and commitments are far different between the members of the two populations.

Some institutions are starting to grant and charge credit to MOOC takers in the form of a post test after completion of MOOC. This new venue could be a way for institutions to collect some of the investments they expend in creation. There is an emerging field that sees the future of MOOCs as MOCCs (Mid-sized Online Closed Courses) or SPOCs (Small Private Online Courses) (Catropa & Andrews, 2012) that will provide credit, target particular students, be within a university environment and provide higher learning support for a fee.

One of the main criticisms against MOOCs is that they are perceived as reproductions of traditional models that already exist, like master classes in face to face institutions, just with the particularity of being offered online (Gaebel, 2014). Some of these studies offer comparisons between MOOCs and online courses or MOOCs and face to face classes. Therefore sometimes the arguments are not MOOC centered but as a comparison with other types or online or traditional courses. This view contradicts some recent authors that understand MOOCs as a new and different phenomenon that cannot be compared to other known online content delivery methods, (Cooper & Sahami, 2013)

Recent researches are approaching the idea of MOOCs being just a condensed and organized way of sharing knowledge and not a learning environment (Gaebel, 2014) others point out that MOOCs really have the capability of teaching new knowledge to students in another way and requiring students to be more proactive than in traditional face-to-face and online courses (Morgan, 2013). There are current discussions in the field related with these two thoughts. Some copyright issues are appearing as well. MOOCs are open and free to distribute, making the intellectual property blurry and not well defined. This is another field with still little research that should be explored further.

We can also find favorable arguments around MOOCs, they are offered as a high quality learning opportunities to a very large number of students, and therefore the main argument seems to be that the model is not economically sustainable. MOOCs opened the door to a new learning situation going from "many to one" to "many to many" where the instructor's role is not as critical as it has been in traditional face to face courses and standard online courses with less students per class. Research suggests that the usage of adaptive software to individualize students experience will improve MOOCs experience and outcomes. Currently this technology is starting to be developed and there are some constrains that come with it: costs, adaptability to platforms, knowledge of its existence from higher education institutions, publisher companies that would like to have revenue etc. (Stokes, 2013)

Due to the fact that the completion rates are very small, some authors raise the question of MOOC instructional design and delivery. Some attempts had been made to align MOOCs to instruction design theoretical frameworks: connectivism (Bell, 2010; Kop, 2011), complexity theory (deWaard et al., 2011) and socio-constructivist frameworks (Clarà & Barberà, 2013; Wegerif, 2013). Within this field of research, critics highlight that MOOCs mirror lecture halls and classic face-to-face education (Davidson, 2012). The usage of videos, module notes and quizzes do not empower social interactions between the students and may lead to a feeling of confusion and isolation. Diverse studies are appearing that focus on design and content delivery. King, et al. research (2014) advocate for the "fit for purpose" design approach. The main point of their proposal is to create courses particularly designed for an institution or a particular student population. Main points that should be clear and achievable for the students are:

1. Desired outcomes
2. Nature of content
3. Technical and pedagogical design needs for the learner readiness, (this condition is possible only if target population is known)

This is not the case for the vast majority of MOOC's that are open to the public and not particularly to a known cohort of students, but it can be a feasible idea for future designs. With the idea of individualizing the design to fit learners' needs we find other proposals, for example, user centered design methods had been applied to MOOC design to monitor user eLearning within learning management systems (Santos, Boticario & Perez-Marin, 2014).

2.8.- MOOC participants

We know very little about MOOC takers' profiles, their motivations to register and what benefits do they experience going though these courses (Gaebel, 2013; Liyanagunawardena, Parslow, & Williams, 2014). On average, only 10% of students enrolled in MOOCs are able to finish them, and this is an objective but controversial statement (Gasevic, Kovanovic, Joksimovic & Siemens, 2014). Current researches are starting to question if measuring MOOC success by completion rates is the best way to approach this information, and if the current definition of "student dropout" rates can be applied to these environments. Traditionally this concept had been related with financial penalties, and active actions from the students that contact their University and voluntarily withdraw form a course. Within MOOC environments the action of dropping out is totally passive and does not require students to do any specific action (Liyanagunawardena, 2013).

Various types of MOOC participants have been identified in the literature (Milligan, Littlejohn & Margaryan, 2013 ; Hill, 2013). Some students enroll just to audit the course and peruse the introduction materials with no intention of participating in any of the activities (auditors); some others enroll just to sample some of the content do a few activities, and watch some of the lectures or videos available (lurkers). Other students are just interested in a particular topic and they are just active during that particular lesson (drop-ins). Still, there are students that actively engage with the content, perform some of the activities and some of the quizzes but not interact with the community, do not participate in discussions (*passive participants*). Finally some students are fully engaged with content and with the community by participating in discussions and they are known as (*active participants*).

The majority of students enrolled in a MOOC are lurkers (60%-80%) that drop out completely after a week or two. Active participants quantify for (40%-20%) of the students, as numbers seem to stabilize after the second or third week or the course (Hill, 2013). The other categories are difficult to quantize because students only appear when interested.

Younger learners (less than 18 years old) are starting to take MOOCs, mainly to "learn new things" and because of "curiosity" (Macleod, Haywood, Woodgate & Alkhatnai, 20015). This increase might be due to High School teachers proposing MOOCs to their students to support local Universities. It is also common to have a heterogeneous group of students with different nationalities, and same percentage of males than females as an average.

Some higher education instructors are also directing their students to particular modules on MOOC courses as a part of the course requirements. Instructors develop their own assessments to support the expected learning from the MOOC.

2.9.- Future research in MOOCs

Different authors suggest different possible fields that need more investigation, data, or theoretical exploration. Investigating possible MOOC frameworks, MOOC takers' profiles, specific new roles within MOOCs (teaching, coaching, or others), how to build community of learning and new designs seem to be a common suggestion for future investigations. Future research on MOOC's is summarized in Table 2.4:

Table 2.4
Future research areas in the MOOC field. Adapted from Kennedy's proposal (2014)

Authors	Suggestions for future research
de Waard et al. (2011)	• New educational frameworks • Profiles and characteristics of MOOC takers • Design principles to enforce attributes such as: self-organization and self-referencing
Fini, (2009)	• Profiles of participants related with retention • Cost and effectiveness related with instruction
Kop, Fourier and Mak, (2011)	• Roles of educators and learners within the learning experience • Learning through a social learning community
Koutropoulos et al. (2012)	• Social interaction and the social presence model • Learning motivation, engagement, social presence and instructor presence • Types of MOOC takers: lurkers, active participants and dropping out

In the following section we introduce main learning taxonomies used in the design of online courses: Bloom's and Marzano's

2.10.- MOOCs design: Bloom's and Marzano's taxonomies

In order to give a rational for new possible design models within MOOCs, we would like to present the well known Bloom's learning taxonomy and introduce a newer one called Marzano's taxonomy.

2.10.1.- Bloom's taxonomy

Bloom's taxonomy had been widely used in online learning when creating courses and aligning learning outcomes with assignments and assessments with the goal of achieving all cognitive levels as it was traditionally done in face-to-face courses (Joyce & Weil, 1985). The usage of this taxonomy within MOOCs is starting to be studied and some research had been performed comparing MOOC activities to the different cognitive levels within the taxonomy (Bali, 2014).

Bloom's taxonomy (1956) is a model to classify thinking levels; it is a systematic classification of the thinking processes, and provides instructors and developers a well accepted universal tool to measure learning progression. It presents three domains: cognitive, affective and psychomotor (see Table 2.3). Within this model it is understood that after a learning episode occurs the learner has gained new knowledge, new attitudes and new skills.

Within the cognitive domain the learning levels proposed by this taxonomy from simplest to complex are: knowledge, comprehension, application, analysis, synthesis and evaluation.

Within the affective domain the categories from simplest to complex are: receiving phenomena, responding to phenomena, valuing, organization and internalizing values (Bloom & Masia, & Krathwohl , 1974)

Within the psychomotor domain the proposed categories from simple to complex are: perception, set, guided response, mechanism, complex overt response, adaptation and origination (Simpson, 1972).

Table 2.5
Bloom's taxonomy domains from simple to complex

Cognitive	Affective	Psychomotor
Knowledge: Recall information	**Receiving phenomena:** Awareness, being attentive to knowledge	**Perception:** Ability to use senses to perceive information
Comprehension: Understand meaning	**Responding to phenomena:** Reaction in front of a particular content	**Set:** Readiness to act
Application: Use acquired knowledge in a new situation	**Valuing** Worth assigned to a particular idea or concept	**Guided response:** Early stages of learning, imitation and trial and error
Analysis: Divide concepts into smaller parts	**Organization:** Classification of values into priorities	**Mechanism:** Movements are know and can be performed
Synthesis: Add concepts together to summarize knowledge	**Internalizing values:** How values will relate with behaviors	**Complex overt response:** Complex movements that together enable to perform
Evaluation: Make judgments about knowledge and ideas		**Adaptation:** Skills are well developed and can be modified
		Origination: Able to create new movement patterns

There had been other proposals for psychomotor and affective domains, (Harrow, 1972; Dave, 1975; Krathworthl, 2001), and around 20 Bloom's taxonomy revisions had been developed during the last 50 years (Anderson and Krathworthl, 2001). The outcomes of these revisions suggested to change the last two cognitive levels to *evaluating* and *creating,* and to add some changes in terminology and structure. For example, *knowledge* had been changed to the action verb *remember* and *comprehension* is now *understand.* Re-structuring the taxonomy and being consistent with the terminology was the main concern of the revisions. (see Table 2.6).

Table 2.6
Revised Bloom's taxonomy

Old Bloom's taxonomy version	New Bloom's taxonomy version
Evaluation	Create
Synthesis	Evaluate
Analysis	Analyze
Application	Apply
Comprehension	Understand
Knowledge	Remember

Even though educators had been using this taxonomy for more than 50 years there are some authors questioning its applicability and validity (Kreitzer and Madaus, 1994; Furst, 1994). The taxonomy was designed to fit educational objectives and learning environments 50 years ago and it is viewed as an oversimplification of the nature of thoughts and not aligned with current brain research and theories. When created it was really useful to evaluate programs and curriculum, but learning had changed and new learning environments and learning methodologies had been developed. Blooms might not be the best taxonomy to apply when designing online courses in current environments.

One of the major concerns when using Bloom's taxonomy is that differences between levels are understood as changes in degrees of difficulty; for example, evaluating is understood as being more difficult than understanding. This idea contradicts psychology principles where the difficulty of a mental process depends on two variables: complexity of the process and personal familiarity with it (Anderson, 1983; LaBerge, 1995; LaBerge and Samuels, 1974). This taxonomy was not designed to predict specific behaviors; therefore it is not a model or a theory (Rohwer and Sloane, 1994).

2.10.2.- Marzano's taxonomy

It seems more natural to think that *tasks* are the ones sparking the process of learning, rather than trying to adjust levels of complexity to thought systems (Marzano & Kendall, 2006). Following this idea a new taxonomy had been developed that better fits new learning environments, making it more appropriate to be used in curriculum design, when the emphasis is in allowing students' independent learning (Nakyam, Kwangswad, & Sriampai, 2013).

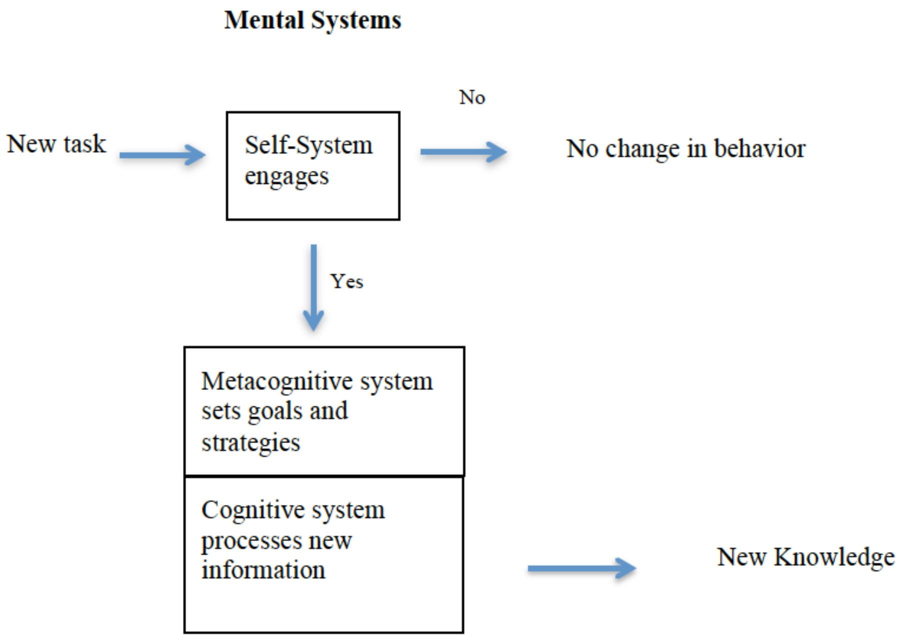

Figure. 2.3. Marzano's taxonomy framework

Figure 2.3 presents the three mental systems in the taxonomy: self, metacognitive and cognitive and also the possible task that initiates the process. The process starts when a new task is offered. The individuals can engage or not in the new task depending on how important is for them, their believes and their degree of motivation, (Garcia and Pintrich, 1995; Markus and Ruvolo, 1990). If the new task is started the metacognitive system engages by setting goals and organizing priorities within the task, and the cognitive system will be responsible for the processing of information and new knowledge acquisition. This conceptualization is very similar to the one presented by Garrison, Anderson and Archer (2000) in their critical thinking or inquiry learning framework. A triggering event followed by perception, analysis, deliberation and action taken is the process these author's understand as leading to learning.

Within this framework Marzano's taxonomy is developed. It presents two dimensions: Systems of Thinking (table 2.7) and Knowledge Domains, (Table 2.8)

Table 2.7
Marzano's Systems of Thinking (adapted from Marzano & Kendall, 2006)

Cognitive	Metacognitive	Self
Retrieval: Recall information	**Goals:** Set own objectives	**Motivation:** Engagement in new task
Comprehension: Understand meaning	**Processes:** Select own strategies and path to follow	**Importance:** How important is learning
Analysis: Divide concepts into smaller parts	**Clarity:** Monitor own understanding	**Efficacy** How much can you learn
Knowledge utilization: Add concepts together to summarize knowledge	**Accuracy:** Check for quality of acquired knowledge	**Emotion** Feelings about the task
Evaluation: Make judgments about knowledge and ideas		

Table 2.8
Marzano's Knowledge Domains (adapted from Marzano & Kendall, 2006)

Information	Mental procedures	Psychomotor procedures
Organization of simple and complex ideas	Simple and complex processes, strategies, mental approached to learning	Physical characteristics need to perform tasks

2.10.3.- Similarities and differences

There are some similarities and differences between Marzano's taxonomy and Bloom's. Both taxonomies classify tasks by considering type of knowledge involved and mental procedures taking place, therefore there is a behavior change implication when a new task is started; however the dimensions in these taxonomies have differences related with how they see the self-system. Bloom's taxonomy places it within the affective domain as how the individual responses to interest engagement in a particular task, whereas Marzano's taxonomy has the Self-system as a separate mental process and the first one that decides to engage or not in a task.

Within online education environments the Self system seems to be a higher priority for students, being able to set specific goals, reflect on their learning, self-monitor their activities and being proactive in organizing and planning their own learning path helps with participating in discussions and forums (Eryilmaz, Thoms, Mary, Kim, & Van der Pool, 2014). A brief summary of similarities and differences is presented in Table 2.9

Table 2.9
Marzano's and Bloom's similarities and differences

Similarities	Differences
Both classify tasks by type of knowledge and mental procedures Main goal: offer a standard classification to frame design	Developed 50 years apart Different dimensions in each taxonomy Differences on classification for the Self System Bloom's classifies levels by task difficulty and Marzano's by engagement and familiarity with it

In the following section we explore the role of the Self- system together with the SDL competence within MOOC environments.

2.11.- MOOCs and SDL

SDL was introduced in the 60's as an adult learning characteristic (Houle, 1961) but it was with Knowles in 1975 that the concept was grounded and defined. Using Knowles' definition we present SDL as a learning characteristic that enables adult learners to set their own goals, plan and organized their own learning without the help of an external agent. Students are able to monitor their own progress and make adjustments to benefit the final outcome (Schulze, 2014).

Different authors have offered different approaches to the dimensions of SDL. Candy (1991) proposes four dimensions for this characteristic: personal autonomy, self-management, learner control and independent pursuit of learning. Hiemstra (1994) suggests four characteristics to explain and define SDL:

1. Personal responsibilities: learners can become empowered to take a greater role in their learning.
2. Degree of directedness: SDL is a trait that exists in every individual in some sort and degree.
3. Social side of SDL: Independent learning does not mean to learn in isolation but to direct own path even within a social activity.
4. Learning transaction: Transfer of learning from one situation to another is present in strong SDL individuals.

There are three elements involved in the action of learning under this perspective: the individual, the process and the context (Brockett & Hiemstra, 2010). Characteristics of the individual will play an important role in how he or she approaches learning (creativity, life experience, motivation, previous learning experiences). The process also shapes the way that learning happens: teaching-learning transaction, how learning is facilitated, teaching style, and planning and organizing. The context where learning takes place adds to the learning climate, how content is organized and delivered, and what is the culture of the learning setting.

The learning steps that are associated with SDL can be summarized in the five following actions: (Guglielmino, 1976; Simmering, Posey & Piccoli, 2009; Demir & Yurdugul, 2013)

- Diagnose learning needs
- Identify learning objectives
- Decide how to evaluate learning outcomes
- Following and deciding resources and learning strategies
- Evaluation products of learning

Knowles' opinion about education states that its main role is to give students the skills to be independent and life-long learners, more than share content and knowledge. In this sense this idea is quite related with the desirable characteristics of MOOC takers and how these environments can help students beyond transmitting content. Individuals that have a lifelong learning inclination, that look for learning opportunities fits well within the learning context of MOOCs (Schulze, 2014).

To measure SDL an original instrument was developed by Guglielmino in 1977 with eight components and 58 items. The Self Directed Learning Readiness Scale (SDLRS) is a self-report instrument widely used and well-respected

(McCune, 1988; Long, 1991; Guglielmino and Klatt, 1994; Haggerty, 2000). According to Guglielmino and Klatt (1994), this scale is still used when doing quantitative research within the field of SDL but some revisions and new original instruments had been developed during the years. The following table summarizes some original instruments to measure SDL and revisions: (Table 2.10)

Table 2.10
SDL instruments

Original Instruments	Final components	Description
Guglielmino (1977) Self-Directed Learning Readiness Scale	Eight components Openness to learning opportunities, self-concept as an effective learner, informed acceptance of responsibility for one's own learning, love of learning, creativity, positive orientation to the future, ability to use basic study skills, and problem solving skills	58 items Content validity: Delphi study Construct validity: PCFA (Principle Component Factor Analysis)
Oddi et al. (1990) Oddi Continuing Inventory	Three components Proactive/reactive learning drive, cognitive openness/defensiveness, and commitment/aversion to learning	24 items Construct validity: PCFA (Principle Component Factor Analysis)
Williamson (2007) Self-Rating Scale of Self-directed Learning	Five components Awareness, learning strategies, learning activities, evaluation and interpersonal skills	65 items Content validity: 2 rounds of Delphi study Construct validity: Known-groups technique
Revalidation Instruments		
Fisher et al. (2001) Self-Directed Learning Readiness Scale	Three components Self-management, desire for learning, and self-control	40 items Content validity: 2 rounds of Delphi study Construct validity: PCFA (Principle Component Factor Analysis)

Original Instruments	Final components	Description
Harvey (2006) Oddi Continuing Learning Environment	Four components Learning with others, learner motivation/self-efficacy/autonomy, ability to be self-regulating, and reading avidity	24 items Construct validity: CFA (Confirmatory Factor Analysis)
Hendry and Ginn (2009) Self-Directed Learning Readiness Scale	Four components Critical self-evaluation, learning self-efficacy, self-determination, effective organization for learning	38 items Construct validity: (EFA) Exploratory Factor Analysis
Cadorin et al. (2013) Self-Rating Scale of Self-directed Learning	Eight components Awareness, attitudes, motivation, learning strategies, learning methods, learning activities, interpersonal skills, constructing knowledge	40 items Construct validity: PCFA (Principle Component Factor Analysis) and PCA (Principal Component Analysis)

Some of the mentioned recent studies argue that online courses should support personalized and collaborative learning systems as a way of utilizing and improving students' SDL skills (Eryilmaz, Thoms, Mary, Kim, & Van der Pol, 2014). Course design should emphasize social possibilities while acknowledging that adult online learners manage their own learning activities and monitor their performance. Socialization seems to empower SDL in online environments.

In the next section we present the COI framework and highlight the role of SDL within the social presence of this model.

2.12.- Research framework: COI in online environments

There is an important body of research around the importance of *presence* in online learning (Jézégou, 2010; Garrison and Anderson, 2003). *Presence* within this field of investigation is understood as the perception of the activities to be as close to a face-to-face situations as possible (Lombard and Ditton, 1997). Garrison and Anderson (2003) in their research within COI environments identify three interlinked presences that take part in students' engagement when taking online courses: social, teaching and cognitive presence, see figure 2.3

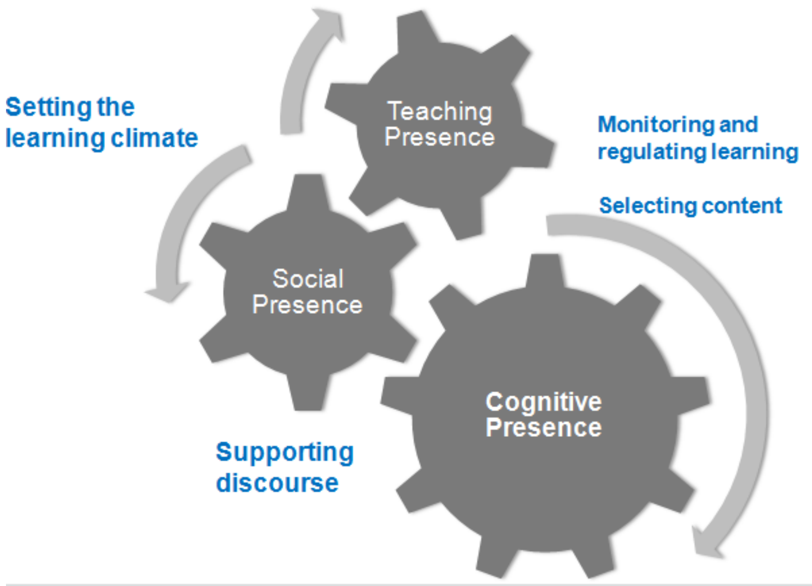

Figure. 2.4. COI presences

Figure 2.4 represents how knowledge is constructed collaboratively and how each of the presences plays an integral part of a successful educational experience. Cognitive presence requires the two other ones, social and teaching, to take place: teaching presence will monitor and regulate learning structure and select content, and social presence will support discourse and move the group forward. Social and teaching presence complement each other as well, by setting the learning climate and offering a welcoming environment for learning to take place (Swan, Garrison & Richardson 2009).

The COI framework is based on Dewey's inquiry model (1933) and his idea of practical inquiry. Practical inquiry presents three parts: pre-reflection, reflection and post reflection. The student gains knowledge from his/her experience with different elements: content, other members of the group, and instructor or coach. From these key elements three presences can be defined, and they are introduced below.

2.12.1.- Social presence and its relation with SDL

Social presence in a COI is defined as the ability that the participants have to present themselves as a *real person* and communicate with the rest of the group (Garrison, Anderson and Archer, 2000)

Cognitive presence will be better incorporated during the learning experience if social presence is first achieved (Gunawardena, 1995; Garrison, 1997). This concept is easier to state than to achieve, because students should go beyond just sharing personal information to establish a collaborative community with the goal of helping gaining. Rovai (2001) states that the sense of community in online learning environments is influenced and directly correlates with group facilitation, teacher interaction, collaborative learning, and SDL as well. SDL competence guides the way students relate with the rest of the group an their sense of community. Good social integration with peers directly correlates with student persistency rates (Wlodkowski, 2003), and self-directed strategies such as control, critical reflection and responsibility are better accomplished with the social and instructor support for students (Lee & Gibson, 2003). These authors suggest in their study that efforts should be made to integrate both presences (teaching and social) when farming the course to empower SDL possibilities.

2.12.2.- Teaching and cognitive presence and their relation with SDL

Teaching presence is starting to be researched in online open environments because definitions and learning opportunities within this environments change the way teacher interacts with the group of students (Kop, Fourier & Mak, 2011).

Traditionally, teaching presence in COI is defined as the design of the educational experience and facilitation of this experience. This is mainly performed by the instructor, but it is a function that can be performed by any of the participants in the COI: students, instructors, teaching assistants, graders.

In open online environments this presence needs to be defined again because the possible interaction instructor-student are less frequent than in traditional online courses. Some new roles are appearing for faculty teaching open courses: curator of course content, supporter, facilitator, guide for thought repurposing and instigator for new ideas (Siemens, 2008; Downes, 2010). For this situation to be successful it requires a high order of SDL in the learners (Kop, Fourier & Mak, 2011)

Cognitive presence is the COI presence that will most impact on students' success (Garrison, Anderson & Archer, 2000). Cognitive presence in a COI is understood as how the students construct meaning through their interactions with the other two presences and the course content; it is the action of constructing meaning through communications (Anderson and Garrison, 1995; Garrison, 1991)

High rates on teaching, social and cognitive presence in massive online courses are an indicator of efficacy of course design (Nagel & Kotze, 2010), and there is an argument in favor of the possibility of designing massive classes that support community of inquiry. Recommendations of more research using the COI survey in online massive classes are also recommended as future lines of investigation.

With the following table we would like to identify best practices that allow each presence in a COI environment to be achieved (Table 11).

Table 2.11
COI presences and best practices

Presences	Definition	Best practices for achievement in traditional online courses	Best practices for achievement in MOOCs
Social	Ability that students have to present themselves as a real person in online environments	Better results if it is achieved at the begging of the course Influenced by teacher interaction and SDL	Challenging to achieve due to group size SDL seems to help students to interact in an organized manner with their peers
Teaching	Facilitation of the education experience by the instructor of the course	Facilitated by the instructor and students	Student interactions are less frequent New roles appearing: curator of content, technology expert, facilitator, guide

Presences	Definition	Best practices for achievement in traditional online courses	Best practices for achievement in MOOCs
Cognitive	How students construct meaning through their interactions with the other two presences	Construct meaning thought communications	Good course content design empowers the other two presences

This literature review leads us to our personal theoretical framework. In the following section we will summarize the literature review, detail how it influences our research and show our contribution to the field.

2.13.- Summary

The main focus of this literature review is to present the state of the art of Open Educational Resources particularly in the field of MOOCs as open online courses. We understand MOOCs as community of learners and this is why we studied them within the COI framework. Especially we focus our research in exploring the three main presences in this framework: social, teaching and cognitive. **Within the social presence we believe, and support with literature resources, that the SDL competence can help students be more successful completing MOOCs, and feeling less disconnected and isolated from the group.** Our contribution to the research in this sense would be the addition of SDL as a key element within the social presence of the COI framework. This research question is further explored when we design and chose instruments to collect the necessary data to explore this investigation further. The choices and designs of our instruments are influenced by the theoretical framework and research questions.

In our literature research we presented current MOOC definitions and classifications, MOOC MLS platforms and their classifications, and also main online educational pedagogies. **We state that our particular framework for the research we present in next chapters fits within the cognitivist-behaviorist pedagogy because this pedagogy allows courses to adapt to very large number of students and requires low teaching and social presence.** These types of courses (mainly xMOOCs) present a less flexible design, but allows high enrolment and can be shaped in different ways depending on the learning taxonomy that is used.

We also reviewed some of the main current concerns with the MOOC phenomenon: low course completion rates, revenue issues due to the non-fee model and issues surrounding awarding credit due to student authentication challenges.

MOOC participants' profiles seem to be very heterogeneous and generalization is not possible. This situation makes online design for this particular type of curses difficult because of the differences within the target population. Some research had also been presented on course design and best taxonomies to use in these types of courses: Bloom's and Marzano's taxonomies had been explored. Our particular view for this research, after exploring current literature, claims that Marzano's taxonomy aligns better with courses that have a large number of participants and low teaching and social interaction because emphasizes the SDL side of learning. Students can freely relate with content, make sense of it and follow instructions through the course. This competence will also influence on how they see the group as a social construct and how they interact with the rest of members (teacher and peers). With this framework in mind, we have chosen Marzano's taxonomy, as the best taxonomy to apply when designing MOOCs and it is the one used in our MOOC study. The process of designing the Excelsior College MOOC will be explained in the following chapter: Chapter 3: Methodology.

SDL is an important characteristic to be explored within MOOC's (as current literature refers to), therefore designing courses to empower students to be more SDL seems to be a good strategy to help students to be successful and to move forward within the field of online teaching and learning.

Finally the COI design is also introduced and explained: presences, relationships between them, how is the framework applied to online courses, (MOOCs in particular), and what is the role that SDL plays within the social presence in particular. Best practices on how to achieve each of the presences in online traditional courses and MOOCs are also explained.

As a conclusion we would like to summarize our research framework, based on the literature review and in our own view of the situation. The following paragraph aims to show the uniqueness of the research and our contribution to the field:

MOOCs can benefit from an instructional design that uses Marzano's taxonomy with the aim of empowering students SDL skills. COI is the best framework for MOOCs and social presence is better achieved if students have a good environment that enhances their SDL possibilities through design and delivery.

METHODOLOGY

#3

Chapter 1: Introduction

Chapter 2: Review of Literature

Chapter 3: Methodology

- **Abstract**
- **Introduction**
- **Research design: Chosen paradigms**
- **Methodology**
- **Instruments**
- **Summary**

3.1.- Abstract

This chapter introduces the chosen methodology for the research. A mixed methods research with all its components is explained and justified. The instruments with their variables and items are enumerated and described; we align them with research questions and goals of the investigation.

Resumen

Este capítulo introduce la metodología que hemos escogido para nuestro estudio. Una investigación de método mixto (multi-paradigmático) es explicada y justificada. Los instrumentos con sus variables y ítems son enumerados, descritos y alineados con las preguntas y los objetivos de la investigación.

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3.2.- Introduction

In this chapter we introduce our research paradigms, as well as our particular research design that leads to the research methodology, the instruments selected to collect the data, and the reasons each was selected. We understand the methodology as a bridge between the theory (paradigms) and the research tactics (instruments). See Figure 3.1.

Paradigms:

Interpretative, positivist and critical Theory

Methodology:

Mixed methods research

Instruments:

Quantitative and qualitative data collection

Figure 3.1. Methodology schema.

In this chapter, we also introduce how we collected our data. The analysis will be presented in Chapter 4: Results.

3.3.- Research design: chosen paradigms

Selecting the research paradigms is not only a formal question; it involves more than just technical considerations. Personal values, scientific research, approximation to the type of research questions, and the conclusions we would like to reach all shape our chosen forms of research. Our goal is to understand, explain, and reflect on reality, and with this goal in mind the investigation followed a mixed methods research approach.

Paradigms are understood as a set of beliefs that define, for its holder, the nature of the world, the individual's place in it and the relationships between its components (Guba & Lincoln, 1994). Kuhn's (1975) vision of the paradigms suggests that they are a non-permanent scientific realization, universally accepted, that are able to give solutions and explanations to current problems studied by the scientific community. When contradictions appear, the scientific community suggests new paradigms, and knowledge evolves as a result of this cyclical process. On the other hand, Popper (1994) suggests that scientific progress happens as a result of searching for tentative suggestions to new problems within the scientific community. This is the process that leads to paradigms evolving and adapting, making them able to respond to current challenges and new scientific environments. Paradigms can coexist without rupture.

Recent literature in the field highlights three fundamental paradigms: interpretative, positivist and critical (Hassand, 1993; Arnal, del Rincon, & Latorre, 1996; Cohen, Manion, & Morrison, 2011). Each paradigm sees, explains, or examines reality under a different core knowledge umbrella, and each is appropriate for different types of research. Detailed characteristics of each are shown in Table 3.1.

Table 3.1
Research Paradigms

Paradigm Characteristics	Interpretative Exploratory	Positivist Explanatory	Critical Theory
Core knowledge	Phenomenology, interpretative theory	Logical positivism, empiricism	Socio-critical theory
Goals of this type of investigation	Understand and interpret reality	Explain reality and cause-effect relationships	Reflect on reality and promote change
Values	Researcher's values influence investigation	Neutral, the investigator is objective	Shared ideology
Methodology	Qualitative study	Quantitative study	Action research
Methods/ instruments	Descriptive investigation	Test, questionnaires, systematic observation, experimentation	Case studies, dialectic research
Data analysis	Triangulation, analytic induction	Inferential and descriptive statistics	Inter-subjective, dialectic

We are going to explain each of the paradigms in detail in the following section.

3.3.1 Interpretative-exploratory research

This paradigm is also called qualitative, phenomenological, and ethnographic or humanist, and it aims to understand and take action by interpreting reality from the subject's perspective (Latorre, del Rincon, & Arnal, 2004). This framework is interested in individuals' opinions and the way they see their reality. The research focuses on describing and understanding the unique characteristics of each individual; it depicts particularities more than generalizations. Under the interpretative research paradigm, reality is a dynamic entity, showing situations that change and are perceived differently by different subjects. It is understood as an alternative and complementary view to the positivist-explanatory research.

Phase III of our research falls under this perspective. Our goal is to describe current profiles of MOOC takers and depict MOOCs as COI spaces. The data was collected from the subject's perspective and aims to understand the meaning of human actions and social interactions (Erickson, 1986).

3.3.2 Positivist-explanatory research

This paradigm is also called quantitative, empiric-analytic or rationalist, and it is the most used paradigm within the scientific community (Latorre, del Rincon, & Arnal, 2004). The main goal of this framework is to discover the laws underlying educational phenomena and use the discoveries to create scientific theories to guide educational research.

Phase II of our research falls under this perspective by analyzing the correlation between completing a MOOC and the degree of SDL readiness. Collecting objective data from surveys offers new knowledge that could guide our research and enable us to generalize ideas.

3.3.3 Critical theory research

This paradigm was developed with the aim of complementing the other two, adding to the objectivity of the positivist view and to the conservationism of positive-explanatory research. This paradigm seeks to critically evaluate current practices with the idea of improvement, and to connect theory, practice, and knowledge with action research and values (Foster, 1980).

The objectivity of research is questioned under this paradigm; research is understood as a motor for progress and innovation, research changes reality to improve practices and results. Phase II of our investigation explores this research view. We aim to analyze experts' and MOOC takers' opinions on MOOC design and quality, identifying and assessing key factors (processes and practices) which could help to better design and deliver future MOOCs. The main goal is to identify best practices and current challenges to improve MOOC design and user perspectives.

3.3.4 Mixed method research

During the last ten years, research in the field has been mentioning an emergent paradigm called mixed methods research (Gorard & Taylor, 2004; Gorard & Smith, 2006; Teddlie & Tashakkori, 2009). Although it might be too early to affirm whether this is a new paradigm, or just an evolution of the other three, it seems clear that it helps in incorporating different data types and facilitates triangulation between different resources (Cohen, Marion, & Morrison, 2011). This type of research has been used for years now; combining different data sources has been common in the social sciences, but was never called a "new paradigm" until this current movement started.

For now we understand that this new framework combines characteristics of the three paradigms mentioned in Table 3.1. Recent studies suggest that the *quantitative* and *qualitative* terms should be changed to *confirmatory* and *exploratory,* moving away from methodological puritanism to a type of research that combines different research techniques when addressing inquiry questions (Onwuegbuzie & Leech, 2005). This is how we understand our research as well; we aim to understand and interpret reality, explain cause-effect relationships and reflect on reality to promote change. The main characteristics of this emergent paradigm are:

- Research is driven by multiple research questions that are confirmatory and exploratory in nature (for example, *what* and *how*, and *what* and *why* type of questions).
- Confirmatory and exploratory researches complement each other and add new points of view to the research.
- Offers a more comprehensive understanding of the phenomena than single method approaches.
- Depicts social science research more realistically and increases validity of results.

The design that we suggest for our investigation under a mixed methods research paradigm aims to:

1) Describe current profiles of MOOC takers and depict MOOCs as COI spaces;

2) Analyze the correlation between completing a MOOC and the degree of SDL readiness; and
3) Analyze experts and MOOC takers' opinions on MOOC design and quality, identifying and assessing key factors (processes and practices) which could help to better design and deliver future MOOCs.

By answering these questions we are seeking to understand, explain and reflect on the reality of the MOOC environment and give a holistic view of the research situation. We state that in order to have a complete view of the phenomenon and to answer our research questions accurately, we should conduct this research under the mixed methods research umbrella.

In Table 3.2 we indicate which part of our research belongs to each of the chosen paradigms. Research phases will be explained in the following section. Our study comprises three investigation phases:

Phase I: during content development

Phase II: during content delivery

Phase III: during end of course research

Table 3.2
Research Paradigms and Research Phases

Mixed Methods Research			
	Phase II: Content delivery **Positivist Explanatory**	**Phase III: End of course research** **Interpretative**	**Phase III: End of course research** **Critical Theory**
Tasks	Coordinate, teach and monitor MOOC offerings	Create and survey MOOC participants for demographic information, motivation, and COI presences	Create and execute student interviews and expert focus group
Timeline	During MOOC term: February 2014 to March 2014	After completion of MOOC	After completion of MOOC
Instruments	SDL readiness scale questionnaire	A. Creation and distribution of the demographics and motivation survey B. Distribution of COI presences questionnaire	C. Creation and distribution of students' interviews D. Creation and distribution of a focus group questionnaire with experts to explore their opinions
Description of the Instruments	40-item questionnaire to measure the SDL competence within MOOC users developed by Cadorin et al. (2013)	Instrument A: 16-item demographics and motivation survey self-developed with the help of a panel of experts Instrument B: COI questionnaire developed by Arbaugh et al. (2008)	Instrument C: Student interviews with 11 items self-developed and validated by a panel of experts Instrument D: Focus group questionnaire for experts has 17 items and had been self-developed and validated by a panel of experts
Goals of the Investigation	Analyze the correlation between completing a MOOC and the degree of SDL readiness	Describe current profiles of MOOC takers and depict MOOCs as COI spaces	Analyze experts and MOOC takers' opinions on MOOC design and quality, identifying and assessing key factors (processes and practices) which could help to better design and deliver future MOOCs

Mixed Methods Research			
Research Questions	2a. What is the SDL readiness levels of MOOC takers	1a. What is the demographic information of MOOC takers and why are they motivated to take the MOOC?	3a. How can we change processes or practices to specifically facilitate student engagement in a MOOC COI?
	2b.What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?	1b. How is the MOOC COI perceived or experienced by MOOC takers? Social presence Teaching presence Cognitive presence	3b.Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?

3.4.- Methodology

Our research took place in three different phases: content creation, content delivery, and end of course research. Content creation happened from February 2013 to July 2013, programming took place from August 2013 to November 2013 and content delivery occurred from February 2014 to March 2014.

During the content creation phase, the MOOC was developed by a group of experts and a development team. The participants in this project were: a subject matter expert (SME), one instructional designer (ID), one faculty program director (FPD), and a library representative. During this phase, research on best design practices for MOOCs was conducted and group meetings were held. Once the course was created (Phase I), the second and third part of the research took place (during phases II and III). The MOOC ran over a 16-week sessions of 8 modules each. An instructor expert in the field and a TA (teaching assistant) taught the courses during both terms.

Our design can be understood as quasi-experimental because we did not use control groups. Although this type of research does not offer the same external and internal validation as experimental ones, it offers sufficient validity, making it very appropriate for educational research (Bernardo, 2000).

This type of research is beneficial for our purpose because it offers a method of research that is possible to use within the educational field, where it is usually difficult to plan for control groups and variables. Within the educational context, the groups (classes) and learning environments are not flexible and it is often not fair to have a group of users as control group, depriving them of a new technology or an experimental tool. Mixed methods research offers such a possibility.

Specifically, the phases of this research are described below.

3.4.1 Phase I: content development

The first phase of this research involved the design of the MOOC and the LMS selection. The team followed best practices in online course design and created course content over a four-month period. There are no instruments of measure in this section of the development, just teamwork to complete the task. See Table 3.3.

Table 3.3
Research Process: Instruments, Techniques and Procedures for Phase I

Phase I	Tasks	Timeline	Description of Research	Instruments	Description of Instruments
Content Creation	MOOC content creation and programming	February 2013-July 2013	Creation and research of best practices for MOOC creation, with emphasis on helping students to be self-directed	None	None
	LMS selection	February 2013-July 2013	Investigating different LMS platforms and select the best one for our needs		

Course development started with a kickoff meeting that brings everyone on the team together. The core of online course development is course outcomes, properly termed Student Learning Outcomes (SLO). The student outcomes indicate what the student should be able to do as a result of participating in the course learning activities. The outcomes should be written using active verbs and cover a wide range of learning levels within the chosen taxonomy. They should be able to be observed and evaluated. In our research, we had chosen to use Marzano's taxonomy. After reviewing the current literature around taxonomies, we agreed that this taxonomy better fits the massive online environments where our research takes place. Current literature states that when the instructional design emphasizes strategies and opportunities for students to create their own independent learning paths, Marzano's taxonomy seems to be the best fit (Nakyam, Kwangswad, Toopthong, & Sriampai, 2013). An elevated level of independent learning is required from the students in xMOOC type of courses, therefore, with the goal of helping students be successful, Marzano's taxonomy was chosen for use in the designing stages. The final approved outcomes were the following:

1. Examine the fundamental concepts and elements of cybersecurity from a people, process, and technology perspective.
2. Apply a holistic view of the concepts and terminologies of cybersecurity.
3. Examine basic threats and protection mechanisms for physical, personal, computer, and application level security.
4. Identify basic threats and protection mechanisms for Internet, network, mobile, wireless, and web security.
5. Apply the basic principles of information security in defending against cybersecurity threats and protecting information assets.
6. Investigate common cybersecurity laws, standards, and best practices.

The syllabus is another key element established at the beginning of development. Educational materials, a draft of discussion topics, assessments, and learning activities should be created at kickoff and used as a guide during the rest of the development (see appendix for the syllabus).

Educational materials were also chosen at this stage. The textbook was chosen through discussions between content developers and the faculty program director for the course. Multimedia, Open Educational Resources (OER), interactivities and other learning resources were also selected at the beginning of the course development.

One important concept to have in mind is that content should be created with the idea of online delivery. Breaking down content into small pieces and incorporating interactivities or multimedia to complement main ideas should be a central goal at this stage of the development. One of the main objectives of online courses is to create and develop them in a way that allows and sustains community presence. The following section presents the different sections we created in the MOOC in order to accomplish the aforementioned outcomes.

3.4.1.1.- MOOC design

The *Introduction to Cybersecurity* MOOC consists of eight modules; each module introduces one main topic and they are delivered weekly (see Table 3.4).

Table 3.4
MOOC Modules

	Business Capstone Kickoff Meeting
Module 1	Introduction to Cybersecurity
Module 2	The Big Picture of Cybersecurity
Module 3	Personal and Physical Security
Module 4	Computer and Application Security
Module 5	Web Security
Module 6	Network Security
Module 7	Mobile and Wireless Security
Module 8	Cybersecurity Standards and Law

Each module was developed following the same structure, with the goal of facilitating student navigation and familiarity with content (see Fig. 3.2).

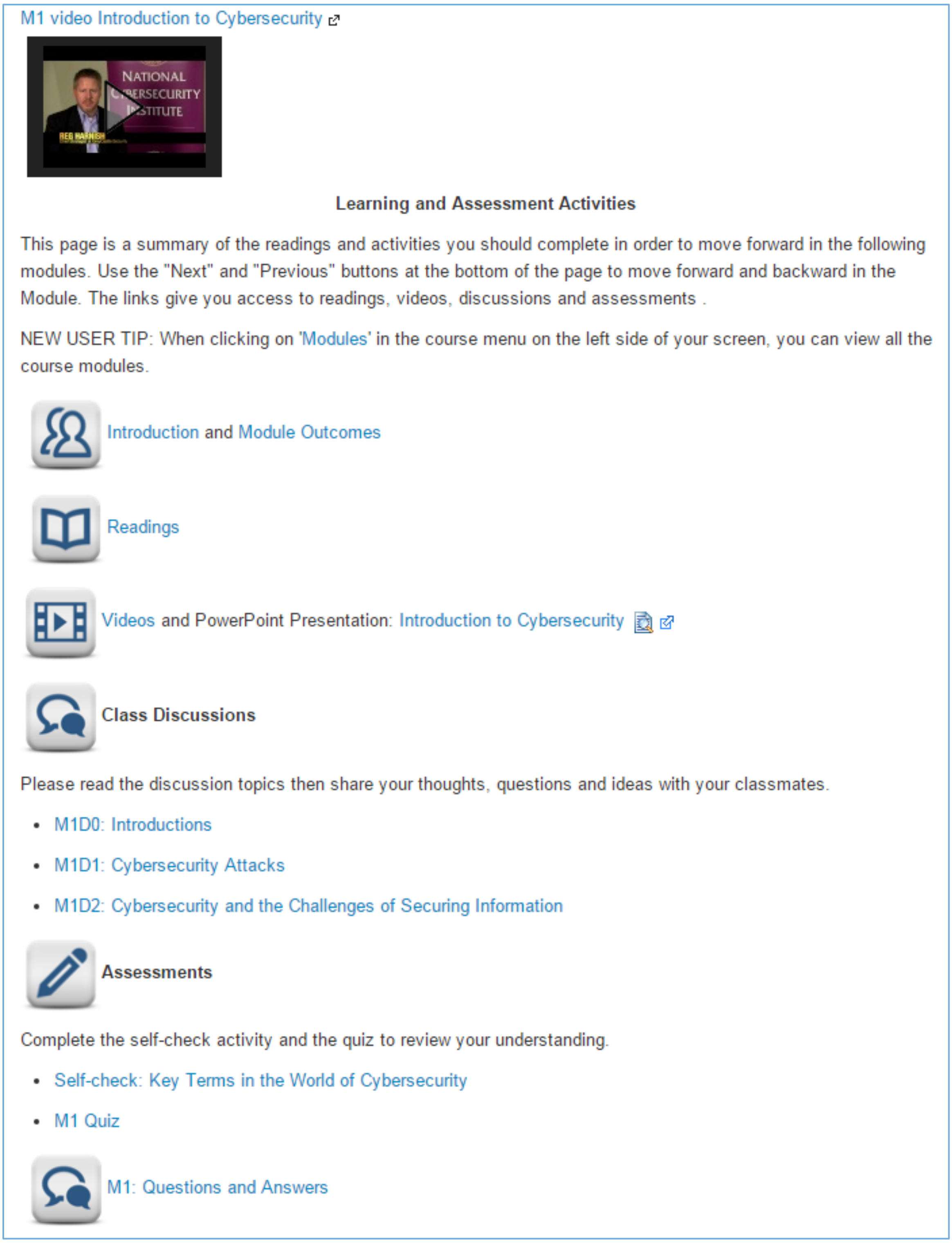


Figure 3.2. Module 1

The module sections are:

- *Introductory videos:* The most important ideas in each module are introduced with very short videos (3 to 5 minutes in length) at the beginning of each module. These should introduce the module topic and spark curiosity in the students. Experts in the field were selected to try to reach everyone in the diverse population we expected in the MOOC.
- *Introduction and module outcomes:* In this section of the module, the main concepts are re-introduced using text to convey the information. The goal is to complement the ideas from the introductory video using another delivery method. Module outcomes are also stated in this section. These should be clear and inform students about what concepts they are going to learn in that module, as well as and what they will be able to do, perform, or understand at the conclusion of the module.
- *Readings*: In this section of the module, the notes from experts and OER resources are combined in a downloadable pdf file, clearly organized to facilitate its comprehension of the module topics. Resources to expand on some of the most difficult or interesting topics are also provided. An example of module notes can be found in the annex.
- *Videos and PowerPoint presentation:* Videos from the college library, Khan Academy, or YouTube are also suggested to the students. A narrated PowerPoint presentation simulating a f2f master class is also included. Some of the students are used to learning by listening to the experts, and we added mini-lectures with the idea of reaching all types of learning styles and preferences.

- *Class discussions:* This part of the module aims to create a community of inquiry. The social presence of the community starts building up in this section. The initial discussions in Module One facilitate student and instructor introductions, and it is the first place that the community is able to interact together. One of the main reasons that students drop out of online courses is feelings of isolation; they do not feel connected with the other students and the instructor. The instructor is encouraged to respond to all students, or at least as many as possible.
- *Assessments*: In each module there are two types of assessments, non-graded self-check activities and graded quizzes. The self-check activities are created to prepare students for the quiz and to review the learned concepts. They are designed as interactivities, engaging students in activities such as labeling, matching, system designing, and so on.
- *QA section*: In the last section in the module, students can ask questions to their peers or the instructor, and share comments and ideas. This offers another discussion-type section to emphasize COI.

3.4.1.2.- LMS selection

The team explored different options for LMS hosting services. Some companies were actually contacted (Schoology, D2L and CANVAS), while others were just explored (Moodle and Blackboard). The final decision to use CANVAS was made based on economic criteria and ease of use. CANVAS is one of the products of Instructure an LMS supplier. Particularly, CANVAS is the section where MOOCs can be hosted, but this company also offers an OER reservoir to share own resources and use content from other institutions. For Excelsior's MOOC the content was developed during phase I of the research and programmed within the MOOC environment. In January of 2014 we opened it for enrollment. Phase II of the development is explained in the next section.

3.4.2 Phase II: content delivery

The MOOC had been offered in February of 2014 and had a total of 3,320 students enrolled. 317 students completed the course, this give us a 9.5% completion rate.

On the first day of the course, an announcement from the instructor was posted for the students with important information on how to navigate the course, the course expectations, tasks, how to contact the instructor, and so on. A new module unlocks every week and is kept open until the end of the course. This practice encourages students to revisit any concepts they would like to review. During this phase of the course, quantitative research data was collected. The students were asked to voluntarily complete the Self-Rating Scale of Self-Directed Learning (SRSSDL) a SDL survey validated by Cadorin, Bortoluzzi, and Palese (2013) from the original created by Guglielmino (1977).

More detailed information about the instruments used in Phase II is summarized in Table 3.5.

Table 3.5
Research Process: Instruments, Techniques and Procedures for Phase II

Phase II	Tasks	Timeline	Description of Research	Instruments	Description of Instruments
Content Delivery	Coordinate, teach and monitor MOOC offerings	1rst MOOC term: February 2014	Positivist-explanatory (quantitative)	SDL readiness scale questionnaire	40-item questionnaire to measure the SDL competence of MOOC users developed by Cadorin et al. (2013)

3.4.3 Phase III: end of course research

A week after the students finished their course, an end of course survey was sent out to them. This instrument comprises two parts: Instrument A: *Demographics and motivation* survey and Instrument B: *Community of inquiry* survey. Instrument A has been self-developed and validated by a group of experts. Validation correspondence and comments from the experts can be found in the annex. Instrument B was developed by Arbaugh et al (2008).

The first instrument (A) gathers data on students' personal motivations for taking the MOOC and student demographic information. The second instrument (B) collects students' impressions about the community of inquiry presences and how they experienced them during the course. Table 3.6 has more detailed information on the instruments and the tasks performed during the end of course research.

Table 3.6

Research Process: Instruments, Techniques and Procedures for Phase III

Phase III	Tasks	Timeline	Description of Research	Instruments	Description of Instruments
End of Course Research	Create and distribute survey of MOOC participants for demographic information and motivation, and COI presences	After completion of MOOC	Interpretative (qualitative)	A. Creation and distribution of the demographics and motivation survey	Instrument A: 16-item demographics and motivation survey self-developed with the help of a panel of experts
				B. Distribution of COI presences questionnaire	Instrument B: COI questionnaire developed by Arbaugh, Cleveland-Innes, Diaz, Garrison, Ice, Richardson & Swan (2008)
	Create and execute student interviews and expert focus group	After completion of MOOC	Critical Theory	C. Creation and distribution of student interviews	Instrument C: Student interviews with 11 items self-developed and validated by a panel of experts
				D. Creation and distribution of a focus group questionnaire for experts to explore their opinions	Instrument D: Focus group questionnaire for experts has 17 items and was self-developed and validated by a panel of experts

In the next section we describe the instruments in each of the phases, with the reasons why we selected them. During the first phase of the development, content creation, we did not use any instrument; therefore we are starting our description with Phase II: Content Delivery

3.5.- Instruments

During this section of the methodology we would like to describe the steps that were followed to create and validate, if necessary, each of the instruments used in the research.

3.5.1.- Phase II instruments: SD instrument

This phase of the research falls under the positivist-explanatory part of our study and aims to collect quantitative data on SDL perceptions in MOOC takers.

The instrument used during this phase is the Self-Rating Scale of Self-Directed Learning (SRSSDL), a SDL survey validated by Cadorin, Bortoluzzi, and Palese (2013) from the original created by Guglielmino (1977). The original instrument and subsequent revisions aim to measure the attitudes, skills and characteristics that comprise an individual's level of readiness to manage their own learning and be self-directed. This instrument is the most widely used in the field of SDL (Merriam, Baumgartner, & Caffarella, 2007)

Table 3.7 provides a brief summary of the type of research, the name of the instrument and a brief description.

Table 3.7
Self-Rating Scale of Self-Directed Learning (SRSSDL)

Description of Research	Instruments	Description of Instruments
Positivist-explanatory (quantitative)	SDL readiness scale questionnaire	40-item questionnaire to measure the SDL competence of MOOC users developed by Cadorin, Bortoluzzi, and Palese, (2013)

We have chosen to use this instrument because it is the most up-to-date survey to measure SDL skills. The final instrument contains forty items that can be classified in the following categories: awareness, attitudes, motivation, learning strategies, learning methods, learning activities, and constructing knowledge.

3.5.1.1.- Variable definitions

The variables offered by this instrument are:

1. *Antecedents of SDL skills*: This data gives us information about awareness, attitudes and motivation towards learning and starting new tasks.
2. *Skills needed to effectively manage the process of SDL*: This data gives us information about learning strategies, learning methods, learning activities and interpersonal skills.
3. *Constructing knowledge*: This data gives us information about how the individuals actively construct knowledge, not through interaction, but through actively engaging with course content.

3.5.1.2.- Indicators

Once we have defined the variables, we mapped them to the indicators to create the instrument, as can be seen in Table 3.8.

Table 3.8
Variables and Indicators for Instrument A: Self-Rating Scale of Self-Directed Learning (SRSSDL)

Variable	Indicators
1. Antecedents of SDL skills	Awareness SD.1.1 I identify my learning needs. SD.1.2 I am able to select the most suitable method for my learning. SD.1.3 I keep up to date with the range of learning resources available. SD.1.4 I am responsible for my learning process. SD.1.5 I am responsible for identifying the areas I need training in. SD.1.6 I am able to maintain my motivation for learning over time. SD.1.7 I am able to plan and define my learning goal. Attitudes SD.1.8 I maintain good interpersonal relationship with others. SD.1.9 My communication is effective. SD.1.10 I find it easy to work in collaboration with others. SD.1.11 I am able to express my ideas freely. SD.1.12 I find it necessary to create interdisciplinary relations in order to maintain social harmony. SD.1.13 I am able to express my ideas effectively in writing. SD.1.14 I appreciate any criticism as a basis for improving my learning. SD.1.15 I keep an open mind to points of view different from my own. Motivations SD.1.16 New learning is challenging for me. SD.1.17 I consider problems as challenges. SD.1.18 I am motivated by other people's success. SD.1.19 I organize my self-learning activities in order to develop an ongoing learning approach in my life. SD.1.20 I make use of any opportunities that come my way. SD.1.21 I am internally motivated to develop and improve my learning method.
2. Skills needed to	Learning Strategies

Variable	Indicators
effectively manage the process of SDL	SD.2.1 I am able to identify my areas of strength and weakness. SD.2.2 I am able to assess my learning progress. SD.2.3 I am able to assess the achievement of my learning objectives. SD.2.4 I am able to identify my learning strategies. SD.2.5 I am able to define my role within a group. Learning Methods SD.2.6 I make notes or summarize all my ideas, thoughts, and new learning. SD.2.7 I enjoy exploring information even beyond the prescribed aims of the course. SD.2.8 My concentration and my attention increase when I read a complex study content. SD.2.9 I go back over and revise my lessons. Learning Activities SD.2.10 I think simulation is an effective didactic technique. SD.2.11 I think case studies are an effective didactic technique. SD.2.12 I find that interactive sessions are more effective than listening to lectures. SD.2.13 I find that role play is a useful technique for complex learning. Interpersonal Skills SD.2.10 I take part in group discussions. SD.2.11 I feel the need to share information with others. SD.2.12 I find the support of my peers very effective. SD.2.13 My interaction with others helps me develop my program of further learning.
3. Constructing knowledge	SD.3.1 I think conceptual maps are an effective learning technique. SD.3.2 I use conceptual maps as a useful method for understanding a wide range of information.

3.5.2.- Phase III instrument layout

Within this part of the research, we are conducting our investigation under two paradigms: interpretative and critical theory research. Phase III has four instruments, two belonging to each of the paradigms:

Interpretative investigation:

- Instrument A: Demographic Information and Motivation to Take a MOOC
- Instrument B: COI in MOOC (Arbaugh, Cleveland-Innes, Diaz, Garrison, Ice, Richarson & Swan, 2008)

Critical theory research:

- Instrument C: Student Interviews
- Instrument D: Expert Focus Groups

A brief description of each instrument is shared below:

- *Instrument A* is a demographic and motivation survey, which aimed to collect data on students' demographics and their motivation to take the MOOC. Validation for instrument A can be found in the Appendix. The validations were accomplished through informal conversations with the panel of experts and through email exchanges. A summary of comments and the final validation can be found in the Appendix.
- *Instrument B* is the COI questionnaire, which was used to collect data about student perceptions of COI when taking the MOOC.
- *Instrument C* is a student interview questionnaire that aims to collect further information on students' opinions about social presence within

the COI of the course. Validation for instrument C can be found in the Appendix. The validations were accomplished through informal conversations with the panel of experts and through email exchanges. A summary of comments and the final validation can be found in the Appendix

- *Instrument D* is the expert focus group which was used to collect further data about MOOC design and the cognitive presence. Validation for instrument D can be found in the Appendix. The validations were accomplished through informal conversations with the panel of experts and through email exchanges. A summary of comments and the final validation can be found in the Appendix

3.5.2.1.- Instrument A: demographic information and motivation to take a MOOC

The main objective of this instrument was to collect demographic data about the MOOC takers and information about their motivation to take the MOOC. Particularly:

1. We wanted to gather data related to personal demographic information.
2. Related to the main reasons to register for the MOOC.
3. Related to the main reasons as to why students remained engaged during the MOOC.
4. And related to reasons why students decided not to pursue the MOOC anymore.

In order to answer these questions we created *Instrument A* by defining the variables, identifying dimensions for each variable, and finally determining empirical indicators for each one (Sierra Bravo, 2001). The final variables are the result of our conversations with the panel of experts and the literature research conducted to define them.

3.5.2.1.a.- Variable definitions

The variables selected for this instrument were:

1. *Personal demographic information*: This data will gives information about different students' profiles, places of residency, and English language proficiency levels.
2. *Main reasons to register for the MOOC*: This data gives us information about the motivation behind enrolling in a MOOC.
3. *Main reasons to keep engaged during the MOOC*: This data gives us information about the reasons students have to keep engaged during the MOOC.
4. *Main reasons to stop pursuing the MOOC:* This data gives us information about situations and concerns that prevented students from finishing the MOOC.

3.5.2.1.b.- Indicators

Once we defined the variables, we mapped them to the indicators to create the instrument, as seen in Table 3.9.

Table 3.9

Variables and Indicators for Instrument A

Variable	Indicators
1. Personal demographic information	A.1.1 Age A.1.2 Gender: male A.1.3 Gender: female A.1.4 Country of residence when taking the MOOC A.1.5 First language: English A.1.6 First language: Other A.1.7 Level of English proficiency: Beginner A.1.8 Level of English proficiency: Intermediate A.1.9 Level of English proficiency: Advanced A.1.10 Highest degree of education: Elementary studies A.1.11 Highest degree of education: High school degree or equivalent (e.g. GED) A.1.12 Highest degree of education: Some college but no degree A.1.13 Highest degree of education: Associate's degree A.1.14 Highest degree of education: Bachelor's degree A.1.15 Highest degree of education: Master's degree A.1.16 Highest degree of education: PhD or EdD A.1.17 Highest degree of education: Other

Variable	Indicators
2. Main reasons to register for the MOOC	A.2.1 Academic curiosity A.2.2 Formal education is too expensive A.2.3 Thought the course would be fun A.2.4 Thought it would help to improve my performance in my current job position A.2.5 Not geographically close to educational institutions A.2.6 Looking to change careers A.2.7 The course relates to my current program A.2.8 The course relates to my current job responsibilities A.2.9 The skills that I can learn from the course may be helpful in obtaining a new job

Variable	Indicators
	A.2.10 Make professional connections
	A.2.11Other
	A.2.12 Experience in the cybersecurity field: No experience
	A.2.13 Experience in the cybersecurity field: Beginning
	A.2.14 Experience in the cybersecurity field: Intermediate
	A.2.15 Experience in the cybersecurity field: Advanced
	A.2.16 Main goals at registration related with completion: Complete the course
	A.2.17 Main goals at registration related with completion: Obtain a certificate of completion
	A.2.18 Main goals at registration related with completion: No expectations about finishing the course
	A.2.19 Main goals at registration related with completion: Other

Variable	Indicators
3. Main reasons to keep engaged during the MOOC	A.3.1 Helpful learning activities: Videos
	A.3.2 Helpful learning activities: Discussions
	A.3.3 Helpful learning activities: Self-checks
	A.3.4 Helpful learning activities: Quizzes
	A.3.5 Helpful learning activities: Readings
	A.3.6 Helpful learning activities: PowerPoint presentations
	A.3.7 Helpful learning activities: Other

Variable	Indicators
4. Main reasons to stop pursuing the MOOC	A.4.1 MOOC completion: yes
	A.4.2 MOOC completion: no
	A.4.3 Main obstacles for completion: Disappointment with MOOC content
	A.4.4 Main obstacles for completion: Conflict with my job
	A.4.5 Main obstacles for completion: Time constraints
	A.4.6 Main obstacles for completion: Technology unfamiliar
	A.4.7 Main obstacles for completion: Connection problems
	A.4.8 Main obstacles for completion: Family-related issues

Variable	Indicators
	A.4.9 Main obstacles for completion: Clarity of instruction
	A.4.10 Main obstacles for completion: Knowledge of instructor
	A.4.11 Main obstacles for completion: Course workload
	A.4.12 Main obstacles for completion: Course pacing
	A.4.13 Main obstacles for completion: Difficulty with discussions
	A.4.14 Main obstacles for completion: Difficulty communicating with instructor
	A.4.15 Main obstacles for completion: Other
	A.4.16 Previous online learning experience: Have taken other MOOCs
	A.4.17 Previous online learning experience: Have taken other online courses for credit
	A.4.18 Previous online learning experience: Have taken other online courses but not for credit
	A.4.19 Previous online learning experience: No online experience
	A.4.20 Likelihood of taking a MOOC again: no plans on taking more MOOCs
	A.4.21 Likelihood of taking a MOOC again: might take another MOOC again
	A.4.22 Likelihood of taking a MOOC again: will keep taking MOOCs as part of my lifelong learning

Once we had the indicators for each of the variables established, we created the survey. An introduction to the questionnaire, an explanation of the research, and a voluntary participation form were also provided to the students.

The questionnaires were delivered by email. The link to the form was sent to all participants a week after the course ended. The population for the instrument was the 3,320 students in the MOOC.

Validation was through a panel of experts. Experimental validation was not appropriate for our questionnaire because the selected sample is not representative of any population; we just wanted to explore this particular course within the context of Excelsior College. With the aim of exploring the different sides and key elements of online learning, the instrument has a large number of questions and items, making it difficult to empirically validate. Some of the questions offer the possibility of open responses; this has been done on purpose with the aim of collecting MOOC takers' opinions and particularities.

The panel of experts' validation was conducted by the Director of Outcomes and Assessment from the School of Business and Technology at Excelsior College, the Associate Dean of Business from the School of Business and Technology at Excelsior, and a recent PhD graduate from the EDUTIC group at Blanquerna University.

- Dr. Robin Berenson, Associate Dean for Business Programs, School of Business and Technology, Excelsior College, Albany NY
- Dr. Scott Dolan, Director of Assessment and Program Evaluation, School of Business and Technology, Excelsior College, Albany NY
- Dr. Jordi Diaz Gibson, researcher at FPCCEE Blanquerna, University Ramon Llull, Barcelona, Spain

The majority of the discussions were conducted informally during short meetings. Final suggestions were collected and can be found in the Annex.

3.5.2.2.- Instrument B: COI in MOOCs

The COI questionnaire we chose to use has been developed by Arbaugh et al. (2008). The main objective of this instrument is to collect data about teaching, cognitive and social presences within the course environment. Particularly:

1. We wanted to gather data related to the teaching presence in the MOOC.
2. Related to the cognitive presence in the MOOC.
3. And related to the social presence in the MOOC.

3.5.2.2.a.- Variable definitions

The variables selected for this instrument were:

1. *Teaching presence in the MOOC*: This data gives us information about different students' profiles, places of residency and English language proficiency levels.
2. *Cognitive presence in the MOOC*: This data gives us information about the motivation behind enrolling in a MOOC.
3. *Social presence in the MOOC*: This data gives us information about students' reasons that keep them engaged during the MOOC.

3.5.2.2.b.- Indicators

Once we defined the variables, we mapped them to the indicators to create the instrument, as seen in Table 3.10.

Table 3.10
Variables and Indicators for Instrument B

Variable	Indicators
1. **Teaching Presence**	B.1.1 Clearly communicates course concepts. B.1.2 Clearly communicates course goals. B.1.3 Clearly communicates how to participate in course learning activities. B.1.4 Clearly communicates important due dates/time frames for learning activities. B.1.5 Clearly identifies areas of agreement and disagreement on course topics. B.1.6 Clearly guides the class towards understanding course topics. B.1.7 Clearly keeps course participants engaged and participating in productive dialogue. B.1.8 Clearly keeps the course participants on task. B.1.9 Clearly encourages course participants to explore new concepts in this course. B.1.10 Clearly reinforces the development of a sense of community among course participants. B.1.11 Clearly focuses discussion on relevant issues. B.1.12 Clearly provides feedback to help students with strengths and weaknesses. B.1.13 Clearly provides timely feedback.

Variable	Indicators
2. **Cognitive Presence**	B.2.1 Problems posed increased my interest in course issues. B.2.2 Course activities piqued my curiosity. B.2.3 I felt motivated to explore content related questions. B.2.4 I utilized a variety of information sources to explore problems posed in this course. B.2.5 Brainstorming and finding relevant information helped me resolve content related questions. B.2.6 Online discussions were valuable in helping me

Variable	Indicators
	appreciate different perspectives. B.2.7 Combining new information helped me answer questions raised in course activities. B.2.8 Learning activities helped me construct explanations/solutions. B.2.9 Reflection on course content and discussions helped me understand fundamental concepts in this class. B.2.10 I can describe ways to test and apply the knowledge created in this course. B.2.11 I have developed solutions to course problems that can be applied in practice. B.2.12 I can apply the knowledge created in this course to my work or other non-class related activities.

Variable	Indicators
3. Social Presence	B.3.1 Getting to know other course participants gives me a sense of belonging in the course. B.3.2 I was able to form distinct impressions of some course participants. B.3.3 Online or web-based communication is an excellent medium for social interaction. B.3.4 I felt comfortable conversing through the online medium. B.3.5 I felt comfortable participating in the course discussions. B.3.6 I felt comfortable interacting with other course participants. B.3.7 I felt comfortable disagreeing with other course participants while still maintaining a sense of trust. B.3.8 I felt that my point of view was acknowledged by other course participants. B.3.9 Online discussions helped me to develop a sense of collaboration.

3.5.2.3.- Instrument C: Student interviews

The main objective for this instrument was to collect social data from the MOOC takers, complement the COI questionnaire data with students' opinions, and understand what they experience when taking the MOOC. Particularly:

1. We wanted to gather data on the personal opinions of MOOC takers about their sense of community of learning.
2. Related to satisfaction levels as to whether students felt able to express opinions freely.
3. Related to personal opinions about the importance of belonging to a group when taking the MOOC.
4. And related to independent learning during the MOOC.

In order to answer these questions we created *Instrument C* by defining the variables, identifying dimensions for each variable, and finally determining empirical indicators for each (Sierra Bravo, 2001).

3.5.2.3.a.- Variable definitions

The variables selected for this instrument were:

1. *Sense of community of learning*: This data gives us information about the students' sense of community when taking the MOOC.
2. *Open communication*: This data gives us information about how the students felt when sharing opinions with the group.
3. *Group cohesion*: This data gives us information about the importance of belonging to a group.

4. *Self-directedness:* This data gives us information about independent learning when taking the MOOC.

3.5.2.3.b.- Indicators

Once we defined the variables, we mapped them to the indicators to create the instrument. The indicators are written so as to give interviewees a chance of explaining their thoughts, to generate discussions, and to encourage open-ended responses. The indicators were changed to questions when conducting the interviews.

Table 3.11
Variables and Indicators for Instrument C

Variable	Indicators
1. Sense of Community of Learning	C.1.1 Experience a sense of community while taking the MOOC C.1.2 Role of discussion in learning C.1.3 Discussions as aim to experience some learning community

Variable	Indicators
2. Open Communication	C.2.1 Feel free to communicate opinion with the rest of the students C.2.2 Opportunity to express your opinion/thoughts within the course

Variable	Indicators
3. Group Cohesion	C.3.1 Feelings that you belonged to the group during the

Variable	Indicators
	MOOC
	C.3.2 Importance of communicating with other students or getting their input

Variable	Indicators
4. Self-Directedness	
	C.4.1 How and what did you learn during the MOOC
	C.4.2 Learn on your own, versus from an instructor or through interactions with other students
	C.4.3 Strategies you use to learn independently during the MOOC
	C.4.4 Learning goals
	C.4.5 Learning monitoring
	C.4.6 Challenges

Once we established the indicators for each of the variables we created the survey. An explanation of the research and a voluntary participation form was also provided to the students. The interviews have been recorded and transcribed; they are included in the Annex. Validation for the instrument was done by the same panel of experts mentioned before:

- Dr. Robin Berenson, Associate Dean for Business Programs, School of Business and Technology, Excelsior College, Albany NY
- Dr. Scott Dolan, Director of Assessment and Program Evaluation, School of Business and Technology, Excelsior College, Albany NY
- Dr. Jordi Diaz Gibson, researcher at FPCCEE Blanquerna, University Ramon Llull, Barcelona, Spain

Experimental validation was not necessary for our questionnaire because the selected sample is not representative of any population and we are not going to generalize results. We aim to triangulate outcomes from our instruments and verify a conclusion using different sources of data.

3.5.2.4.- Instrument D: Experts focus group

The questions for the focus group were developed with the idea of expanding our understanding of the teaching and cognitive presences by having an informal discussion with the experts who helped develop the course. Particularly:

1. We wanted to gather data related to triggering events within the cognitive presence.
2. Related to content quality and design in the MOOC.
3. Related to integration of cognitive presence within the MOOC.
4. Related to cognitive presence transfer.
5. Related to the design and organization of the MOOC from the teaching presence perspective.
6. Related to the facilitation of discourse from the teaching presence perspective.
7. And related to direct instruction within the teaching presence.

3.5.2.4.a.- Variable definitions

The variables selected for this instrument were:

1. *Processes or practices used to capture students' attention*: This data gives us information about pedagogical techniques used by designers and instructors to capture students' attention early on.
2. *Content quality and design of the MOOC*: This data gives us information about the strengths and weaknesses of the MOOC design and content.
3. *Learning activities' alignment with goals of the course*: This data gives us information about how well the outcomes align with activities and assessments.
4. *New ideas students take with them after the MOOC:* This data gives us information about student learning evidences.
5. *Design and organization of the MOOC*: This data gives us information about how the design and activities facilitate teaching.
6. *Processes and practices to facilitate community of discourse:* This data gives us information about what practices were followed by the instructor to overcome course size and create community.
7. *Direct instruction:* This data gives us information about direct instruction opportunities within the MOOC and how they were managed by the instructor.

3.5.2.4.b.- Indicators

Once we defined the variables we mapped them to the indicators to create the instrument.

Table 3.12
Variables and Indicators for Instrument D

Variable	Indicators
1. Processes or practices used to capture students' attention	D.1.1 What pedagogical techniques have you used to motivate students when teaching the MOOC? D.1.2 What pedagogical techniques were used to motivate students when designing the MOOC?

Variable	Indicators
2. Content quality and design of the MOOC	D.2.1 MOOC content compared with face to face formats. D.2.2 Strengths and weaknesses in the MOOC. D.2.3 Alignment with Marzano's taxonomy.

Variable	Indicators
3. Learning activities' alignment with goals of the course	D.3.1 MOOC learning outcomes compared with more traditional courses. D.3.2 Alignment of MOOC outcomes. D.3.3 Suggestions for different activities that might work better.

Variable	Indicators
4. New ideas students take with them after the MOOC	D.4.1 Evidence of student benefits when taking the MOOC. D.4.2 Concepts students learned during the MOOC. D.4.3 MOOC advantages for students.

Variable	Indicators
5. Design and organization of the MOOC	D.5.1 Design and organization of the MOOC. D.5.2 MOOC design facilitates teaching. D.5.3 Sections/activities that we could design better.

Variable	Indicators
6. Processes and practices to facilitate community of discourse	D.6.1 Practices to facilitate discussion in a massive environment. D.6.2 Challenges in discussions in massive environments. D.6.3 Other variables that challenge instruction in massive environments.

Variable	Indicators
7. Direct instruction	D.7.1 Opportunities for direct instruction in online massive environments. D.7.2 Methods to emphasize direct instruction.

3.6.- Summary

Within this chapter we presented the chosen paradigms for our investigation: interpretative, positivist-explanatory and critical theory. These three frameworks are present in the chosen methodology of mixed methods research. This investigation was deployed following three phases:

- Phase I: Content Development: This is where MOOC design and content creation occurred. LMS platforms were also investigated and the final selection was made.
- Phase II: Content Delivery: During this phase, the students took the MOOC during eight weeks, the SDL instrument was distributed and data collected.
- Phase III: End of Course Research: During this phase, the information for the rest of the instruments was collected.

In this chapter we also presented each of the instruments, their variables and indicators, and the selected items. In the next chapter we will present the data collected through all the instruments and discuss how we analyzed it.

RESULTS

#4

4.1.- Abstract

This chapter present a visual representation of the data collected for each of the instruments. Each instrument displays variables and indicators and the results for each. Some preliminary conclusions and first impressions are also shared. An exhaustive analysis of the results is presented in the following chapter, chapter 5: Results.

Resumen

Este capítulo presenta una representación visual de los datos recogidos para cada uno de los instrumentos. Para cada instrumento se presentan las variables, los indicadores y los resultados, así cómo algunas conclusiones preliminares. El análisis exhaustivo de los datos recogidos se presentará en el capítulo siguiente, capítulo 5: Resultados

4.2.- Introduction

This chapter presents the data collected from our five instruments. Chapter 5 will provide the discussion of the results and the final conclusions for this dissertation and will give insights about our probing and research questions. Chapter 6 will be presenting main conclusions limitations of the research and future researches. In order to introduce the instruments and their results we would like to restate our central probing questions again:

- **Main probing research question**: What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?

- **Secondary probing research question**: Could MOOCs designed using Marzano's learning taxonomy empower student's SDL skills and make them more successful in these open environments?

In order to respond to our core research questions we broke down the investigation into specific objectives to collect adequate information and be able to triangulate results:

- Firstly we describe current profiles of MOOC takers and depict MOOCs as COI spaces. (Exploratory analysis). This part of the investigation gives us a snapshot of the student population taking the MOOC, and we also collect information on the MOOC environment understood as a COI. We are collecting data about our population sample, their demographics and motivation to take this particular MOOC. This part of the research is aligned with the first probing question and adds insights to the COI within MOOC's, the different presences and how the students experience them.

- Secondly we analyze the correlation between completing a MOOC and the degree of SDL readiness. (Correlational analysis): within this part of the investigation we compare SDL student levels and their level of involvement within the MOOC. We are looking for any relationship we could establish between these two variables and how one influences the other.
- And thirdly we analyze experts and MOOC takers' opinions on MOOC design and quality, identifying and assessing key factors (processes and practices) that could help to better design and deliver future MOOCs. (Critical analysis). This part of the investigation aims to gather data to respond to our second probing questions related with design, experts and students opinions about the MOOC.

Table 4.1 shows the alignment between probing, research questions and instruments.

Table 4.1
Instruments and connection with research questions

	Probing Question 1 **What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?**	**Probing Question 2** **Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?**
Research Questions	1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC? 1b. How is the MOOC COI perceived and experienced by MOOC takers? Cognitive presence Teaching presence Social presence 2a. What is the SDL readiness levels of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?	3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI? 3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?
Instruments	Phase II Instrument SD: Readiness Scale questionnaire Phase III Instrument A: Demographic and motivation information Instrument B: COI presences questionnaire	Phase III Instrument C: Student interviews Instrument D: Experts focus groups

4.3.- Instrument results overview

Each of the instruments aligns with one research question (Fig. 4.1). Instrument A aims to give insights to the research question 1a. Instrument B collects information in order to respond to research question 1b. Instruments C and D assess research questions 3a and 3b and instrument SD relates with research questions 2a and 2b.

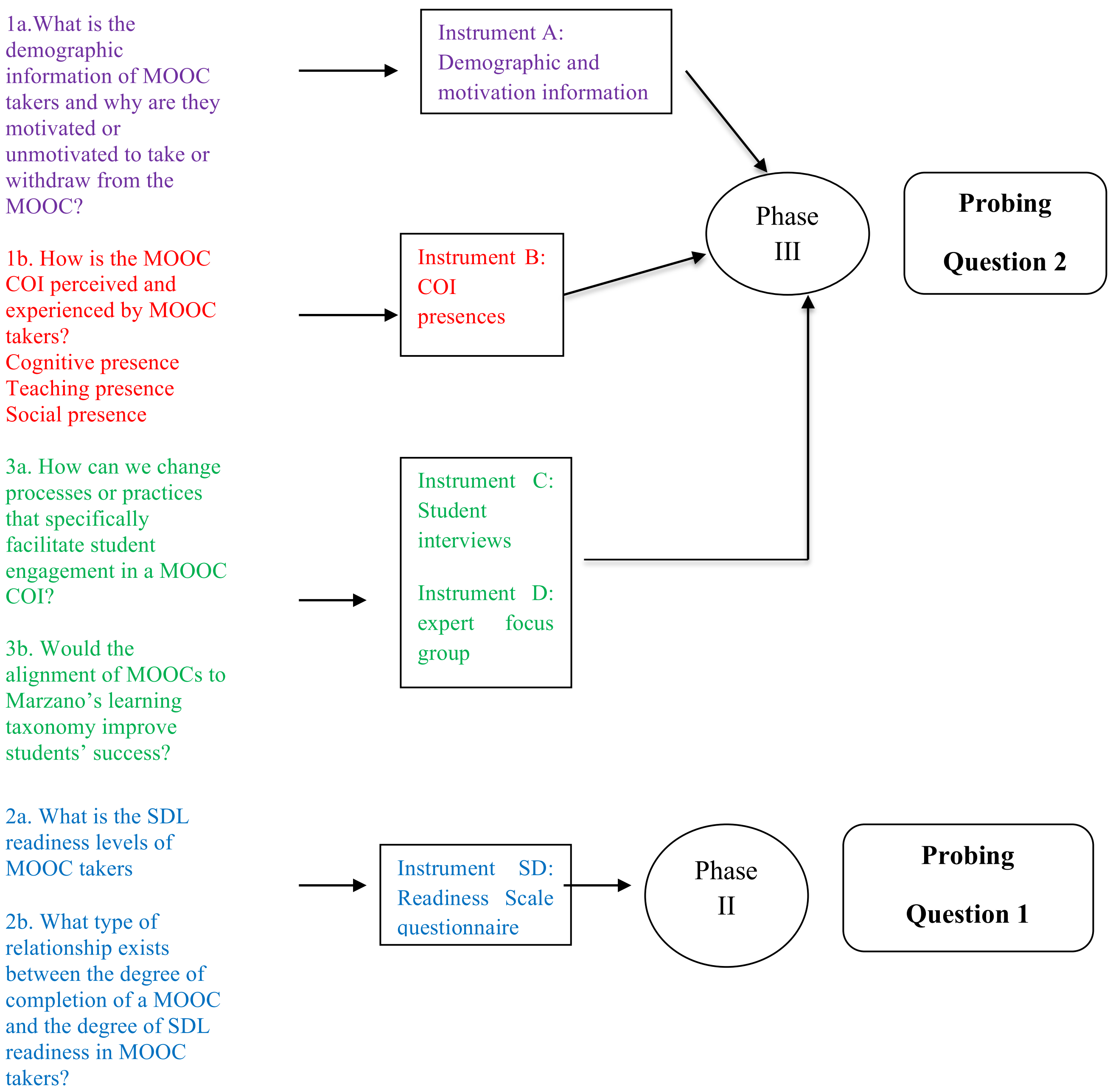


Figure. 4.1 Research questions aligned with instruments and research phases

We are going to display the results of this investigation following the same order that we used to present the instruments and their variables in chapter 3. Even though the full analysis of the results will be provided in chapter 5, we have included a brief descriptive summary of each of them in this chapter, to start identifying trends and possible patterns. Table 4.2, 4.3, 4.4, 4.5 and 4.6 show the number of participants for each of the instruments:

Table 4.2
Participants for SD instrument and quizzes taken

MOOC takers	SDL survey takers	Number of quizzes taken	SDL surveys taken by students in each group
3320	434 (13.1% return rate)	Took 1 quiz but did not finish:52	48
		1 quiz: 890	31
		2 quizzes: 151	20
			Sub-total 99
		3 quizzes: 52	11
		4 quizzes: 34	10
		5 quizzes: 47	13
		6 quizzes: 40	14
		7 quizzes: 32	11
		8 quizzes: 317	76
			Sub-total 135
			Total 99+135=234

Table 4.2 indicates that the completion ratio for this MOOC is 9.5% if we count 8 quizzes taken as an indicator of completing the course (317/3,320=0.095=9.5%). For now the number of students that will be taking part in this investigation is n=234. This number indicates the total students that took the SDL survey.

Table 4.3 indicates the number of takers for the Instrument A: Motivation and demographics survey. This survey was sent to all the participants (3320) by email after the end of the MOOC. Responses were accepted during a month after the end date of the MOOC.

Table 4.3
Participants for Instrument A: Motivation and demographics

	MOOC takers	Motivation and demographics survey takers
Participants	3320	126 (3.8 % return rate)

Table 4.4 indicates the number of takers for Instrument B: COI in MOOCs survey. This survey was sent to all the participants (3320) by email after the end of the MOOC. Responses were accepted during a month after the end date of the MOOC.

Table 4.4
Participants for Instrument B: COI in MOOCs

	MOOC takers	COI in MOOC survey takers
Participants	3320	140 (4.2% return rate)

Table 4.5 indicates the number of participants in Instrument C: Students interviews. The request to participate in the interview was sent to all participants (3320) by email after the end of the MOOC. 11 students accepted to participate in the discussions, 9 were the final participants.

Table 4.5
Participants for Instrument C: student interviews

	MOOC takers	Students accepted to participate	Students interviewed
Participants	3320	11	9 (81.8% final participation)

Table 4.6 indicates the number of participants in Instrument D: Experts' focus group. The request to participate in the focus group was sent by email to 4 members of the development team, 3 of them finally accepted to take part in the discussion (Faculty Program Director, Subject Matter Expert and Instructor)

Table 4.6
Participants for Instrument D: Experts focus group

	Experts invited to the focus group	Experts in the focus group
Participants	4	3 (75% final participation

In the following sections we are presenting the results for each of the instruments

4.4.- Instrument SD

During this phase of the research quantitative data was collected. The students taking the MOOC were asked to voluntarily complete the Self-Rating Scale of Self-Directed Learning (SRSSDL) a SDL survey validated by by Cadoring, Bortoluzzi and Palese (2013) from the original one created by Guglielmino (1977), and we obtained 434 responses out of 3,320 giving us a 13.1% completion ratio.

More detailed information about the instruments used in Phase II is summarized in Table 4.7.

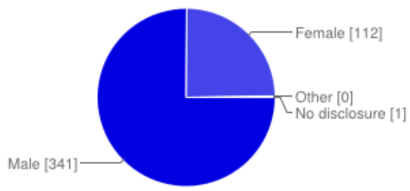
Table 4.7
Research process: instruments, techniques and procedures for Phase II

Phase II	Description of research	Instruments	Description of instruments
Content Delivery	Positivist-explanatory (quantitative)	SDL Readiness Scale questionnaire	40 items questionnaire to measure the SDL competence within MOOC users developed by Cadorin et al. (2013)

Our goal is to display the results of the SDL items and how this questionnaire correlates with the amount of quizzes taken during the MOOC. This is going to give us an indicator of the relationship between level of SDL and inclination to finish the MOOC.

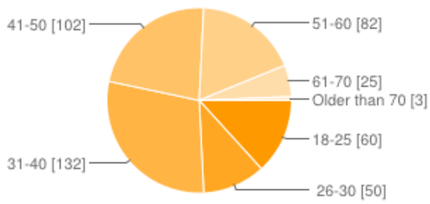
This particular questionnaire is a likert scale with 5 possible values: Never, seldom, sometimes, often, always. Numerical values had been added to the parametric responses as: 1-never, 2-seldom, 3-sometimes, 4-often, 5-always). We also collected demographic data (gender and age), Fig.4.2.

Gender



Male	**341**	75.1%
Female	**112**	24.7%
Other	**0**	0%
No disclosure	**1**	0.2%

Age



18-25	**60**	13.2%
26-30	**50**	11%
31-40	**132**	29.1%
41-50	**102**	22.5%
51-60	**82**	18.1%
61-70	**25**	5.5%

Figure. 4.2 Gender and age data collected from SLD questionnaire

Summary of results for gender and age

Three fourths of the MOOC populations are males and one fourth is composed by females. We had one participant that did not want to reveal his/her gender. The majority of students are in the range of 31 to 60 years old; students younger than 31 are more numerous than students older than 60. In the figure 4.3 we represent the histogram showing mean and standard deviation for all the SDL surveys collected:

SDL_score

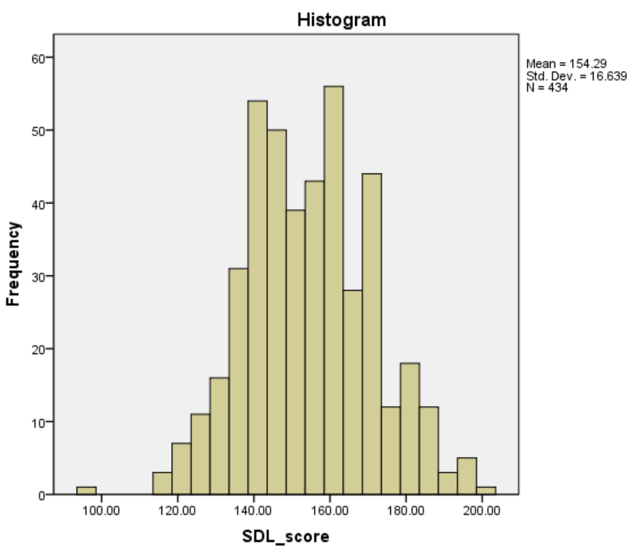
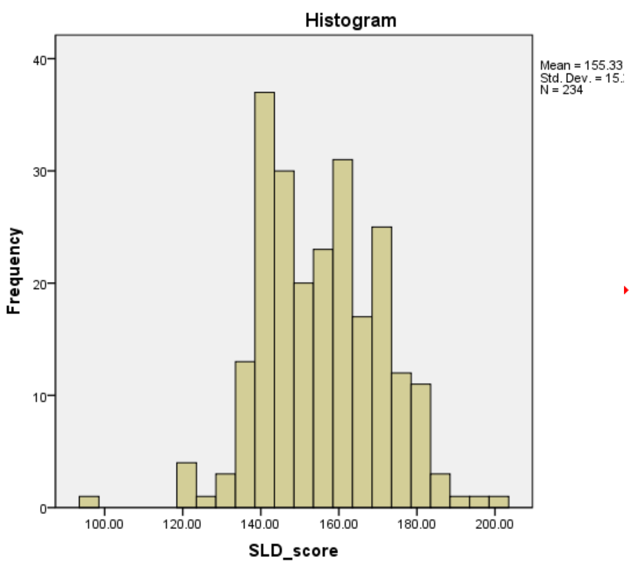


Figure. 4.3. Total SDL values (all students, raw data)

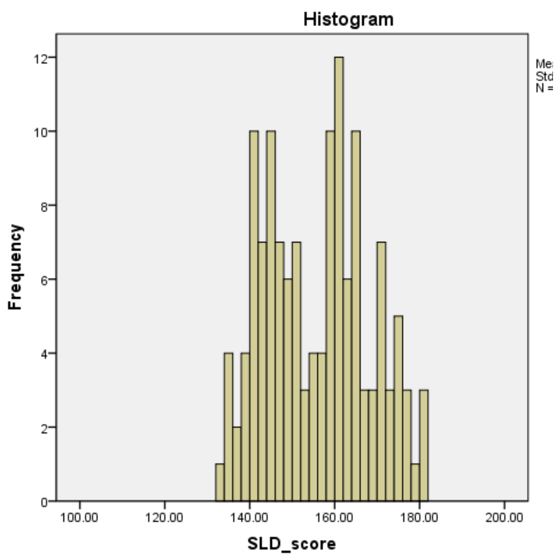
N=434, Mean=154.29, Std. dev 16.6

Figure 4.4 and 4.5 show SDL scores for the students that we have information about quizzes taken.

SLD_score



SLD_score



N=234, Mean=155.33, Std. dev 15.3
Figure. 4.4 SDL histogram for students that took at least one quiz

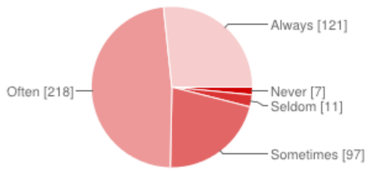
N=135, Mean=155.36, Std. dev 12.
Figure. 4.5 SDL histogram fo students that took at least 3 quizzes

From these histograms we can see that the SDL averages are consistent within our population and appears follow normal distributions. In the figures below we report the summary for each of the items in the SDL questionnaire. We group the results following the variables and indicators that we have chosen during the methodology, table 4.8:

Table 4.8
Variable results for the SDL questionnaire

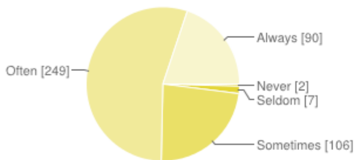
Variable	Indicators
1.Antecedents of SDL skills	**Awareness**

SD.1.1 I identify my learning needs



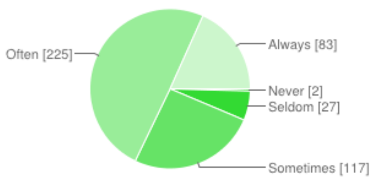
Never	**7**	1.5%
Seldom	**11**	2.4%
Sometimes	**97**	21.4%
Often	**218**	48%
Always	**121**	26.7%

SD.1.2 I am able to select the most suitable method for my learning



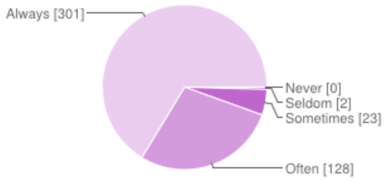
Never	**2**	0.4%
Seldom	**7**	1.5%
Sometimes	**106**	23.3%
Often	**249**	54.8%
Always	**90**	19.8%

SD.1.3 I keep up to date with the range of learning resources available



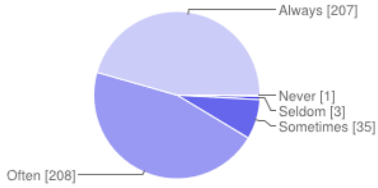
Never	**2**	0.4%
Seldom	**27**	5.9%
Sometimes	**117**	25.8%
Often	**225**	49.6%
Always	**83**	18.3%

SD.1.4 I am responsible for my learning process



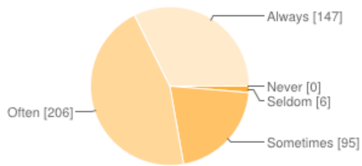
Never	**0**	0%
Seldom	**2**	0.4%
Sometimes	**23**	5.1%
Often	**128**	28.2%
Always	**301**	66.3%

SD.1.5 I am responsible for identifying the areas I need training in



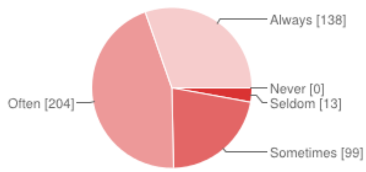
Never	**1**	0.2%
Seldom	**3**	0.7%
Sometimes	**35**	7.7%
Often	**208**	45.8%
Always	**207**	45.6%

SD.1.6 I am able to maintain my motivation for learning over time



Never	**0**	0%
Seldom	**6**	1.3%
Sometimes	**95**	20.9%
Often	**206**	45.4%
Always	**147**	32.4%

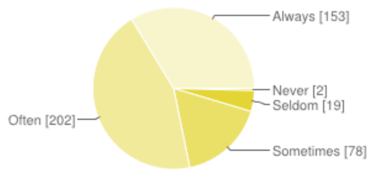
SD.1.7 I am able to plan and define my learning goal



Never	**0**	0%
Seldom	**13**	2.9%
Sometimes	**99**	21.8%
Often	**204**	44.9%
Always	**138**	30.4%

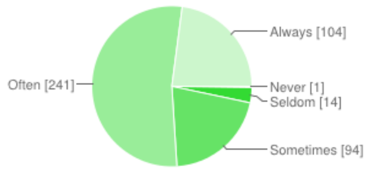
Attitudes

SD.1.8 I maintain good interpersonal relationship with others



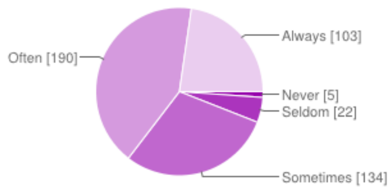
Never	**2**	0.4%
Seldom	**19**	4.2%
Sometimes	**78**	17.2%
Often	**202**	44.5%
Always	**153**	33.7%

SD.1.9 My communication is effective



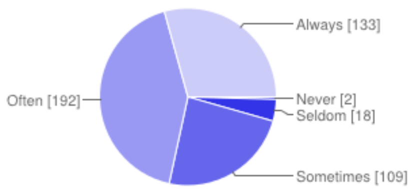
Never	**1**	0.2%
Seldom	**14**	3.1%
Sometimes	**94**	20.7%
Often	**241**	53.1%
Always	**104**	22.9%

SD.1.10 I find it easy to work in collaboration with others



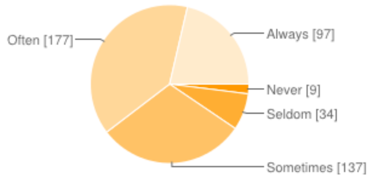
Never	**5**	1.1%
Seldom	**22**	4.8%
Sometimes	**134**	29.5%
Often	**190**	41.9%
Always	**103**	22.7%

SD.1.11 I am able to express my ideas freely



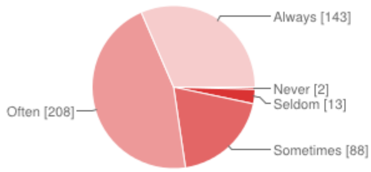
Never	**2**	0.4%
Seldom	**18**	4%
Sometimes	**109**	24%
Often	**192**	42.3%
Always	**133**	29.3%

SD.1.12 I find it necessary to create interdisciplinary relations in order to maintain social harmony



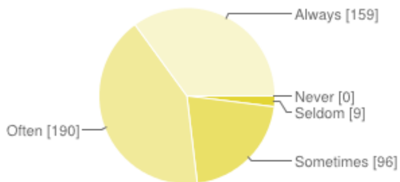
Never	**9**	2%
Seldom	**34**	7.5%
Sometimes	**137**	30.2%
Often	**177**	39%
Always	**97**	21.4%

SD.1.13 I am able to express my ideas effectively in writing



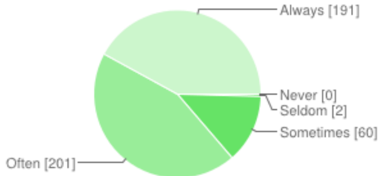
Never	**2**	0.4%
Seldom	**13**	2.9%
Sometimes	**88**	19.4%
Often	**208**	45.8%
Always	**143**	31.5%

SD.1.14 I appreciate any criticism as a basis for improving my learning



Never	**0**	0%
Seldom	**9**	2%
Sometimes	**96**	21.1%
Often	**190**	41.9%
Always	**159**	35%

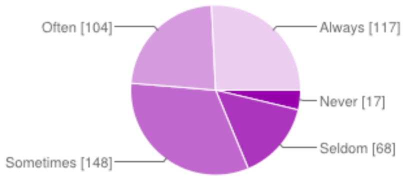
SD.1.15 I keep an open mind to points of view different from my own



Never	**0**	0%
Seldom	**2**	0.4%
Sometimes	**60**	13.2%
Often	**201**	44.3%
Always	**191**	42.1%

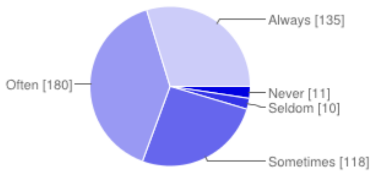
Motivations

SD.1.16 New learning is challenging for me



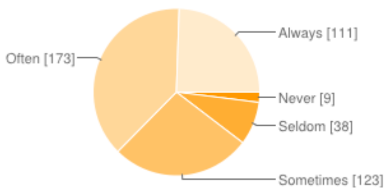
Never	**17**	3.7%
Seldom	**68**	15%
Sometimes	**148**	32.6%
Often	**104**	22.9%
Always	**117**	25.8%

SD.1.17 I consider problems as challenges



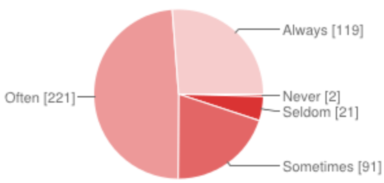
Never	**11**	2.4%
Seldom	**10**	2.2%
Sometimes	**118**	26%
Often	**180**	39.6%
Always	**135**	29.7%

SD.1.18 I am motivated by other people's success



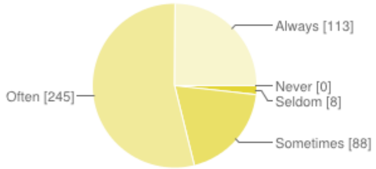
Never	**9**	2%
Seldom	**38**	8.4%
Sometimes	**123**	27.1%
Often	**173**	38.1%
Always	**111**	24.4%

SD.1.19 I organize my self-learning activities in order to develop an ongoing learning approach in my life



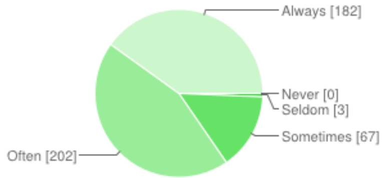
Never	**2**	0.4%
Seldom	**21**	4.6%
Sometimes	**91**	20%
Often	**221**	48.7%
Always	**119**	26.2%

SD.1.20 I make use of any opportunities that come my way



Never	**0**	0%
Seldom	**8**	1.8%
Sometimes	**88**	19.4%
Often	**245**	54%
Always	**113**	24.9%

SD.1.21 I am internally motivated to develop an improve my learning method

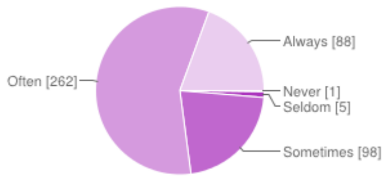


Never	**0**	0%
Seldom	**3**	0.7%
Sometimes	**67**	14.8%
Often	**202**	44.5%
Always	**182**	40.1%

2.Skills needed to effectively manage the process of SDL

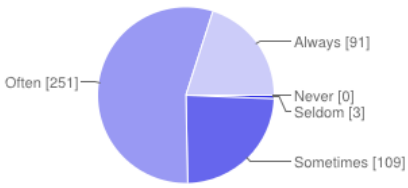
Learning Strategies

SD.2.1 I am able to identify my areas of strength and weaknesses



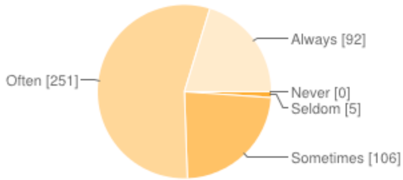
Never	**1**	0.2%
Seldom	**5**	1.1%
Sometimes	**98**	21.6%
Often	**262**	57.7%
Always	**88**	19.4%

SD.2.2 I am able to assess my learning progress



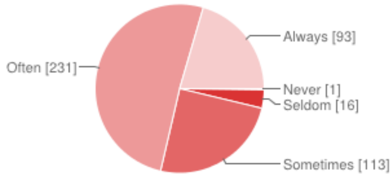
Never	**0**	0%
Seldom	**3**	0.7%
Sometimes	**109**	24%
Often	**251**	55.3%
Always	**91**	20%

SD.2.3 I am able to assess the achievement of my learning objectives



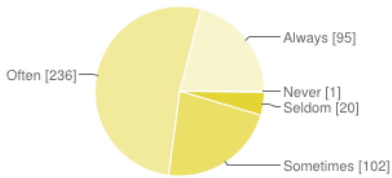
Never	**0**	0%
Seldom	**5**	1.1%
Sometimes	**106**	23.3%
Often	**251**	55.3%
Always	**92**	20.3%

SD.2.4 I am able to identify my learning strategies



Never	**1**	0.2%
Seldom	**16**	3.5%
Sometimes	**113**	24.9%
Often	**231**	50.9%
Always	**93**	20.5%

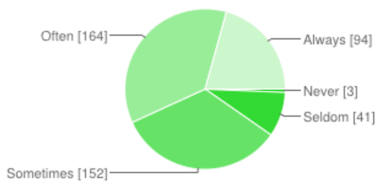
SD.2.5 I am able to define my role within a group



Never	**1**	0.2%
Seldom	**20**	4.4%
Sometimes	**102**	22.5%
Often	**236**	52%
Always	**95**	20.9%

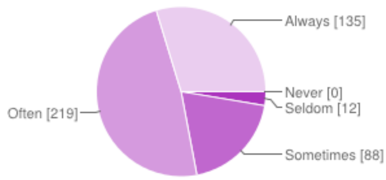
Learning Methods

SD.2.6 I make notes or summarize all my ideas, thoughts, and new learning



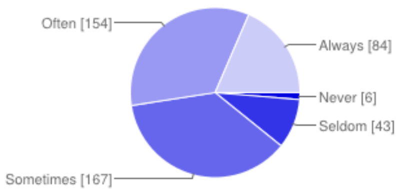
Never	**3**	0.7%
Seldom	**41**	9%
Sometimes	**152**	33.5%
Often	**164**	36.1%
Always	**94**	20.7%

SD.2.7 I enjoy exploring information even beyond the prescribed aims of the course



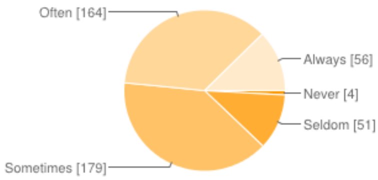
Never	**0**	0%
Seldom	**12**	2.6%
Sometimes	**88**	19.4%
Often	**219**	48.2%
Always	**135**	29.7%

SD.2.8 My concentration and my attention increase when I read a complex study content



Never	**6**	1.3%
Seldom	**43**	9.5%
Sometimes	**167**	36.8%
Often	**154**	33.9%
Always	**84**	18.5%

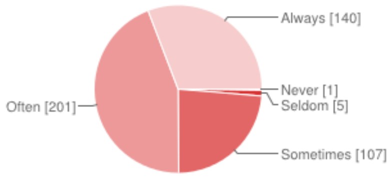
SD.2.9 I go back over and revise my lessons



Never	**4**	0.9%
Seldom	**51**	11.2%
Sometimes	**179**	39.4%
Often	**164**	36.1%
Always	**56**	12.3%

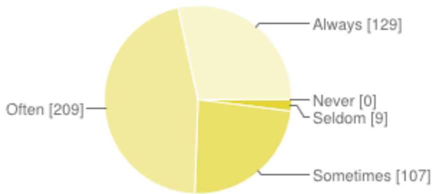
Learning Activities

SD.2.10 I think simulation is an effective didactic technique



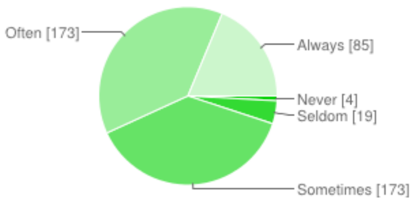
Never	**1**	0.2%
Seldom	**5**	1.1%
Sometimes	**107**	23.6%
Often	**201**	44.3%
Always	**140**	30.8%

SD.2.11 I think case studies are an effective didactic technique



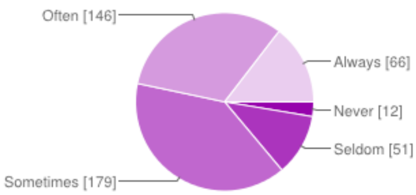
Never	**0**	0%
Seldom	**9**	2%
Sometimes	**107**	23.6%
Often	**209**	46%
Always	**129**	28.4%

SD.2.12 I find that interactive sessions are more effective than listening to lectures



Never	**4**	0.9%
Seldom	**19**	4.2%
Sometimes	**173**	38.1%
Often	**173**	38.1%
Always	**85**	18.7%

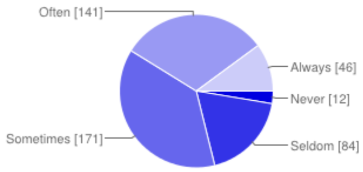
SD.2.13 I find that role play is a useful technique for complex learning



Never	**12**	2.6%
Seldom	**51**	11.2%
Sometimes	**179**	39.4%
Often	**146**	32.2%
Always	**66**	14.5%

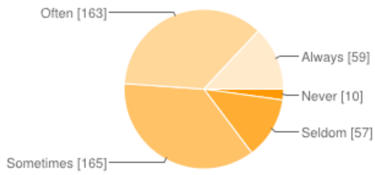
Interpersonal Skills

SD.2.10 I take part in group discussions



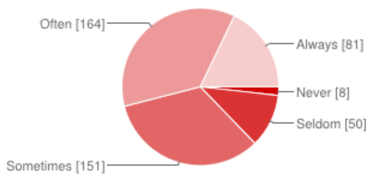
Never	**12**	2.6%
Seldom	**84**	18.5%
Sometimes	**171**	37.7%
Often	**141**	31.1%
Always	**46**	10.1%

SD.2.11 I feel the need to share information with others



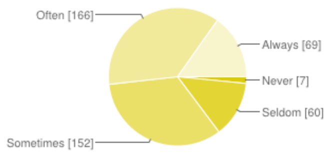
Never	**10**	2.2%
Seldom	**57**	12.6%
Sometimes	**165**	36.3%
Often	**163**	35.9%
Always	**59**	13%

SD.2.12 I find the support of my peers very effective



Never	**8**	1.8%
Seldom	**50**	11%
Sometimes	**151**	33.3%
Often	**164**	36.1%
Always	**81**	17.8%

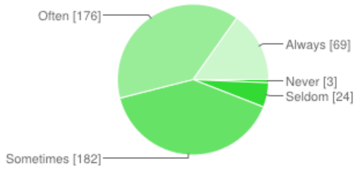
SD.2.13 My interaction with others helps me develop my program of further learning



Never	**7**	1.5%
Seldom	**60**	13.2%
Sometimes	**152**	33.5%
Often	**166**	36.6%
Always	**69**	15.2%

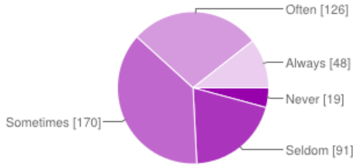
3.Constructing Knowledge

SD.3.1 I think conceptual maps are an effective learning technique



Never	**3**	0.7%
Seldom	**24**	5.3%
Sometimes	**182**	40.1%
Often	**176**	38.8%
Always	**69**	15.2%

SD.3.2 I use conceptual maps as a useful method for understanding a wide range of information



Never	**19**	4.2%
Seldom	**91**	20%
Sometimes	**170**	37.4%
Often	**126**	27.8%
Always	**48**	10.6%

4.4.1 Summary of results for instrument SD

We divided our questionnaire in different variables: antecedents of SDL skills, skills needed to effectively manage the process of SDL, and constructing knowledge. Within each of these variables the instrument suggests some indicators. We are describing the average results from these indicators in the following summary points. A full analysis is presented in Chapter 5, this is just an snapshot of the situation.

1. Antecedents of SDL skills:

    a. **Awareness**: students in the MOOC are often/always aware of their learning needs (~65%)

   b. **Attitudes:** students in the MOOC have often/always a positive attitude towards relating and communication with others (~60%)
   c. **Motivations**: students in the MOOC find learning often/always challenging (~50%)
2. Skills needed to effectively manage the process of SDL
   a. **Learning strategies**: students in the MOOC are sometimes/often aware of their own learning strategies (~70%)
   b. **Learning methods**: students in the MOOC often explore information beyond the course content (~40%)
   c. **Learning activities**: students in the MOOC believe simulations and case studies are effective learning activities to use in MOOCs (~80%)
   d. **Interpersonal skills**: students in the MOOC sometimes take part in discussions and think interpersonal skills are important (~40%)
3. Constructing knowledge: Students in the MOOC believe that conceptual maps are sometimes/often an important tool to aid learning (~65%)

4.4.2 Correlation results: SD grade and quizzes taken

We are also interested in exploring the relationship that exists between the final SDL score and how many quizzes the students took during the MOOC. This correlation will give us insights to respond to our research question 2b: "What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?"

We have chosen to use "quizzes taken" as our independent variable because the data was easily accessible and it gives an idea of how many modules the students were active in. Discussions and self-checks were more difficult to track. In our study the selected LMS, (CANVAS), provided information in the grade book about quizzes taken. It was the best accurate tracking mechanism we could use to assure students' participation in each of the modules; therefore, we selected quizzes as our variable. We finally had n=234 students that we could correlate together, meaning that we had data on SDL final grades (students voluntarily took the SDL survey) and were active enough in the MOOC for us to be able to collect data on how many quizzes were they taking (from Q1 to Q8). We will use a one-way ANOVA to test this dependency and the IBM-SPSS Statistics 19 software package to perform the statistical analysis. We are correlating the relationship between the final scores for the SDL questionnaire and the quizzes taken per student:

Dependent Variable: SDL final scores

Independent variable: Number of quizzes taken

In order for us to use the one-way ANOVA test our data should fulfill the following requirements:

1. The dependent variable (SDL final scores) needs to be ordinal or continuous. Likert scales are accepted at this level.
2. Independent variable (tests taken) should consist of two or more independent groups. We have chosen to explore six independent groups. The rational for these choices is explained in Fig. 4.8:
    a. Students that took 3 quizzes (nf3= 11)
    b. Students that took 4 quizzes (nf4=10)

c. Students that took 5 quizzes (nf5=13)

d. Students that took 6 quizzes (nf6= 14)

e. Students that took 7 quizzes (nf7= 11)

f. Students that took all 8 quizzes and therefore finished the MOOC (f=76)

Data related with these independent groups is displayed in table 4.9:

Table 4.9
Participants for SD instrument

	SDL survey takers	Quiz takers (M3 to M8)	Students that took SDL survey and M3 to M8 quizzes	
Participants	434 (13.1% return rate)	Q3: 52	11(21%)	
		Q4: 34	10(29%)	
		Q5: 47	13(28%)	
		Q6: 40	14(35%)	
		Q7: 32	11(34%)	
		Q8: 317	76(24%)	
			Total	**135 (31.1%)**

3. Independence of observations, meaning that there is no dependence between the individuals in the 6 subgroups of the independent variables. An individual does not belong to more than one of the subgroups.

4. No significant outliners. We have detected data points that did not follow the same usual pattern as the other ones. One outliner was detected by the stem and leaf plot in SPSS for SDL score

(Fig. 4.6) and another one when we conducted the same plot for both SDL and quizzes (Fig. 4.7). We removed both outliners and decided not to use it in the analysis, our sample now is n=133

SLD_score

```
SLD_score Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

     1.00 Extremes    (=<96)
     1.00       11 .  9
     3.00       12 .  013
     1.00       12 .  8
     7.00       13 .  0234444
    12.00       13 .  555677888999
    41.00       14 .  00000000000000011111222222222333333444444
    28.00       14 .  5555555566667777778888899999
    20.00       15 .  00000111122333344444
    24.00       15 .  555566666778888888999999
    34.00       16 .  0000000000111111222222333444444444
    13.00       16 .  5556778899999
    24.00       17 .  000000000111222223334444
    11.00       17 .  55667788999
     8.00       18 .  00000112
     3.00       18 .  556
     2.00       19 .  04
      .00       19 .
     1.00       20 .  0

 Stem width:      10.00
 Each leaf:        1 case(s)
```

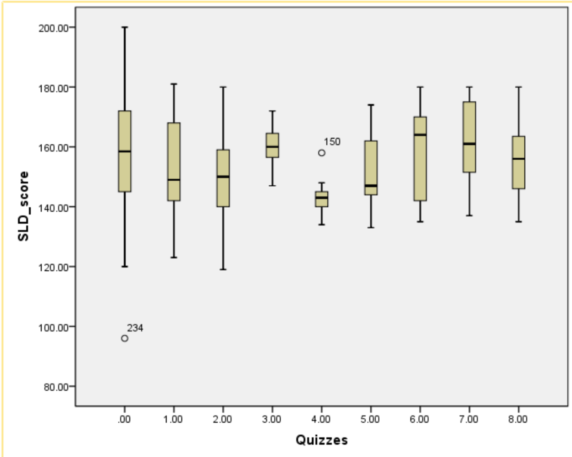
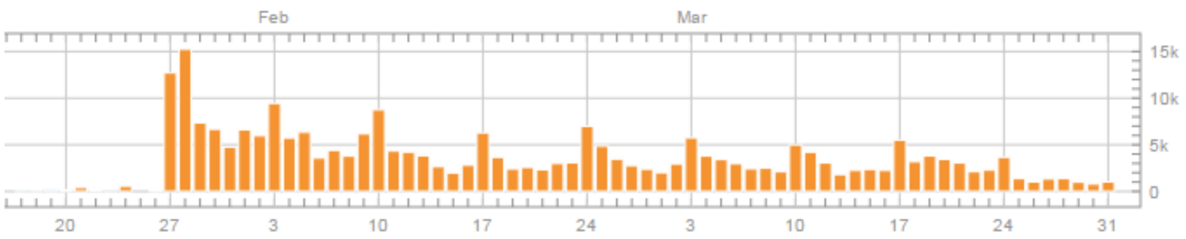


Figure. 4.6 Stem and leaf plot with outliners for SDL scores

Figure. 4.7 Stem and leaf plot with outliners for SDL and quizzes taken

We decided to add a final requirement to our data due to the environment that the information is coming from. Researchers in the field state that the participation in the MOOC's changes week by week and can be difficult to decide what the real pattern is. (Kop, Fourier &, Mak, 2011). Data shows that the first two weeks in a MOOC can be misleading on the amount of students really taking the course. Third week can be considered the starting point of the "normal" amount of students that are doing something else than just exploring and login in for a few minutes. We are conducting our analysis with data from active students from Module 3 (week 3) to M8 (week 8). Our analysis period expands from February 10th to March 24th (6 weeks). Moreover, in table 4.2 we can see that during week 1 we have more than 900 active students taking quizzes, and more than 150 in week 2. The following weeks stabilize around similar percentages for the following weeks.

The following diagram, Fig. 4.8 shows the participants accessing the MOOC and being active in the different modules week by week. We can see that module one and two show a higher number of students than the average trend that is shown for week 3 to 8. Due to this final data cribbage the number of students that we can correlate between having taken the SDL questionnaire and some quizzes (3 or more) is reduced to n = 135.



Week1 Week 2 Week3 Week 4 Week5 Week6 Week7 Week8

x axis: weeks

y axis: number of participants

Figure.4.8 Display active students per week. Image retrieved from https://learn.canvas.net/courses/95/analytics

Below in table 4.10 we are displaying the results from one-way ANOVA test. This test will give us information about differences between the six groups with respect to the final SDL score: we will be able to see the correlation between number of quizzes taken and SDL scores.

Our hypothesis for the ANOVA test will be:

$H_0 = \mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$ where μ are the means for each group

H_A= the means are not all equal

If H_0 is true, all the means for each of the groups (nf3, nf4, nf5, nf6, nf7,f8) are equal, with no statistical differences. If the significance value provided by the ANOVA test is smaller than 0.05 we can reject the null hypothesis (H_0) and state that the groups have some type of difference between them. Table 4.10 provides the information for the ANOVA test:

Table 4.10
ANOVA results

ANOVA

SLD_score

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2564.132	5	512.826	3.765	.003
Within Groups	17433.906	128	136.202		
Total	19998.037	133			

Table 4.10 shows a significant level of 0.003 (p=0.003) which is below 0.05, and therefore we can state that there is a statistically significant difference in the mean of final SDL scores between the different groups of students that took different amounts of quizzes.

In order to know a little bit more about what group differs the most from the other ones we perform a multiple comparison test, presented in table 4.11. The nf4 group (students that took 4 quizzes) Is the one showing differences with the other groups.

Table 4.11
Multiple comparisons with groups

Multiple Comparisons

SLD_score
Tukey HSD

(I) Quizzes	(J) Quizzes	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
nf3	nf4	17.24545*	5.09924	.012	2.4915	31.9994
	nf5	8.31469	4.78112	.509	-5.5188	22.1482
	nf6	1.18831	4.70221	1.000	-12.4169	14.7935
	nf7	-1.27273	4.97635	1.000	-15.6711	13.1257
	f	5.42545	3.76803	.703	-5.4768	16.3277
nf4	nf3	-17.24545*	5.09924	.012	-31.9994	-2.4915
	nf5	-8.93077	4.90890	.457	-23.1340	5.2725
	nf6	-16.05714*	4.83208	.014	-30.0381	-2.0762
	nf7	-18.51818*	5.09924	.005	-33.2721	-3.7642
	f	-11.82000*	3.92890	.036	-23.1877	-.4523
nf5	nf3	-8.31469	4.78112	.509	-22.1482	5.5188
	nf4	8.93077	4.90890	.457	-5.2725	23.1340
	nf6	-7.12637	4.49509	.610	-20.1323	5.8795
	nf7	-9.58741	4.78112	.345	-23.4209	4.2461
	f	-2.88923	3.50616	.963	-13.0338	7.2553
nf6	nf3	-1.18831	4.70221	1.000	-14.7935	12.4169
	nf4	16.05714*	4.83208	.014	2.0762	30.0381
	nf5	7.12637	4.49509	.610	-5.8795	20.1323
	nf7	-2.46104	4.70221	.995	-16.0662	11.1442
	f	4.23714	3.39776	.813	-5.5938	14.0681
nf7	nf3	1.27273	4.97635	1.000	-13.1257	15.6711
	nf4	18.51818*	5.09924	.005	3.7642	33.2721
	nf5	9.58741	4.78112	.345	-4.2461	23.4209
	nf6	2.46104	4.70221	.995	-11.1442	16.0662
	f	6.69818	3.76803	.484	-4.2041	17.6005
f	nf3	-5.42545	3.76803	.703	-16.3277	5.4768
	nf4	11.82000*	3.92890	.036	.4523	23.1877
	nf5	2.88923	3.50616	.963	-7.2553	13.0338
	nf6	-4.23714	3.39776	.813	-14.0681	5.5938
	nf7	-6.69818	3.76803	.484	-17.6005	4.2041

*. The mean difference is significant at the 0.05 level.

In table 4.12 we present the detail of this information and the values for the group nf4 and the other ones.

Table 4.12
Multiple comparisons nf4 with other nf's

Post Hoc Tests

SLD_score
Tukey HSD

(I) Quizzes	(J) Quizzes	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
nf4	nf3	-17.24545*	5.09924	.012	-31.9994	-2.4915
	nf5	-8.93077	4.90890	.457	-23.1340	5.2725
	nf6	-16.05714*	4.83208	.014	-30.0381	-2.0762
	nf7	-18.51818*	5.09924	.005	-33.2721	-3.7642
	f	-11.82000*	3.92890	.036	-23.1877	-.4523

*. The mean difference is significant at the 0.05 level.

Key:

nf4: students that did not finish and took 4 quizzes

nf3: students that did not finish and took 3 quizzes

nf5: students that not finish and took 5 quizzes

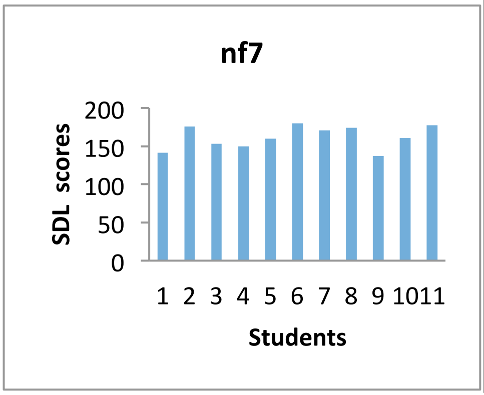
nf6: students that did not finish and took 6 quizzes

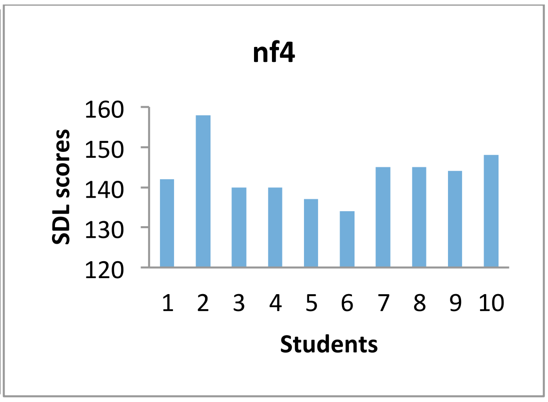
nf7: students that did not finish and took 7 quizzes

f: students that finished and therefore took 8 quizzes

Table 4.12 shows significant differences in SDL scores between the group of students that took 4 quizzes (nf4) and all the other ones (nf3 p=0.012, nf6 p=0.014, nf7 p=0.005 and f p=0.036) but not with the group that took 5 quizzes (nf5, p=0.457). The SDL scores of students that took 4 quizzes are statistically different in reference with the ones that took, 3, 6,7 or 8 quizzes, but not 5.

From table 4.12 we can see that the highest difference between means is shown for students that took 4 quizzes (nf4) and students that took 7 quizzes (nf7), in the following figure we provide the bar graph for each of the groups and the SDL score average:





SDL average (nf7)= 161.8 SDL average (nf4)= 143.3

Figure.4.9 nf4 and nf7 SDL score values and average

Summary of results for SDL and quizzes correlation

For now our correlation results are showing that there is statistical difference between the final grade for SDL surveys between students that took 4 quizzes and the ones that took 3,6, 7 and 8 but not 5, being the maximum difference in the SDL average value for students taking 4 quizzes and taking 7. An appropriate discussion and possible reasons to explain why this happens will be shown in chapter 5.

4.5.- Instrument A: demographic and motivation information

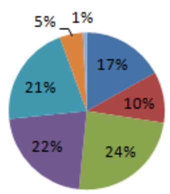
A week after the students finished their course an end-of-the course survey was sent to all the students enrolled in the MOOC even if they did not complete it (n=3,320), we received 126 surveys back 3.8% return ratio. We are interested in researching all students' profiles and some questions were specific for the students that could not finish. The survey comprises two parts: the first one collects data on *Demographics and motivation* (Instrument A) and the second one collects data on *Community of Inquiry* (Instrument B*)*. Both instruments were sent at the same time to increase return rates, and to minimize unwanted communication with students. Table 4.13 summarizes instrument A:

Table 4.13
Instrument A

Phase III	Description of research	Instruments	Description of instruments
End of Course research	A.Creation and distribution of th Demographics and Motivation survey	Interpretative (qualitative)	14 items self-developed with the help of a panel of experts

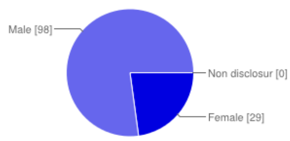
The first data display we are presenting is the demographic information of MOOC takers: age, gender, (Fig.4.10) country of residency while taking the MOOC (Fig.4.11), and Table 4.14 presents the variable results for instrument A.

Age



Gender

Female	**29**	22.8%
Male	**98**	
Non disclosure	**0**	

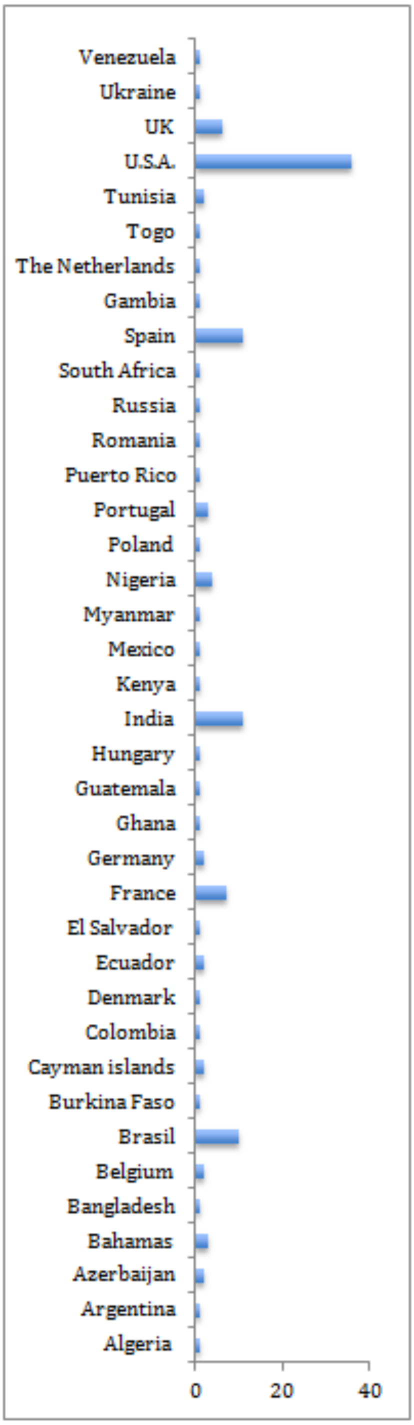


18-25	**21**	16.6%
26-30	**13**	10.3%
31-40	**31**	24.6%
41-50	**28**	22.2%
51-60	**26**	20.6%
61-70	**6**	4.7%
Older than 70	**1**	0.7%

Figure.4.10 Age and gender data from instrument A

1.Personal demographic information

A.1.4 Country of residence when taking the MOOC

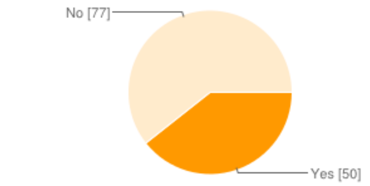


Country	Count	Percent age
Algeria	1	0.8
Argentina	1	0.8
Azerbaijan	2	1.6
Bahamas	3	2.4
Bangladesh	1	0.8
Belgium	2	1.6
Brazil	10	7.9
Burkina Faso	1	0.8
Cayman islands	2	1.6
Colombia	1	0.8
Denmark	1	0.8
Ecuador	2	1.6
El Salvador	1	0.8
France	7	5.6
Germany	2	1.6
Ghana	1	0.8
Guatemala	1	0.8
Hungary	1	0.8
India	11	8.7
Kenya	1	0.8
Mexico	1	0.8
Myanmar	1	0.8
Nigeria	4	3.2
Poland	1	0.8
Portugal	3	2.4
Puerto Rico	1	0.8
Romania	1	0.8
Russia	1	0.8
South Africa	1	0.8
Spain	11	8.7
The Gambia	1	0.8
The Netherlands	1	0.8
Togo	1	0.8
Tunisia	2	1.6
U.S.A.	36	28.6
UK	6	4.8
Ukraine	1	0.8
Venezuela	1	0.8
	126	**100.0**

Figure.4.11 Country of residence when taking the MOOC

Table 4.14 *Variable results for Instrument A*

Variable	Indicators
1.Personal demographic information	A.1.5 and A.1.6 First language: English or other

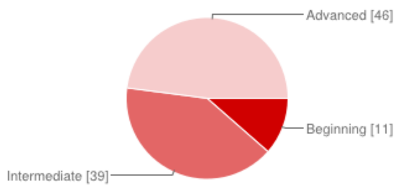


Yes	**50**	39.4%
No	**77**	60.6%

A.1.7 Level of English proficiency: Beginner

A.1.8 Level of English proficiency: Intermediate

A.1.9 Level of English proficiency: Advanced



Beginning	**11**	8.7%
Intermediate	**39**	30.7%
Advanced	**46**	36.2%

A.1.10 Highest degree of education: Elementary studies

A.1.11 Highest degree of education: High School degree or equivalent

A.1.12 Highest degree of education: Some College but no degree

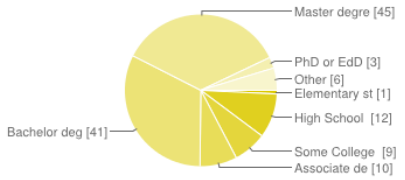
A.1.13 Highest degree of education: Associate degree

A.1.14 Highest degree of education: Bachelor degree

A.1.15 Highest degree of education: Master degree

A.1.16 Highest degree of education: PhD or EdD

A.1.17 Highest degree of education: Other



Elementary studies	**1**	0.8%
High School degree or equivalent (e.g GED)	**12**	9.4%
Some College but no degree	**9**	7.1%
Associate degree	**10**	7.9%
Bachelor degree	**41**	32.3%
Master degree	**45**	35.4%
PhD or EdD	**3**	2.4%
Other	**6**	4.7%

Variable	Indicators
2.Main reasons to register for the MOOC	A.2.1 Academic curiosity A.2.2 Formal education is too expensive A.2.3 Thought the course would be fun A.2.4 Thought it would help to improve my performance in my current job position A.2.5 Not geographically close to educational institutions A.2.6 Looking to change careers A.2.7 The course relates to my current program A.2.8 The course relate to my current job responsibilities A.2.9 The skills that I can learn from the course may be helpful in obtaining a new job A.2.10 Make professional connections A.2.11Other

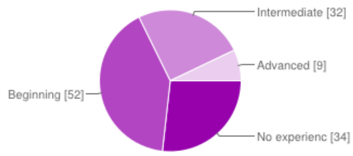
Academic curiosity	**69**	54.3%
Formal education is too expensive	**34**	26.8%
Thought the course would be fun	**30**	23.6%
Thought it would help me to improve my performance in my current job position	**37**	29.1%
I am not geographically close to educational institutions	**10**	7.9%
Looking to change careers	**34**	26.8%
The course relates to my current study program	**39**	30.7%
The course relate to my current job responsibilities	**41**	32.3%
The skills that I can learn from the course may be helpful in obtaining a new job	**48**	37.8%
I wanted to make professional connections	**36**	28.3%
Other	**4**	3.1%

A.2.12 Experience in the Cybersecurity field: No experience

A.2.13 Experience in the Cybersecurity field: Beginning

A.2.14 Experience in the Cybersecurity field: Intermediate

A.2.15 Experience in the Cybersecurity field: Advanced



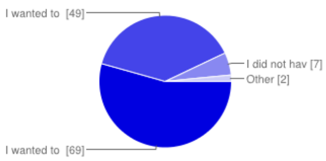
No experience	**34**	26.8%
Beginning	**52**	40.9%
Intermediate	**32**	25.2%
Advanced	**9**	7.1%

A.2.16 Main goals at registration related with completion: Complete the course

A.2.17 Main goals at registration related with completion: Obtain a certificate of completion

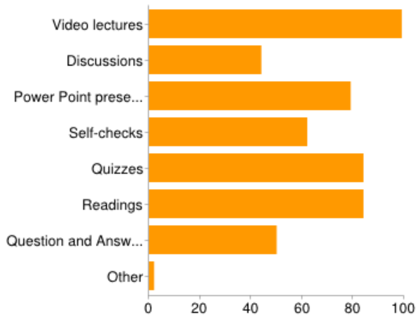
A.2.18 Main goals at registration related with completion: No expectations about finishing the course

A.2.19 Main goals at registration related with completion: Other



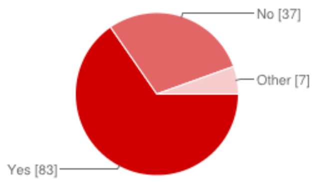
I wanted to complete the course	**69**	54.3%
I wanted to obtain a certificate of completion	**49**	38.6%
I did not have expectations about finishing the course	**7**	5.5%
Other	**2**	1.6%

Variable	Indicators
3.Main reasons to keep engaged during the MOOC	A.3.1 Helpful learning activities: Videos A.3.2 Helpful learning activities: Discussions A.3.3 Helpful learning activities: Self-checks A.3.4 Helpful learning activities: Quizzes A.3.5 Helpful learning activities: Readings A.3.6 Helpful learning activities: PowerPoint presentations A.3.7 Helpful learning activities: Other



Video lectures	**99**	78%
Discussions	**44**	34.6%
Power Point presentations	**79**	62.2%
Self-checks	**62**	48.8%
Quizzes	**84**	66.1%
Readings	**84**	66.1%
Question and Answer section	**50**	39.4%
Other	**2**	1.6%

Variable	Indicators
4.Main reasons to stop pursuing the MOOC	A.4.1 MOOC completion: yes A.4.2 MOOC completion: no



Yes	**83**	65.4%
No	**37**	29.1%
Other	**7**	5.5%

A.4.3 Main obstacles for completion: Disappointment with MOOC content
A.4.4 Main obstacles for completion: Conflict with my job

A.4.5 Main obstacles for completion: Time constrains

A.4.6 Main obstacles for completion: Technology unfamiliar

A.4.7 Main obstacles for completion: Connection problems

A.4.8 Main obstacles for completion: Family-related issues

A.4.9 Main obstacles for completion: Clarity of instructor

A.4.10 Main obstacles for completion: Knowledge of instructor

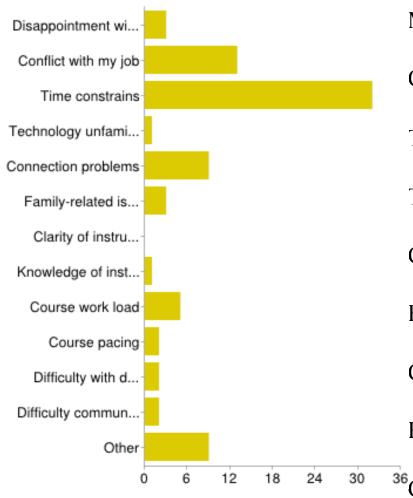
A.4.11 Main obstacles for completion: Course workload

A.4.12 Main obstacles for completion: Course pacing

A.4.13 Main obstacles for completion: Difficulty with discussions

A.4.14 Main obstacles for completion: Difficulty communicating with instructor

A.4.15 Main obstacles for completion: Others



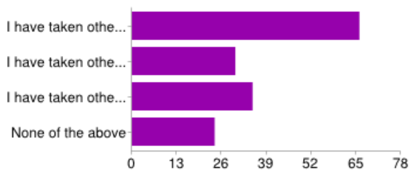
Disappointment with MOOC content	**3**	2.4%
Conflict with my job	**13**	10.2%
Time constrains	**32**	25.2%
Technology unfamiliar	**1**	0.8%
Connection problems	**9**	7.1%
Family-related issues	**3**	2.4%
Clarity of instructor	**0**	0%
Knowledge of instructor	**1**	0.8%
Course work load	**5**	3.9%
Course pacing	**2**	1.6%
Difficulty with discussions	**2**	1.6%
Difficulty communicating with instructor	**2**	1.6%
Other	**9**	7.1%

A.4.16 Previous online learning experience: Have taken other MOOC's

A.4.17 Previous online learning experience: Have taken other online courses for credit

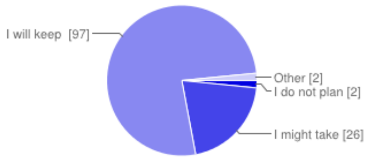
A.4.18 Previous online learning experience: Have taken other online courses but not for credit

A.4.19 Previous online learning experience: No online experience



I have taken other MOOC's	**66**	52%
I have taken other online courses for credit	**30**	23.6%
I have taken other online courses but not for credit	**35**	27.6%
None of the above	**24**	18.9%

A.4.20 Likelihood of taking a MOOC again: no plans on taking more MOOCs
A.4.21 Likelihood of taking a MOOC again: might take another MOOC again
A.4.22 Likelihood of taking a MOOC again: will keep taking MOOC's as part of my lifelong learning



I do not plan on taking more MOOC's	**2**	1.6%
I might take another MOOC	**26**	20.5%
I will keep taking MOOC's as part of my lifelong learning	**97**	76.4%
Other	**2**	1.6%

4.5.1 Summary of results for instrument A

We divided our Instrument A in different variables: personal demographic information, main reasons to register for the MOOC, main reasons to keep engaged during the MOOC, main reasons to stop pursuing the MOOC. We are describing the average results from these indicators in the following summary points:

1. Personal demographic information:

    a. **Age**: students in the MOOC are evenly distributed between ~31 to 60

    b. **Gender:** More than three fourths of the MOOC population is composed by males and around one fourth is composed by females.

c. **Country of residency**: 29% of the students that took the MOOC are from the USA, and around 8% are from Spain, Brazil and India respectively

d. **Language**: 40% of the students have English as a first language and 60% don't. Around ~66% of the non native rated themselves as Intermediate/advanced level

e. **Highest degree of education:** around 70% of the students have bachelor's or masters degrees

2. Main reasons to register for the MOOC

    a. **Main reasons to take the MOOC**: Academic curiosity and relation to job/study program were the main reasons

    b. **Experience in Cybersecurity**: Mainly beginning experience

    c. **Main goals at registration**: the majority of students wanted to complete the course at registration

3. Main reasons to keep engaged during the MOOC

    a. **Helpful learning activities**: video lectures, quizzes and readings were the ones selected the most around a 70%

4. Main reasons to stop pursuing the MOOC

    a. **MOOC completion**: 65% completed the MOOC versus around 30% that did not (we had the option of responding "other" as well)

    b. **Main obstacles to completion**: time constrains 25%, and conflict with job schedule 10%

c. **Previous online learning experience**: around 50% have taken other MOOCs previously

d. **Likelihood of taking a MOOC again**: around 75% of students say that they will keep taking MOOCs a part of their education

At the end of the demographic questionnaire the last question asked the students for anything they wanted to share about the MOOC, and these are some of the insights:

Student A: Discussions should be optional

> "The problem with MOOCs is that discussions are hard to participate in and there is not a lot of incentive to participate in discussions since there are far too many posts to read and there is no reason to expect anyone to read my posts. There is nothing at stake and should not be. It should be optional with a group this size"

Student B: Good to learn independently

> "It is one of the best learning pathway. I am independent learner and I have taken so many online courses before. This one is even better. I enjoyed it. I am also taking an accounting course"

Student C: More Self-paced opportunities

> "It was too bad I could not be entirely self-paced and that my class expired. I did not know that it would expire. If I

> had have know this I would have made sure to complete by deadline. Would be great if you could be clear about the expiration date of the course. Other than that, thought it was a great learning module and format"

Student D: Use of a roadmap

> "The layout of courses may be somehow troubling and allowing confusion. The use of a roadmap could help to get through the weblink, mooc course sections"

Student E: Good teaching presence

> "I'd like firstly to thank you to all the team for this opportunity. The effort made by the teacher to reply to all the posts in forum and to engage new discutions was absolutely stunning. Never seen such a good communication inside a MOOC. Secondly, would it be possible to have more specific and advanced courses, like second part, third part etc."

Student F: Length of videos

> "I am liking the diversity and the brevity of the video content. Many other MOOCs include longer videos by the same presenter. This is better"

4.6.- Instrument B: COI in MOOCs

Instrument B collects data about presences (teaching, social and cognitive) within the COI framework (table 4.15):

Table 4.15
Instrument B

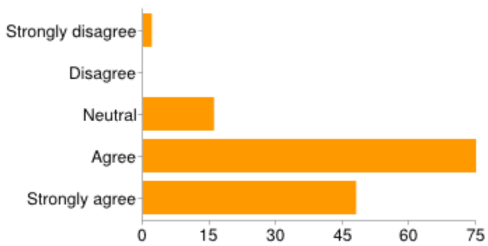
Phase III	Description of research	Instruments	Description of instruments
End of Course research	B. Distribution of COI presences questionnaire	Interpretative (qualitative)	COI questionnaire developed by Arbaugh, Cleveland-Innes, Diaz, Garrison, Ice, Richardson & Swan, (2008)

Tables 4.16, 4.17, 4.18 present the results by presence:

4.6.1 Teaching presence results

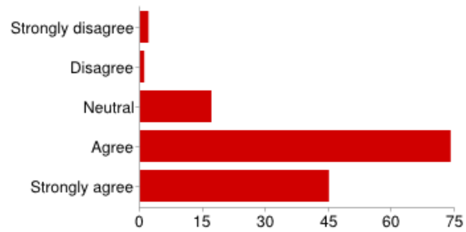
Table 4.16
Teaching presence results

Variable	Indicators
1.Teaching Presence	B.1.1 Clearly communicates course concepts



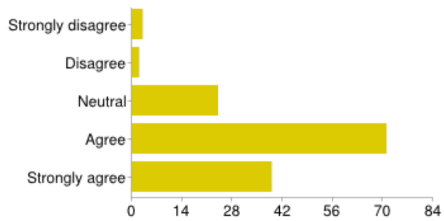
Strongly disagree	**2**	1.5%
Disagree	**0**	0%
Neutral	**16**	11.7%
Agree	**75**	54.7%
Strongly agree	**48**	35%

B.1.2 Clearly communicates course goals



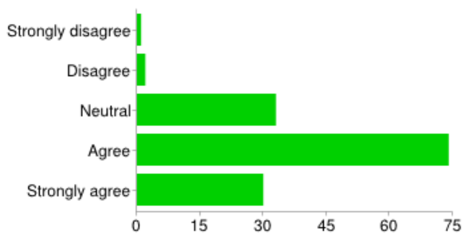
Strongly disagree	**2**	1.5%
Disagree	**1**	0.7%
Neutral	**17**	12.4%
Agree	**74**	54%
Strongly agree	**45**	32.8%

B.1.3 Clearly communicates how to participate in course learning activities



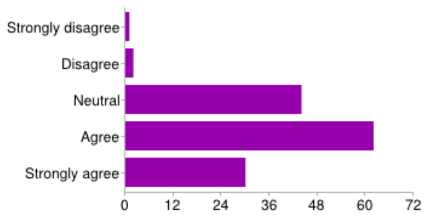
Strongly disagree	**3**	2.2%
Disagree	**2**	1.5%
Neutral	**24**	17.5%
Agree	**71**	51.8%
Strongly agree	**39**	28.5%

B.1.4 Clearly communicates important due dates/time frames for learning activities



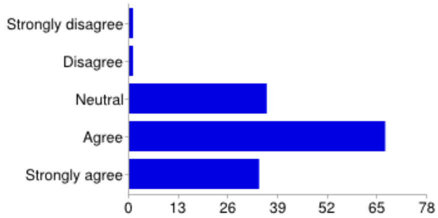
Strongly disagree	**1**	0.7%
Disagree	**2**	1.5%
Neutral	**44**	32.1%
Agree	**62**	45.3%
Strongly agree	**30**	21.9%

B.1.5 Clearly identifies areas of agreement and disagreement on course topics.



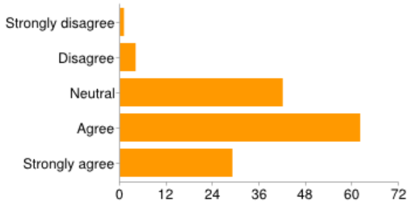
Strongly disagree	**1**	0.7%
Disagree	**2**	1.5%
Neutral	**33**	24.1%
Agree	**74**	54%
Strongly agree	**30**	21.9%

B.1.6 Clearly guides the class towards understanding course topics



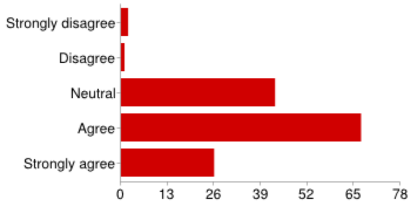
Strongly disagree	**1**	0.7%
Disagree	**1**	0.7%
Neutral	**36**	26.3%
Agree	**67**	48.9%
Strongly agree	**34**	24.8%

B.1.7 Clearly keeps course participants engaged and participating in productive dialogue.



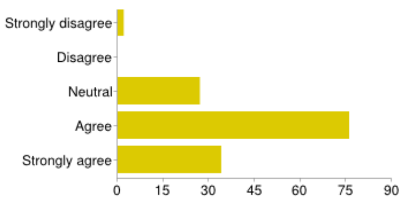
Strongly disagree	**1**	0.7%
Disagree	**4**	2.9%
Neutral	**42**	30.7%
Agree	**62**	45.3%
Strongly agree	**29**	21.2%

B.1.8 Clearly keeps the course participants on task



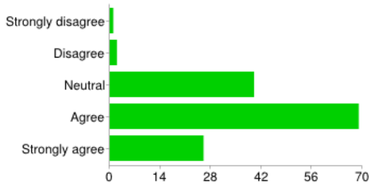
Strongly disagree	**2**	1.5%
Disagree	**1**	0.7%
Neutral	**43**	31.4%
Agree	**67**	48.9%
Strongly agree	**26**	19%

B.1.9 Clearly encourages course participants to explore new concepts in this course.



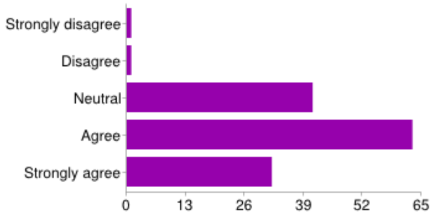
Strongly disagree	**2**	1.5%
Disagree	**0**	0%
Neutral	**27**	19.7%
Agree	**76**	55.5%
Strongly agree	**34**	24.8%

B.1.10 Clearly reinforces the development of a sense of community among course participants.



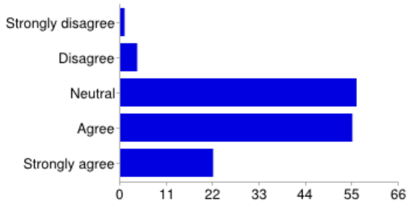
Strongly disagree	**1**	0.7%
Disagree	**2**	1.5%
Neutral	**40**	29.2%
Agree	**69**	50.4%
Strongly agree	**26**	19%

B.1.11 Clearly focus discussion on relevant issues



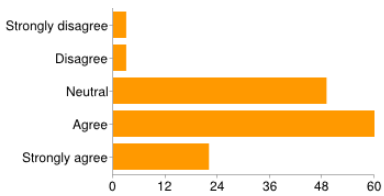
Strongly disagree	**1**	0.7%
Disagree	**1**	0.7%
Neutral	**41**	29.9%
Agree	**63**	46%
Strongly agree	**32**	23.4%

B.1.12 Clearly provides feedback to help students with strengths and weaknesses



Strongly disagree	**1**	0.7%
Disagree	**4**	2.9%
Neutral	**56**	40.9%
Agree	**55**	40.1%
Strongly agree	**22**	16.1%

B.1.13 Clearly provides timely feedback



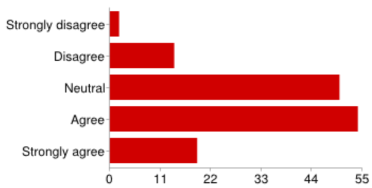
Strongly disagree	**3**	2.2%
Disagree	**3**	2.2%
Neutral	**49**	35.8%
Agree	**60**	43.8%
Strongly agree	**22**	16.1%

As a summary we would like to highlight that students seem to agree about the teaching presence as enforcing the sense of community in the group 69.4% (“agree” and “strongly agree”), and understand the instructor’s role as a guide for the course 73.7% (“agree” and “strongly agree”). Communication and knowledge about the content had been highly graded as well, around 80% (“agree” and “strongly agree”). Providing feedback is the one that had been graded the lowest, but still has a high percentage 59.9% (“agree” and “strongly agree”).

4.6.2 Social presence results

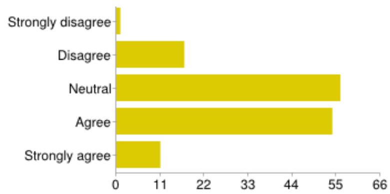
Table 4.17
Social presence results

Variable	Indicators
Social Presence	B.2.1 Getting to know other course participants gives a sense of belonging in the course.



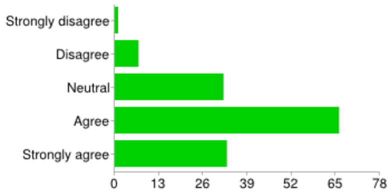
Strongly disagree	**2**	1.5%
Disagree	**14**	10.2%
Neutral	**50**	36.5%
Agree	**54**	39.4%
Strongly agree	**19**	13.9%

B.2.2 I was able to form distinct impressions of some course participants



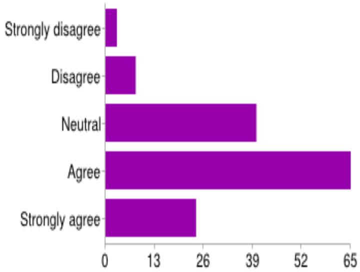
Strongly disagree	**1**	0.7%
Disagree	**17**	12.4%
Neutral	**56**	40.9%
Agree	**54**	39.4%
Strongly agree	**11**	8%

B.2.3 Online or web-based communication is an excellent medium for social interaction



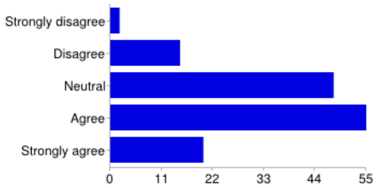
Strongly disagree	**1**	0.7%
Disagree	**7**	5.1%
Neutral	**32**	23.4%
Agree	**66**	48.2%
Strongly agree	**33**	24.1%

B.2.4 I felt comfortable conversing through the online medium.



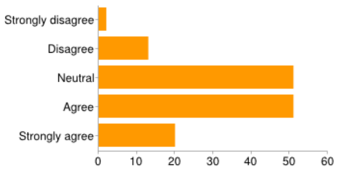
Strongly disagree	**3**	2.2%
Disagree	**8**	5.8%
Neutral	**40**	29.2%
Agree	**65**	47.4%
Strongly agree	**24**	17.5%

B.2.5 I felt comfortable participating in the course discussions.



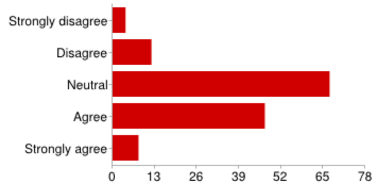
Strongly disagree	**2**	1.5%
Disagree	**15**	10.9%
Neutral	**48**	35%
Agree	**55**	40.1%
Strongly agree	**20**	14.6%

B.2.6 I felt comfortable interacting with other course participants



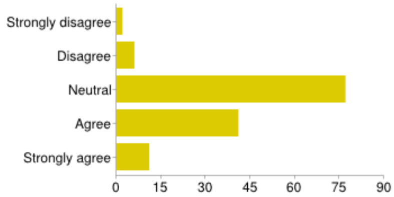
Strongly disagree	**2**	1.5%
Disagree	**13**	9.5%
Neutral	**51**	37.2%
Agree	**51**	37.2%
Strongly agree	**20**	14.6%

B.2.7 I felt comfortable disagreeing with other course participants while still maintaining a sense of trust



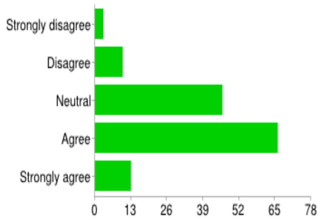
Strongly disagree	**4**	2.9%
Disagree	**12**	8.8%
Neutral	**67**	48.9%
Agree	**47**	34.3%
Strongly agree	**8**	5.8%

B.2.8 I felt that my point of view was acknowledged by other course participants



Strongly disagree	**2**	1.5%
Disagree	**6**	4.4%
Neutral	**77**	56.2%
Agree	**41**	29.9%
Strongly agree	**11**	8%

B.2.9 Online discussions help me to develop a sense of collaboration



Strongly disagree	**3**	2.2%
Disagree	**10**	7.3%
Neutral	**46**	33.6%
Agree	**66**	48.2%
Strongly agree	**13**	9.5%

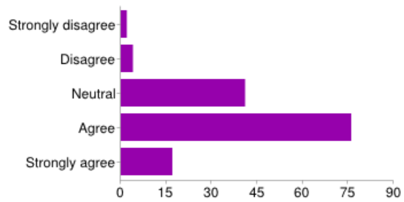
This presence does not show results as strong as the ones found in the teaching presence. Students assign lower values to some of the items: getting to know the other students gives a sense of community ~50% ("neutral", "disagree" and "strongly disagree"), feeling confortable while participating in course discussions ~47% ("neutral", "disagree" and "strongly disagree"), feeling confortable agreeing or disagreeing with others 60% ("neutral", "disagree" and "strongly disagree").

4.6.3 Cognitive presence results

Table 4.18

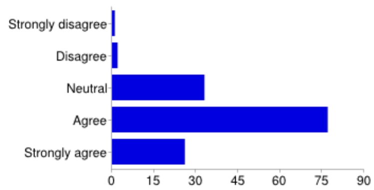
Cognitive presence results

Variable	Indicators
Cognitive Presence	B.3.1 Problems posed increased my interest in course issues



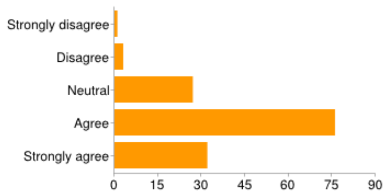
Strongly disagree	**2**	1.5%
Disagree	**4**	2.9%
Neutral	**41**	29.9%
Agree	**76**	55.5%
Strongly agree	**17**	12.4%

B.3.2 Course activities piqued my curiosity



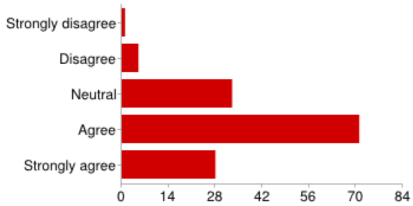
Strongly disagree	**1**	0.7%
Disagree	**2**	1.5%
Neutral	**33**	24.1%
Agree	**77**	56.2%
Strongly agree	**26**	19%

B.3.3 I felt motivated to explore content related questions.



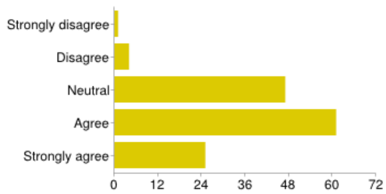
Strongly disagree	**1**	0.7%
Disagree	**3**	2.2%
Neutral	**27**	19.7%
Agree	**76**	55.5%
Strongly agree	**32**	23.4%

B.3.4 I utilized a variety of information sources to explore problems posed in this course



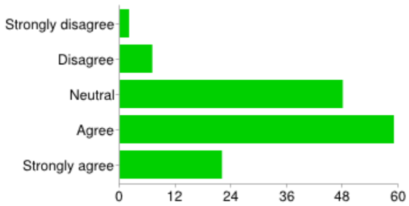
Strongly disagree	**1**	0.7%
Disagree	**5**	3.6%
Neutral	**33**	24.1%
Agree	**71**	51.8%
Strongly agree	**28**	20.4%

B.3.5 Brainstorming and finding relevant information helped me resolve content related questions



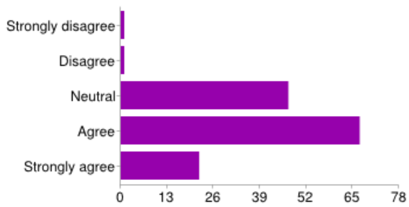
Strongly disagree	**1**	0.7%
Disagree	**4**	2.9%
Neutral	**47**	34.3%
Agree	**61**	44.5%
Strongly agree	**25**	18.2%

B.3.6 Online discussions were valuable in helping me appreciate different perspectives.



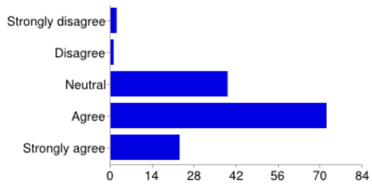
Strongly disagree	**2**	1.5%
Disagree	**7**	5.1%
Neutral	**48**	35%
Agree	**59**	43.1%
Strongly agree	**22**	16.1%

B.3.7 Combining new information helped me answer questions raised in course activities.



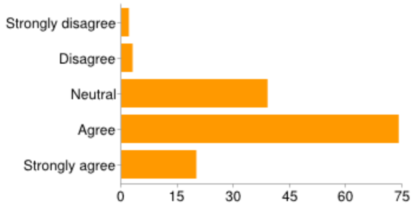
Strongly disagree	**1**	0.7%
Disagree	**1**	0.7%
Neutral	**47**	34.3%
Agree	**67**	48.9%
Strongly agree	**22**	16.1%

B.3.8 Learning activities helped me construct explanations/solutions



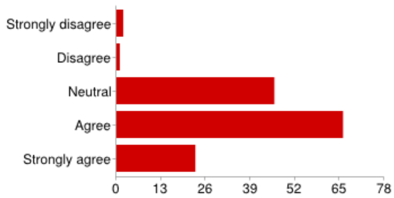
Strongly disagree	**2**	1.5%
Disagree	**1**	0.7%
Neutral	**39**	28.5%
Agree	**72**	52.6%
Strongly agree	**23**	16.8%

B.3.9 Reflection on course content and discussions helped me understand fundamental concepts in this class



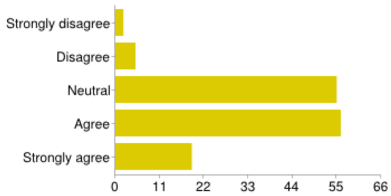
trongly disagree	**2**	1.5%
isagree	**3**	2.2%
eutral	**39**	28.5%
gree	**74**	54%
Strongly agree	**20**	14.6%

B.3.10 I can describe ways to test and apply the knowledge created in this course.



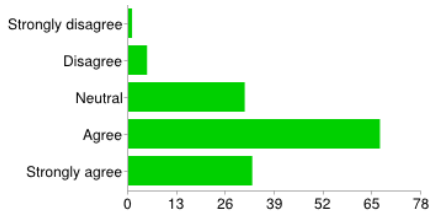
Strongly disagree	**2**	1.5%
Disagree	**1**	0.7%
Neutral	**46**	33.6%
Agree	**66**	48.2%
Strongly agree	**23**	16.8%

B.3.11 I have developed solutions to course problems that can be applied in practice.



Strongly disagree	**2**	1.5%
Disagree	**5**	3.6%
Neutral	**55**	40.1%
Agree	**56**	40.9%
Strongly agree	**19**	13.9%

B.3.12 I can apply the knowledge created in this course to my work or other non-class related activities



Strongly disagree	**1**	0.7%
Disagree	**5**	3.6%
Neutral	**31**	22.6%
Agree	**67**	48.9%
Strongly agree	**33**	24.1%

Student responses indicate that they relate with the course content and are interested in the topic due to the course design and the activities ~75.2% (“agree, “strongly agree”). They use a variety of resources to accomplish course’s tasks to combine different sources of information 72.2% (“agree, “strongly agree”). They also show awareness of their own understanding during the course ~65% (“agree, “strongly agree”)

4.7.- Instrument C: Student interviews

This instrument collects data from students' interviews. Details are summarized in the table below (Table 4.19). 9 students returned the interview questions and gave their personal opinions responding to 11 questions related with the sense of COI that they experienced when taking the MOOC.

Table 4.19
Instrument C

Phase III	Description of research	Instruments	Description of instruments
End of Course research	Creation and distribution of Students Interviews	Critical Theory	Student interviews have 11 items self-developed and validated by a panel of experts

Student interviews had been transcribed and are organized in table 4.20. They were conducted by email with the goal of collecting knowledge about individuals' thoughts, feelings and behaviors. The interviews were structured, all question were predesigned before sending (Johnson, 2002). Email interviews are somehow controversial, (Bampton & Cowton, 2002; Joëlle, 2005; Opdenakker, 2006; Mason & Ide, 2014) in the sense that asynchronous exchanges lose the interactivity and time-dependent feedback that can be captured when the interview is conducted by phone or in person. The Online environment is more flexible and offers participants the freedom to participate in the research and stop at any time, (Mason & Ide, 2014). We have to overcome some face to face interview practices when interviewing by email: information about interview length, number of questions, topic and purpose need to be clearly communicated at the beginning of the interview. MOOC takers are located in different time zones and geographies; the email interview was the preferred method for students to share their opinions when asked if they will be willing to participate in an interview for an academic research.

The codification of the meaningful units can be found in table 11 (102 units of content). We have used codes from literature (Swan, & Ice, 2010) and some codes had emerged naturally from the data. Coding our data is a transitional process between data collection and the analysis of the results. Our main goal when coding the interviews is to identify emerging common patterns between different participants. We expect to group similarly coded data into families and be able to recognize the beginning of a pattern. Some of the grouping could be similarities, differences, sequences, causations and correlations. We are aware that coding is a subjective task and different researchers might have different final codes (Mason, 2002; Creswell, 2007). Having in mind that coding is not just labeling qualitative data units; we look for the linkage between the codes and the overall final idea. In order to overcome this situation we had coded the units in three rounds, as is suggested in the literature (Saldana , 2009) to consolidate codes, pay attention to emerging patterns and create a final framework to support our understanding of the situation. It is a good practice to keep the probing questions and research goal in sight when conducting the coding as a way of focusing ideas and aligning the codes with the research (Onwuegbuzie, Dickinson, Leech and Zoran, 2009).

To perform our coding we present a constant comparison analysis (Glaser & Strauss, 1967; Boeije, 2002). Within this method there are three major steps that should be followed:

- First stage: data is broken down into small units and codes are attached to each of the units. We accomplished this in three rounds of coding, final codes are displayed in table 4.20.
- Second stage: the codes are grouped into different categories or families
- Third stage: development of one or more themes to express and discuss the content of each of the groups. A proposed framework will be presented as well

Final codes are shown in the table 4.20 and the preliminary ones can be found in the annex.

4.7.1 Final round of first stage coding

Table 4.20
Student interviews codes

Question	ID	Transcript	Code
1.Did you finish the MOOC? If not please let me know what happened, why did you not finish	1	Yes I did	---
	2	Yes	---
	3	No. My work hours got in the way with multiple schedule changing and I lost track of time for due times	Work issues
	4	Yes I finished the MOOC	Assert
	5	Yes, I finished the course because I was interested in it	Value judgment
	6	Yes	Assert
	7	*No response*	---
	8	*No response*	---
	9	*Yes*	Assert

Question	ID	Transcript	Code
2.Did you experience a sense of community while taking the MOOC? Why, why not?	1	Yes, everybody contributing ideas was fun and helpful	Sense of community
	2	Yes, I gained much experience with the course	Course content
	3	Yes	Assert
	4	Somehow but learners here do not interact very much	Sense of community
	5	At the time I was first starting I did have sense of community	Sense of community
	6	Yes, because the community was interested in information security.	Sense of community
		And no, because I haven't really exchange a lot in the forum	Online discussions
	7	Sort of- I read other posts from people all over the world	Diversity
	8	Yes I experienced it	Assert
	9	No, I did not take the class for the community but for me.	Future goals
3.What has been the role of discussion in your learning? Do you think discussion helped you to experience some learning community	1	Yes, because other persons shared their views	Diversity
		on various discussions that gave a sense of issues and solutions going on around me,	Online discussions
		like the areas that focus on how to put security measures in place to help alleviate cyber attacks	Course content
	2	Yes, I think they [discussions] are fundamental for learning	Online discussions
	3	Making contributions and I also appreciated the contribution of other learners	Sense of community
	4	*No response*	---
	5	*No response*	---

Question	ID	Transcript	Code
	6	They provided fresh insights into other perspectives.	Diversity
		It helps you think outside the box	Innovative thinking
	7	Yes of course	Assert
	8	Yes, the discussion aspect is very good.	Online discussion
		Just like college in on-line setting	Value judgment
	9	Not really, no	Negation
4.Were you given enough opportunities to express your opinions and thoughts within the course? Please explain	1	Yes. There was	Assert
		or I did not experience restriction whatsoever. there was no slight indication of the same	Communication
	2	Yes, but having done one per week was enough for me express my opinion and thoughts	Course design
	3	Not really due to my hectic work schedule, that has prevented me during the time to adequately finish the MOOC	Work issues
	4	Yes, the forums were very useful to this.	Online discussions
		I had ways to express my opinions accordingly	Communication
	5	Yes, all my doubts and opinions I could express satisfactorily	Communication
	6	No response	---
	7	I suppose so.	Value judgment
	8	I haven't communicated enough,	Value judgment
		as I was involved in other time consuming projects at the same time	Work issues
	9	I only expressed myself one	Online discussions

Question	ID	Transcript	Code
5.How important was communication with other students or receiving their input?	1	Fantastic, I had no problem with that	Value judgment
	2	Information sharing with the students was something wonderful	Communication
	3	It was good while I did attend the course	Work issues
	4	Very important, because it gave me an opportunity to look at the viewpoints of others	Diversity
		in the industry, as well as other professionals	Real-life connection
	5	Was interesting,	Value judgment
		I am looking to other points of view when possible, for covering a more large spectrum, or get new ideas,	Learning strategies-diversity
		or just like you for analyzing how others think/act	Diversity
	6	In order to know the different thoughts on the subjects	Course content
	7	I liked the diversity offered by this online course. different experiences from across the globe enriched the learning	Diversity
	8	As I said a fresh insight is needed to understand some material	Course content
		so you can move out of your own perspective	Innovative thinking
	9	[communication was] Not very important to me	Value judgement
6.How and what did you learn during the MOOC?	1	I learned about what contracts are and the problems they can impose when they branch out	Course content
	2	I've learn by studying the course materials,	Learning strategies-course content
		looking for more information elsewhere when a subject was interesting and not enough detailed.	SDL-research

Question	ID	Transcript	Code
		What I've learn, honestly it will be difficult to produce you a list	Value judgment
	3	Notions on security, of course. People concerns about them	Course content
	4	I learned the importance of cyber attacks prevention. Also, how to… they could happen, even in a secure environment. Some of the things to put in place so that cyber criminals and hackers could not get in	Course content
	5	The MOOC really opened my eyes to having knowledge of Cybersecurity	Value judgment
	6	I learned through the articles and the handouts	Learning strategies-course content
	7	So far I have completed two courses and I appreciate them.	Value judgment
	8	cybersecurity course enriched my earlier degree course in IT security	SDL-previous knowledge
	9	Learned safety issues for my servers, tips, and improvements I can apply in my work	Real-life connection
		I like the online class	Value judgment
		but I am not big on discussions, everyone has an opinion.	Online discussions
7.How much did you learn on your own, versus from your instructor or through interactions with other students	1	I learned a lot from the instructor	Instructor interactions
		as well as other students	Student Interactions
	2	During the course, not so much, maybe 1-2 hours/week in addition to course.	Real life connection
		It happens that I have learn before the course about this subject	SDL- previous knowledge
	3	Well, the materials provided were not voluminous yet so rich.	Course content
		I appreciate the frequent input from the instructor from time to time	Instructor Interactions

Question	ID	Transcript	Code
	4	I made some researches on my own on the internet	SDL-research
	5	I took the course very serious	Value judgment
		and go through and read several times	Learning Strategies-organization
	6	*No response*	---
	7	I learned a lot from stopping and going through the material the next day instead of trying to rip through the material	Learning Strategies-course content
	8	*No response*	---
	9	I read all the material and refresh myself.	Learning Strategies-keep up to date
8. What strategies did you use to learn independently during the MOOC if any?	1	I did documentation research on internet to help me cross-thinking	SDL-research
	2	I organized myself to study every day	SDL-organization
	3	For one, I made sure I had the hard copy of the material and accessed any link provided	SDL- materials
	4	I read and hear all videos or materials and took the tests	Learning strategies-course content
	5	I read the books pertaining to the course	Learning strategies-course content
	6	After my weekly assignment I would read everything over and over again	Learning strategies-keep up to date
	7	I read some articles on cybersecurity on the internet	SDL-research
	8	Mostly prevention against cyber crime	Course content
	9	None	Negation
9. Did you set up goals for your learning? How did you monitor your progress?	1	My goal was to take the exam after the course but unfortunately I did not pass the first time	Learning goals
	2	In general speaking, yes, I do have a	Learning goals

Question	ID	Transcript	Code
		goal while learning information security. That is to complete my practical and theoretical knowledge about the subject with other notions which I have not had the chance to cover before,	
		keep me informed and instructed about, enlarge my view to a general coverage of the subject and learn new things.	SDL-keep up to date
	3	In one course I don't have specifically any goal except those upper.	Value judgment
	4	No I tried to work when I had time-I work full time	Work issues
		Monitoring the progress inside a course can be done by evaluating a function of speed-easiness-good answers on quizzes, the degree of understanding the material, the degree of challenge as new questions are appearing.	SDL-monitor own progress
	5	But I think an evaluation of progress is hard to get outside of the real world, to measure progress one must face real threats/attacks	Real-life connection
		I made sure or it was my goal to finish going through the materials at most in the first three days of every week	SDL-organization
	6	and then engage in discussion whenever situations allowed	Learning strategy-course design
		Yes, I monitored my progress based on all of the things that I learned. Also,	SDL- monitor own progress
	7	I tested what I learned on the quizzes	Connection with real-life
	8	Established to study 1 hour per	SDL-organization
		Through the grades that I reached	SDL- monitor own progress
	9	Did not have a scope but follow the material to make these test.	Learning strategies-organization

Question	ID	Transcript	Code
10.Did you experience any challenges? Please explain	1	Yes, I wanted to have as much knowledge as possible	Learning goal
	2	During some of the quizzes.	Course design
	3	Work schedule was the biggest challenge	Work issues
	4	Yes, mainly on the more technical subjects.	Course content
	5	My challenges was at the exam (Introduction to cybersecurity),	Course content
		some of the questions during the exam I did not study in the MOOC course.	Course design
	6	It was interesting trying to figure out how the courts would rule.	Value judgment
	7	Yes, sort of. As I am not a native English speaker I've had to turn around sometimes some questions, where the text it was not clear for me	Learning Strategies-learning progress
	8	Not really	---
	9	I had to study	Learning strategies-keep up to date
11.Do you want to add anything else?	1	I really enjoyed the course	Value judgment
		and I learned a lot from the instructor	Instructor Interaction
		and the students.	Student Interaction
	2	I would love to take another course.	Future goals
	3	No, thank you.	---
	4	I wonder if I can get certified course via email	Future goal
		For those of us who want to take the exam after the course should be given hints what to expect or if we can expand our reading beyond MOOC.	Course design
	5	Thank you for the course, again,	Value judgment

Question	ID	Transcript	Code
		and also, don't hesitate to make other courses on this subject, some more specialized.	
	6	I do not understand exactly what the question is asking	---
	7	*No response*	---
	8	*No response*	---
	9	*No response*	---

4.7.2 Second stage of coding

From the final codes we presented in table 4.20 some common patterns had emerged. We had grouped them in families and present a summary in tables 4.21, 4.22, 4.23, and 4.24. This had been accomplished through different rounds and grouping codes under common themes. These themes had emerged during the coding, they show how our thought processing evolved from the variables we defined when creating the instrument to the codes that emerged during the analysis. Our final proposal (before the refinements) for the common themes is displayed in table 4.21:

Table 4.21

Codes grouped in families with common themes (round one)

Social Presence	Cognitive Presence	Teaching Presence	SDL	Personal life
Communication (4)	Course content (11)	Instructor interaction (3)	Research(4)	Work issues(6)
Sense of community(5)	Innovative thinking(2)		Previous knowledge(2)	Value judgment(16)
Diversity(6)			Organization (3)	Real life connection(5)
Online discussion (7)	Learning strategies (12)		Materials(1)	Future goals (2)
Student interactions (2)	Learning goals(2)		Keep up to date (1)	
	Course design (4)		Monitor own progress(3)	

We believe that some of the codes can be grouped again due to their commonalities:

- “Innovative thinking” can be grouped with “Diversity” and relocate under the social presence family. Both codes refer to the diversity of opinions in the MOOC, and the different points of view and possible approaches to same ideas.
- “Future goals” will be counted together with “Monitor own progress” and relocated under the SDL family. These two are characteristics that define SDL readiness and we believe are better coded and grouped under the SDL readiness theme.
- The “sense of community” code will also change to just “community” to simplify language, and
- “Online discussions” will now be referred to as “online communication”, because the units of code refer to discussions but also, QA sections and messages with instructor.

Table 4.22, 4.23 and 4.24 display round two of grouping codes under common themes and these are the changes we introduce:

Table 4.22

Codes grouped in families with common themes (round two, a)

Social Presence	Cognitive Presence	Teaching Presence	SDL	Personal life
Community(7)	~~Course content~~ (11)	Instructor interaction (3)	Research(4)	Work issues(6)
Diversity(8)	Course design (4)		Previous knowledge(2)	Value judgment(16)
Online Communication(11)	Learning strategies and goals (14)		Organization (3)	Real life connection(5)
			Materials(1)	
			Keep up to date (1)	
			Progress goals (5)	

- “Instructor Interaction” is grouped with “Community” and relocated under the social presence theme. We believe that students identify instructor interaction only three times during their interviews and it seems appropriate to group this category under the community common theme and this code refers to student-student and student-instructor interactions.
- “Learning strategies and goals” will be moved to the SDL theme as we understand it fits better under this family than the cognitive presence.
- The “materials” code under SDL is combined with the “research” as both of them refer to the same action of the students expanding on course materials.
- The code “progress goals” had been renamed to “learning progress” to explain its meaning better.

Table 4.23

Codes grouped in families with common themes (round two, b)

Social Presence	Cognitive Presence	Teaching Presence	SDL	Personal life
Community(10)	Course content (11)		Research(5)	Work issues(6)
Diversity(8)	Course design (4)		Previous knowledge(2)	Value judgment(16)
Online Communication(11)			Organization (3)	Real life connection(5)
			Keep up to date (1)	
			Learning progress (8)	
			Learning strategies and goals (14)	

- Next step is to distribute the categories within "learning strategies" between the other codes and families. The other codes within the SDL family are referring to specific learning strategies, and we find appropriate to split this code and add it to the other codes that below to the same unit of meaning. We will distribute the 14 units belonging to "learning strategies" within the rest of codes. This is also indicated in table 4.20 with the codes names.

Table 4.24

Codes grouped in families with common themes (round two, c)

Social Presence	Cognitive Presence	Teaching Presence	SDL	Personal life
Community(10)	Course content (14)		Research(5)	Work issues(6)
Diversity(9)	Course design (5)		Previous knowledge(2)	Value judgment(16)
Online Communication(11)			Organization (6)	Real life connection(5)
			Keep up to date (4)	
			Learning progress (9)	

4.7.3 Third stage of coding

Within this stage we present the framework that links students perspectives when taking a MOOC with the different themes that appear from the interviews. Figure 4.12 will be explored and explained in Chapter 5.

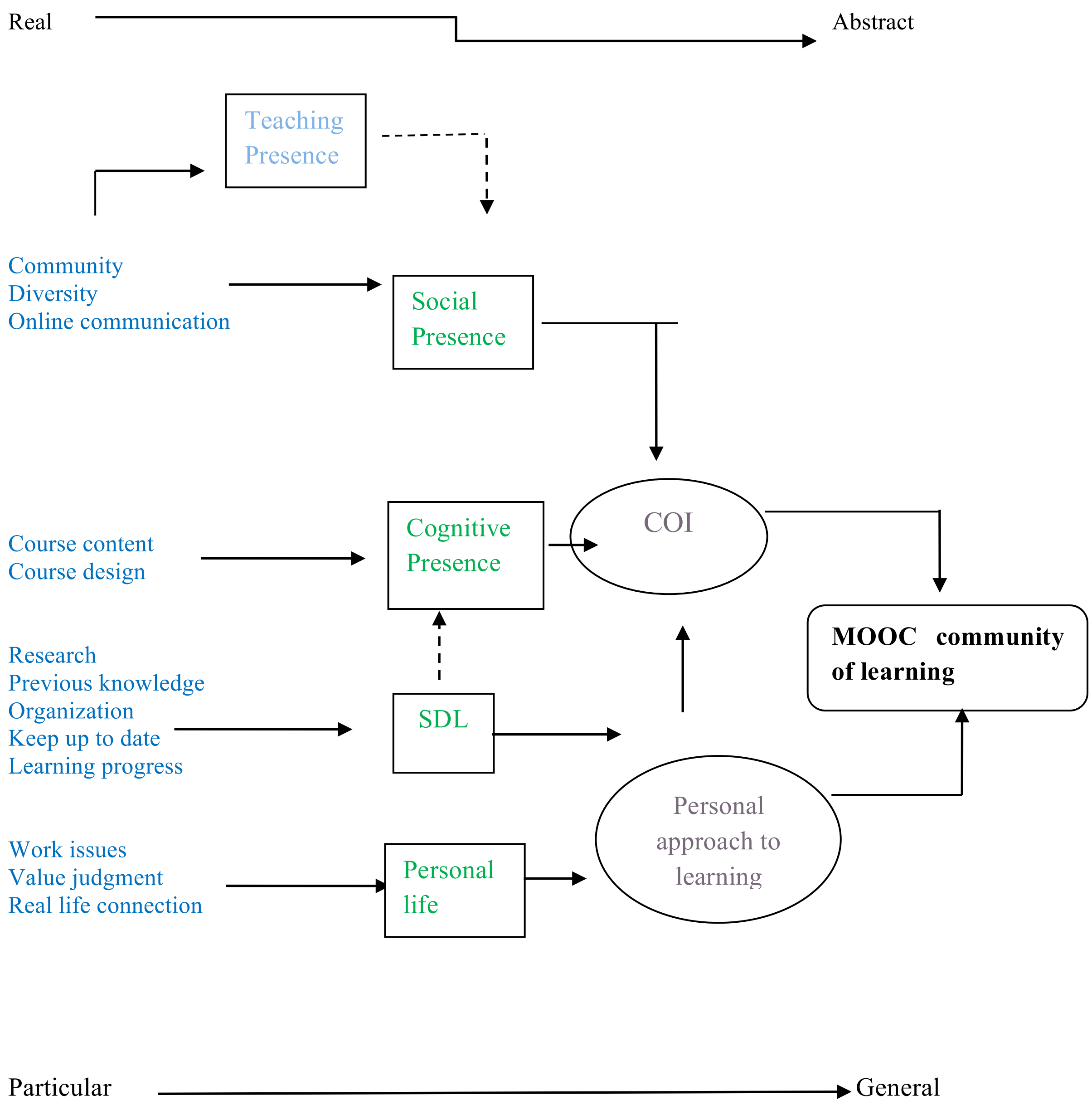


Figure 4.12 Codes to theory framework

4.8.- Instrument D: Experts focus group

Instrument D information is displayed in table 4.25. This instrument collects the data from the experts' focus group:

Table 4.25

Instrument D

Phase III	Description of research	Instruments	Description of instruments
End of Course research	D. Creation and distribution of a focus group questionnaire with experts to explore their opinions	Critical Theory	Focus group question for experts has 17 items and had been self-developed and validated by a panel of experts.

Analyzing focus group data can be a little problematic. Smithson (2000) states that most focus utilize the group as the unit of analysis, but this situation can overlook some of the opinions and comments from individual participants. We are presenting a mini focus groups approach (Morgan, 1997) that includes 3 participants and one single meeting: Developer, Faculty Program Director and Instructor. This approach is acceptable when participants have specialized knowledge and experiences to discuss in the group. The participants are experts in online teaching, online design and Cybersecurity, and had been involved in the design of the MOOC.

The analysis we are presenting is a micro-interlocutor analysis (Onwuegbuzie, Dickinson, Leech and Zoran, 2010). This approach focuses on all the members of the group and their personal opinions; sometimes when analyzing focus group discussions as a whole some opinions or information are missed, and final conclusions can be bias. This method provides insights about less articulated members and also analyzes data on particular situations where some of the members do not think the issues are worthy of discussion, or due to time constrains the moderator moves to the next question and some issues cannot be addressed. This method displays who answered to what questions and what did they said, sometimes the group dynamics gives the idea of consensus and group agreement providing little information about particular points of view.

With the idea of providing information about all participants we have collected their inputs in the table below. The transcript of the conversation can be found in the annex. In table 4.26 we provide information on each member responses.

Table 4.26
Matrix for assessing level of consensus in the focus group adapted from Onwuegbuzie et al. (2009).

NR: No response

Focus group question	Member 1: Content creator	Member 2: Program director	Member 3: Instructor	Consensus
Triggering event				
1. What pedagogical techniques have you used when teaching (instructor) or designing (ID and SME) the MOOC to motivate students and first capture their attention early on?	NR	Challenging to engage them one to one	Initial communication	Yes
Exploration				
2. How would you compare the MOOC content relative to traditional face-to-face formats?	MOOC is harder	Not a lot of difference	Not a lot of difference	No
3.What do you think are the particular strengths of the	More freedom	Community of learning	Content richness	Yes

Focus group question	Member 1: Content creator	Member 2: Program director	Member 3: Instructor	Consensus
content provided in this MOOC? Any weaknesses?				
4. How well is this MOOC aligned with Marzano's taxonomy?	Does not know Marzano's	Does not know Marzano's	Does not know Marzano's	Yes
Integration				
5. How would you rate the learning outcomes for the course compared to more traditional courses?	Same rigor	Same	Same	Yes
6.How well do they align with the outcomes of the modules?	Created from student perspective	Good alignments	NR	Yes
7. Do you have any suggestions for different types of activities that might work better?	NR	Add games Small group activities Student presentations	Add amount of time needed to complete the MOOC	Yes
Resolution				
8.What do you think the students benefit the most when they took this MOOC? What evidences do you have?	Course clear organization and content broken down	Diversity of participants Focus on personal interests	Assignments	No
9.What new/main concepts do you think the students learned during the MOOC?	Basic cyber concepts not high level but introductory	NR	Extra research they did and posted in discussions	Yes
10. What are some of the advantages of MOOC's for students	Work around personal schedules Flexibility	Possibilities in the STEM field Possibility of testing out new areas	NR	Yes
Design and organization				
11.How would you rate the design and organization of the MOOC? Does it facilitate your teaching through the MOOC	SME should teach	NR	Good alignment between modules	Yes

Focus group question	Member 1: Content creator	Member 2: Program director	Member 3: Instructor	Consensus
12.What parts (module notes, videos, self-checks, quizzes, discussions) could have we designed better?	Add weekly surveys about student satisfaction	Revisit outcomes alignment	Course navigation and bugs	Yes
Processes or practices to facilitate community of learning				
13. What are some ways an instructor can facilitate student engagement despite the size of the classroom?	Asking student for feedback	Less interaction and challenging	Extend himself more than in other environments	Yes
14. How does the size of the group affects/challenges discussions? What strategies do you use to overcome the challenge of size?	Harder to have interactions	More opportunities for interactions Authenticity	Could add more students, class size was not a challenge	No
15. Any other variables that are challenging? Education level, geographic situation…	NR	NR	Attracts students that are not local	No
Instructor opinion about possible direct instruction within the MOOC				
16. Please explain from what extend the MOOC gave you opportunities for direct instruction?	Did not know there was an instructor	Use personal experiences and share with the group	Emails, reach out, encouragement to participate, announcements	Yes
17. Can you provide specific examples of methods of direct instruction that you used? How did you manage direct instruction?	Ideally students should be able to ask the content creator	NR	NR	Yes

The responses and agreements or disagreements form the focus group discussion will be analyzed in the following chapter

4.9.- Summary

This chapter presented the summary of results for the 5 instruments in our study. A brief preliminary description and examination was also provided, but the formal analysis will be fully explored in next chapter, Chapter 5: Analysis and conclusions. The instruments we presented are:

- **Instrument SD:** a descriptive analysis of each variable and items, and an ANOVA test has been performed. We did not find conclusive results that indicate higher completion rates related with higher SDL skills. We are analizing this fact in more detail during next chapter.
- **Instrument A and instrument B**: a descriptive analysis and visual representation of the items' results had been provided. We presented a brief demographic description for MOOC takers and some preliminary results on motivation to keep engaged in the MOOC and reasons to unenroll. The COI framework and its presences togueter with the SDL skill has been explored and reults presented.
- **Instrument C:** codification of students interviews and identification of major patterns and idea families had been provided
- **Instrument D**: classification of the focus group discussion had been provided. Agreements and disagreements had been classified and we will analize and provide some conclusions regarding the experts oppinions in future chapters.

Next chapter will expand on the analysis and will provide conclusions for the investigation

4.10.- How Chapter 5: "Results analysis and discussion" will be developed

At this point we consider necessary to introduce the framework in which Chapter 5 will be developed, how the data will be analyzed and how conclusions will be drawn. The framework reflects our thought processing trying to display and relate different types of data and use them to respond to our research and probing questions by triangulating with the theoretical review presented in Chapter 3. Each of the instruments we are analyzing have been described with variables and items in this chapter, in chapter 5 the analysis will refer to each of the items in the instruments. Each instrument analysis will be displayed following the same method: every variable is analyzed by its items and each item builds upon the one before. Like pieces of a puzzle, our research parts fits together and shows the complete picture of the research.

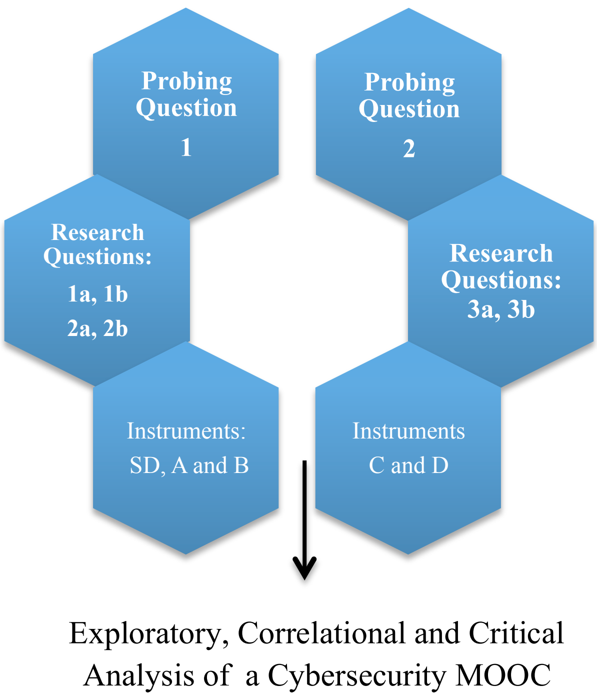


Figure 4.13 Data analysis path

Results Analysis and Discussion

#5

Chapter 5: Analysis of Results and Discussions

5.1.- Abstract

This chapter presents the analysis and discussions for the study. Each instrument is analyzed and we discuss each of its variables. The different data is compared and complemented with other sources. Conclusions are drawn from the analysis and responses to research questions are provided. The final conclusions and our reactions to the probing questions will be offered in Chapter 6: Main Conclusions, Limitations and Future Research.

Resumen

Este capítulo presenta el análisis y las discusiones de nuestro estudio. Cada uno de los instrumentos es analizado y discutimos cada una de sus variables. Los diferentes datos obtenidos son comparados entre ellos y complementados con otros recursos. Establecemos conclusiones y respondemos a las preguntas de investigación. Las conclusiones finales y nuestras reacciones a las preguntas genéricas del estudio se ofrecen en el capitulo 6: Conclusiones centrales, limitaciones y líneas de investigación futuras.

5.2.- Introduction

This chapter aims to respond to the probing questions of this investigation by analyzing the results from our instruments and research questions and tying them with current research in the field. We would like to share our personal vision of the situation and add new insights in the field by displaying and analyzing our findings. The factual conclusions were provided in chapter 4, with our first review of the data, and we compete them with this chapter trying to close the conceptual circle of this doctoral research.

5.3.- Discussion about probing question number 1

The first probing question we would like to respond to is:

> “What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates? “

In order to do so, we are going to analyze the findings from research questions 1a, 1b, 2a and 2b (table 5.1)

Table 5.1
Probing question 1

	Probing Question 1 **What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?**
Research Questions	1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC? 1b. How is the MOOC COI perceived and experienced by MOOC takers? Cognitive presence Teaching presence Social presence 2a. What is the SDL readiness levels of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?
Instruments	Phase II Instrument SD: Readiness Scale questionnaire Phase III Instrument A: Demographic and motivation information Instrument B: COI presences questionnaire

5.3.1 MOOC demographic context

In order to respond to a question about COI and it presences within a MOOC environment we would like to have a context where to situate the community taking this course and learning through this environment. Our first goal is to give a demographic snapshoot of the group taking this particular MOOC and display their motivations when deciding to enroll and take it.

Instrument SD and Instrument A provide information about gender and age. Please refer to the information displayed in Chapter 4. As an average 75% of the MOOC takers are male and 25% female (SD instrument male=75.1%, female 24.7%; instrument A male=77.2%, female 22.8%). This result is in alignment with what is accepted as common numbers in the field of Cybersecurity, a highly male field (Caldwell, 2013). Male and female students' interest in MOOCs is highly correlated with the subject topic (Macleod, Haywood, Woodgate & Alkhatnai, 2014), therefore we are finding a reflection of reality in the field of Cybersecurity showing only 25% of the student population to be females.

Instrument SD and A provide information about age as well. Both instruments provide very similar information: around 50% of students in the MOOC belong to the 31 to 50 years old range, 20% belongs to the range 51-60 years old and the rest 25% belongs to the range 18 to 30 years old, 5% belong to the range of 61 and older, (Fig. 5.1). We could not have students younger than 18 in the study due to Excelsior College RIB policy (see annex)

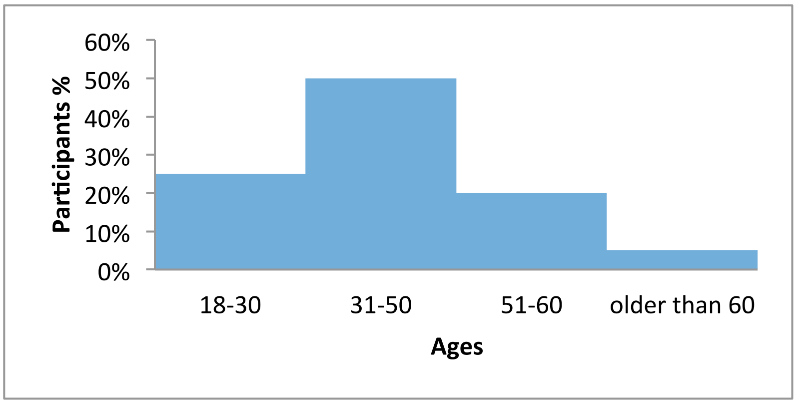


Figure. 5.1 Age data collected from SLD questionnaire

We can see that the amount of students is skewed to younger ages and distributed normally around 40 years old. Although statistics on age are still not widely explored and distributed, recent studied suggest that average age of MOOC takers is around 45 years old (Liyanagunawardena, Parslow & Williams, 2014).

After providing this brief introduction on age and gender we proceed to analyze all the research instruments. In our analysis we will highlight high and low percentages, because we believe that some of the patters and interesting results might come from low grading, or low student's interests in some of the items. One of the aims of this research is to suggest possible enhancements for future MOOCs, therefore we are really interested in analyzing the items selected by the students as "sometimes", "never" or "seldom" when they take the surveys. "Often" and "always" selections have value as well, showing some of the features that are predominant and should be kept.

In our analysis of the findings we will support our statements with current research in the field, therefore we will be comparing our outcomes with other author's statements and conclusions.

5.3.2 Instrument SD

Table 5.2 shows where this instrument is situated within our design and the research questions we are trying to respond with its results.

Table 5.2
Analysis design

	Probing Question 1 What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?	Probing Question 2 Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?
Research Questions	**1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC?** **1b. How is the MOOC COI perceived and experienced by MOOC takers?** **Cognitive presence** **Teaching presence** **Social presence** **2a. What is the SDL readiness levels of MOOC takers** **2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?**	3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI? 3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?
Instruments	**Phase II** **Instrument SD: Readiness Scale questionnaire** **Phase III** **Instrument A: Demographic and motivation information** **Instrument B: COI presences questionnaire**	Phase III Instrument C: Student interviews Instrument D: Experts focus groups

The analysis of the information from the SD instrument is going to be done by its variables (table 5.3):

1. Antecedents of SDL skills
2. Skills needed to effectively manage the process of SDL
3. Constructing Knowledge

Table 5.3
Analysis of SD instrument by variables

1. Antecedents of SDL skills	2. Skills needed to effectively manage the process of SDL	3. Constructing knowledge
Awareness	Learning Strategies	No subcategories
Attitudes	Learning Methods	
Motivation	Learning Activities	
	Interpersonal Skills	

5.3.2.a Variable SD1 analysis: antecedents of SDL skills

This data gives us information about awareness, attitudes and motivation towards learning and starting new tasks.

a) *Awareness:* this indicator gives us information about students' levels of awareness in front of new learning situations, how responsible they feel about their learning path, needs, and the methods that best suits them.

b) *Attitudes:* this indicator gives us information about students' thoughts on the importance of communicating with others.

c) *Motivations:* this indicator gives us information about how students see learning, (as a challenge, as an opportunity etc.)

a) Awareness

Students taking the MOOC show high levels of confidence in knowing their learning needs, and determining most suitable methods for their learning. The vast majority thinks that they are able to keep up with learning resources available (67.9% chose "often" and always"), although 32.1% of the group struggles with this (selection of "sometimes", "seldom" and "never"). Students understand that they are in change of their learning process and responsible to identify the areas that need help with. The group shows awareness of their own motivations and learning plans with high percentages.

b) Attitudes

Students think that they maintain good relationship with others, and are able to communicate effectively and express ideas freely, but 35.4% struggle when they have to work with others as a team member ("sometimes", "seldom" and "never" find it easy to collaborate with others). 39.7% does not think that relationships are crucial for their learning and social communication. Students believe that they are able to communicate effectively in writing and welcome criticism and different points of view as a way to improve their performance and knowledge.

c) Motivation

51.2% of the students taking the MOOC don't think that new learning is challenging for them ("sometimes", "seldom" and "never") and 37.5% are not motivated by other peoples' successes, instead they think that they need to guide their own learning and be in charge of their life long learning plan (“sometimes”, “seldom” and “never”). Students see learning as opportunities and are internally motivated to develop and improve their learning methods.

Findings from the analysis of “antecedents of SDL skills” variable

Related with the variable “antecedents of SDL skills” we would like to highlight the following interesting findings:
Keeping up with all the available resources and information can be challenging for some of the students, working online as a team member is also highlighted by a few students as somehow challenging for them, and the population of these MOOC shows high levels of intrinsic motivation. We will proceed to explain each of the three findings in the following sections:

a) *Keep up with available resources*

Although the majority of students think that are able to keep up with resources available online we would like to mention that 32.1% of them think that this situation is challenging. 32.1% might seem small, but it is the biggest percentage in all the categories that disagree with this particular statement, therefore we find it significant and worth mentioning. Some strategies that are suggested to help users deal with information overload are mentioned below (Pentina, Tarafdar, 2014). We suggest that one of MOOCs’ functions within the education field could be to provide this framework: scaffold and organize selected information for the students:

- Information load adjustment: can be accomplished creating activities that would reduce the amount of information students are required to process. These strategies reduce the number of information and ideas that the user is exposed to, and helps focusing on main topics avoiding dispersion and distractions (Carver & Turoff, 2007). Particularly xMOOCs emphasize the cognitive load of the course, being more content rich than social avenues. Appropriate amounts of information can be organized in a comprehensive way to help students understand ideas and topics. xMOOCs help minimizing the effort required from the students when selecting and sorting information.

- <u>Information complexity handling strategies</u>: can be accomplished by prioritizing information and deciding how should be presented to the students. xMOOCs and cMOOCs at the same level could be a useful tool in this sense. The role of the development team and the Instructional Designer and choosing the appropriate taxonomy to map out the outcomes are crucial decisions (Pentina & Tarafdar, 2014)

b) Work as a team member

Although the majority of students think that are able to work as a member of a team without major problems, we would like to mention that 35.4% of them think that this situation is challenging. Similar to the previous finding 35.4% might seem small, but it is one of the biggest percentage in all the categories that disagree with this particular statement, therefore we find it significant and worth mentioning. MOOCs offer possibilities for collaborative learning: discussion forums, peer-review activities, or social networking with the creation of "interest groups" (Guardia, Maina & Sangrà, 2013). Excelsior College MOOC offered opportunities for interaction within the discussions and the QA section in each module, but the activities were not specifically designed for teams.

c) Create interdisciplinary relations

39.7% of students do not find necessary to create interdisciplinary relations between them to maintain social harmony. In this type of environment we understand that this result shows that students are not giving high importance to building social relationships as one of their main attitudes in the MOOC.

d) Intrinsic motivation

37.5% of the MOOC takers are not motivated by other peoples' successes, instead they think that they need to guide their own learning and be in charge of their lifelong learning plan. Media technology enhanced learning captures students' attention and retention (Guardia, Maina & Sangrà, 2013). Excelsior MOOC offered ungraded self checks in each of the modules. These activities enhanced the content and reinforced difficult ideas; they offer opportunities to practice and check own knowledge before taking module quizzes. As we highlighted in the Literature Review chapter, Marzano's taxonomy classifies comprehension levels by engagement and familiarity with the topic or the task presented, whereas Bloom's taxonomy classifies them by task difficulty. Students choosing self-checks (referred as "simulation" in variable number 2 results: Skills needed to effectively manage the process of SDL) as a preferred media learning enhancement feature of the course can be a reflection that the design of the MOOC supports students' Self system within Marzano's taxonomy.

Table 5.4 presents a summary of our findings for variable 1:

Table 5.4
Summary of results for variable SD 1

Awareness	Attitudes	Motivation
Students are aware of the large amount of information in MOOCs and understand this can be a challenge	Students are used to work as a team member although, but they realize this might be challenging within MOOCs Students do not find necessary to establish relationships between them to maintain social harmony	Students are not motivated by other people's success. We believe that they are intrinsically motivated due to their own inner self.

5.3.2.b Variable SD2 analysis: skills needed to effectively manage the process of SDL

This data gives us information about learning strategies, learning methods, learning activities and interpersonal skills.

a. *Learning Strategies*: this indicator gives us information about how aware are students of their learning progress, achievements and goals.

b. *Learning Methods*: this indicator gives us information about what learning methods they use when learning.

c. *Learning Activities*: this indicator gives us information about what learning activities the students find more helpful.

d. *Interpersonal Skills*: this indicator gives us information about how important is the social community while learning.

a) Learning Strategies

Students taking the MOOC believe that they are able to identify strengths and weaknesses, they believe they are able to assess their learning progress and assess if they reach their learning objectives. They are also able to identify their learning strategies and role within their group. All percentages for these categories are quite uniform around 60-70% in agreement (“often, “always”).

b) Learning Methods

The majority of the students taking the MOOC take notes and summarize what they are learning, and like to explore information beyond the course content. 47.6% of students believe that complex information does not increase their attention (“sometimes”, “seldom”, “never”) and they usually do not go back and revise what they have learned.

c) Learning Activities

Students believe that simulations and case studies are effective in online learning, and interactions are more effective than just listening to lectures. 53.2% do not think that role-playing is as effective as simulations and case studies (“sometimes”, “seldom”, “never”).

d) Interpersonal skills

58.8% of students taking the MOOC do not take part in online discussions often (“sometimes”, “seldom”, “never”). 51.1% do not feel the need of sharing information often with others (“sometimes”, “seldom”, “never”), and do not need the support of their peers to move forward and gain further knowledge.

Findings from the analysis of "skills needed to effectively manage the process of SDL" variable

Related with the variable "Skills needed to effectively manage the process of SDL" we would like to highlight the following interesting findings:

a) *MOOC design related with SDL*

MOOCs can be understood as VLE (Virtual Learning Environments) and be designed to empower students SDL skills. Not a lot of research had been conducted in the field related with this particularity: how to design online environments to empower students to be independent learners (Simmering, Posey & Piccoli, 2009). Excelsior MOOC had been designed with this goal in mind, the development team wanted to provide clear instructions, clear organization for each of the modules and clear expectations for the students to follow and be able to navigate the course independently.

b) *Complex information processing*

MOOCs are gatherings of people that had not prior connection. MOOC takers are interested in others' opinions and points of view and value the diversity of ideas and how the information flows (de Waard et alt., 2010). MOOC takers expect learning not to be a linear process; and they recognize that knowledge builds on previous learned ideas. The learning cycle within MOOC environments is as follows: new knowledge builds on previous understanding, but this previous understanding can be reevaluated and revisited while learning new concepts. Students in this MOOC explore information beyond the goals of the course, this process is performed by the students almost without their knowledge; it is mainly shaped by the group dynamics and MOOC design (de Waard et alt., 2010).

c) *Simulations and case studies*

Preferring simulations and case studies over role-play activities can be explained due to the fact that the course is taking place online. Role playing activities can be accomplish using audio, video or simulations (Ching, 2014), but can be challenging to implement and design instructional activities to accomplish main goals. Students prefer case studies and simulations instead of role playing activities. Simulations are defined as controlled models that depict real world situations (DeBord, 1989). In online environments simulations take the place of role-playing activities, where the students can play the role of a character or be involved in a learning situation. It is understandable that students prefer simulations over role playing because of this reason.

c) Discussions

Particularly excelsior MOOC is a cognitive MOOC and the emphasis is on the content. It has been designed with the goal of being a comfortable environment for students that want to gain knowledge on the topic area, at their path, choosing the resources they want to read/view/explore. Discussions provide the opportunities to build social community but looking at the data gathered on this topic there is a noticeable percentage of students that do not think that is their main goal when taking the MOOC. MOOC discussions can become complex really fast. It is difficult to find peers that share same interests and motivations therefore learning is accomplished by defining self-directed goals and using the optional social interactions to support engagement if needed (McAuley, Stewart, Siemens & Cormier, 2010). Our findings align with current research in the sense that a noticeable percentage of students do not see discussions as a fundamental piece of their MOOC experience. Table 5.5 presents a summary of our findings for variable 2:

Table 5.5
Summary of results for variable SD 2

Learning Strategies	Learning methods	Learning activities	Interpersonal Skills
MOOC was designed with the idea of supporting SDL skills Students are able to assess their leaning progress and set own goals	Students are used to explore information beyond the goals of the course	Students prefer simulations and case studies	Around one fourth of the students do not actively participate in discussions

5.3.2.c Variable SD3 analysis: constructing knowledge

This data gives us information about how the individuals actively construct knowledge, not through interaction, but through actively engaging with course content.

Students think that conceptual-maps are a useful learning tool, but 24% no not use them regularly.

Findings from the analysis of "constructing knowledge" variable

Related with the variable "constructing knowledge" we would like to highlight the following interesting findings:

Conceptual maps usage

The use of conceptual maps in MOOCs seem to aid the students keep up with the course content, and it is recommended as a tool to condense and graphically organize information for the students (Barrachina, Conejero, Jordan & Murillo-Arcilla, 2015). Although 61.6% of the students in the Excelsior MOOC do not use them regularly, ("sometimes", "seldom", never") literature suggests that they should be introduced in MOOC type of courses. Table 5.6 presents a summary of our findings for variable 2:

Table 5.6
Summary of results for variable SD 3

Constructing knowledge
Students see potential in the use if Conceptual Maps to organize and structure course content

5.3.2.d Summary of findings for the SD instrument

Figure 5.2 provides a visual of the findings for each variable

SDL variables			
Demographics	**1.Antecedents of SDL skills**	**2.Skills needed to effectively manage the process of SDL**	**3.Constructing knowledge**
Age	Awareness	Learning Strategies	No subcategories
Gender	Attitudes	Learning Methods	
	Motivation	Learning Activities	
		Interpersonal Skills	

- *Keep up with available resources*
- *Work as a team member*
- *Intrinsic motivation*

- *Complex information processing*
- *Simulations and case studies*
- *Discussions*

- *Conceptual map usage*

Marzano's taxonomy

Figure. 5.2 SDL questionnaire findings

From the results presented in fig. 5.2 we would like to highlight that Marzano's taxonomy could be related with Variable 1: "Antecedents of SDL Skills" and Variable 2: "Skills needed to effectively manage the process of SDL". Results show that students are intrinsically motivated, but need help keeping up with available resources, processing complex information and working as a team member. They prefer case studies and simulations and are not as interested in participating in discussions.

Marzano's taxonomy takes into account the intrinsic motivation that students bring to the tasks (the MOOC) and offers levels of through processing and levels of task classification to design assignments and outcomes for the course. Using this framework for the design allows the students to become independent learners (Nakyam, Kwangswad, Thoopthong, & Sriampai, 2013). Following this taxonomy's classification we could display how it adds value to the MOOC design (table 5.7)

Table 5.7
Marzano's design in the MOOC

Information	Mental Procedures	Psychomotor Procedures
Students engage with course concepts using simulations (self-checks), and assess available resources	Students engage in complex information processing skills	Not applicable

We will expand on this taxonomy classification as we add more data from other instruments. As a snapshot of the results from the SD instrument investigation with the Excelsior MOOC participants we create a prototypical MOOC participant and his characteristics as follows:

> "Male student with an average age of 40 years old. He struggles sometimes keeping up with all the resources available, and working online as a team member although he is usually intrinsically motivated. He is able to identify own strengths and weaknesses and assess and monitor his learning progress. Complex information does not capture his attention and he rather participates in simulations and case studies than online role-playing. Not really interested in participating in MOOC discussions, and it is not too familiar with the usage of cmaps as a learning aid."

1. Antecedents of SDL skills
2. Skills needed to effectively manage the process of SDL
3. Constructing knowledge

5.3.2.e Correlation between SDL degree and quizzes taken in the MOOC

After analyzing the results from the SD survey we present the analysis of the possible correlation between taking more quizzes and having a higher degree of SDL readiness. From the ANOVA results we can conclude that there are significant differences within some groups of quiz takers and the final scores obtained in the SDL survey (significant level of 0.003, $p=0.003< 0.05$). From our knowledge there is only one study that compared SDL readiness and completion rates in MOOCs (Schulze, 2014). This study compared SDL final scores of MOOC participants and their own estimates on completion. MOOC takers were asked to estimate the possibility of finishing the MOOC giving a percentage. The final result of this study was that a correlation exists between showing higher level of SDL readiness and own completion estimation. This study is similar to ours, but we compare SDL readiness with amount of quizzes taken. We found Schulze's study too dependent on students' believes. This is why we wanted to correlate SDL scores with a reliable independent variable. In our situation: number of quizzes taken that is extracted from the LMS data.

In our multiple comparisons study not all the groups showed statistical differences, only students that took 4 quizzes are statistically different related with the SDL scores form the other groups (excluding the students that took 5 quizzes). The biggest difference in the means between groups can be found between students that took four quizzes and 7 quizzes.

Our explanation for such a result is that if a MOOC student stays in the course for about 4 or 5 modules, there is a greater probability that he/she will complete the course; his/her SDL scores are different from the students taking other amount of quizzes. After stating this conclusion, we would like to mention two limitations in our results:

- We have not been tracking some of the messages sent by the instructor to all the students during the modules. It is our impression that some of these emails could be triggering of participation and help with student engagement. This variable might have an affect our result in this correlation.
- We found that module 4 is the one that shows statistical differences with the other modules, and our thought is that maybe module 4 could be a better benchmark to start our analysis than module 3 as we have done for this research.

5.3.3 Instrument A: demographic and motivation information

Table 5.8 shows where this instrument is situated within our design and what question are we trying to respond with its results:

Table 5.8
Analysis design

	Probing Question 1 What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?	Probing Question 2 Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?
Research Questions	**1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC?** **1b. How is the MOOC COI perceived and experienced by MOOC takers?** **Cognitive presence** **Teaching presence** **Social presence** **2a. What is the SDL readiness levels of MOOC takers** **2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?**	3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI? 3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?
Instruments	**Phase II** **Instrument SD: Readiness Scale questionnaire** **Phase III** **Instrument A: Demographic and motivation information** **Instrument B: COI presences questionnaire**	Phase III Instrument C: Student interviews Instrument D: Experts focus groups

The analysis of the information from instrument A is going to be presented by variables (table 5.9):

1. Personal demographic information
2. Main reason to register for the MOOC
3. Main reason to keep engaged during the MOOC
4. Main reason to stop pursuing the MOOC

Table 5.9
Analysis of instrument A by variables

1. Personal demographic information	2. Main reason to register for the MOOC	3. Main reason to keep engaged during the MOOC	4. Main reason to stop pursuing the MOOC
Age and gender *(already analyzed together with SD instrument results)*	Enrollment	Learning activities	MOOC completion
Country of residency	Cybersecurity experience		Obstacles to completion
Language	Goals at registration		Online experience
Highest degree of education			Taking a MOOC again

5.3.3.a Variable A1 analysis: personal demographic information

This data gives us information about students' country of residency, native language and highest degree of education.

a) *Country of residency*: this indicator gives us information about students geographic distribution when taking the MOOC
b) *Native language*: this indicator gives us information about students' mother tongue and English level.

c) *Highest degree of education*: this indicator gives us information about the distribution of professional degrees.

a) Country of residency

This indicator gives us information about how geographically distributed are the students taking the MOOC. Around 30% belong to USA and the rest are international. Approximately 30% of international students are taking the MOOC from Spain (9%), Brazil (8%) and India (9%).

b) Language

This indicator gives us information about the level of English language. 40% of the students have English as a first language and 60% don't. Around 70% of the non-native rated themselves as Intermediate/advanced level

c) Highest degree of education

This item gives us information about the distribution of education degrees with respect to the MOOC students. Almost 80% of the students in the Cybersecurity MOOC have some college degree ranking from Associate degrees to PhD's.

<u>Findings from the analysis of "personal demographic information" variable</u>

Related with the variable "personal demographic information" we would like to highlight the following interesting findings (table 5.10):

Table 5.10

Participants by Country of residency, English level and degree

	English level	Highest degree
USA (28.6%)	Native speaker 61.1%	Undergrad 77.2% Grad 18.3% PhD 4.5%
	Non- native speaker 38.9% *Beginning 14.3%* *Intermediate 7.1%* *Advanced 78.6%*	Undergrad 78.6% Grad 7.1% PhD 14.3%
Spain (8.7%)	Non- native speaker 100% *Beginning 25%* *Intermediate 33.3%* *Advanced 41.7%*	Undergrad 33.3% Grad 66.7% PhD 0%
India (8.7%)	Non- native speaker 100% *Beginning 9%* *Intermediate 36.4%* *Advanced 54.6%*	Undergrad 54.5% Grad 45.5% PhD 0%
Brazil (7.9%)	Non- native speaker 100% *Beginning 10%* *Intermediate 60%* *Advanced 30%*	Undergrad 60% Grad 30% PhD 10%
France (5.6%)	Non- native speaker 100% *Beginning 0%* *Intermediate 75%* *Advanced 25%*	Undergrad 37.5% Grad 62.5% PhD 0%
UK (4.8%)	Native speaker 33.3%	Undergrad 100% Grad 0% PhD 0%
	Non- native speaker 66.7% *Beginning 0%* *Intermediate 0%* *Advanced 100%*	Undergrad 50% Grad 50% PhD 0%
Rest (35.7%) [Countries with percentages lower than 4.8%]	Native speaker 16.4%	Undergrad 100% Grad 0% PhD 0%
	Non- native speaker 83.6% *Beginning 13.2%* *Intermediate 41.3%* *Advanced 45.5%*	Undergrad 54.3% Grad 41.3% PhD 4.4%

We would like to highlight two profiles: native and non-native speakers. Native speakers from USA, UK and some of the "rest" countries show higher percentages of undergraduate students. The majority of non- native students rate themselves with an intermediate-advanced English level. Non-native speakers from USA, Spain, India, Brazil, France, UK and "rest" show a diversity of students' profile, grad and undergrad, with no polarization towards one type or the other. Spanish and French students show higher degrees of education, majority of grad students, while India and Brazil show more undergrad students (Fig.5.3).

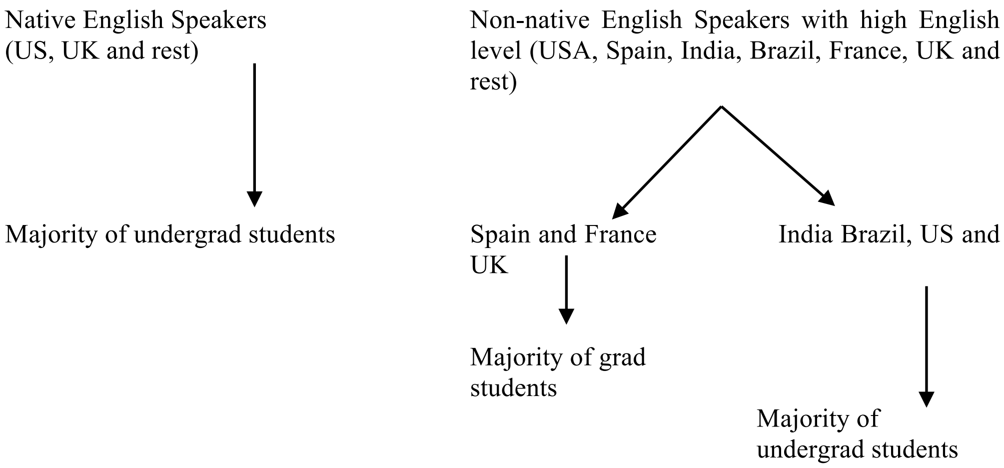


Figure 5.3 provides a visual of the different MOOC takers' profiles

5.3.3.b Variable A2 analysis: main reasons to register for the MOOC

This data gives us information about enrolment, Cybersecurity experience and goals at registration.

a) *Enrolment:* this indicator gives us information about students geographic distribution when taking the MOOC

b) *Cybersecurity experience:* this indicator gives us information about students' mother tongue and English level.

c) *Goals at registration:* this indicator gives us information about the distribution of professional degrees.

a) Enrolment

This item gives us information about main reasons to enroll in the MOOC. Percentages add to more than a 100% because students could choose more than one response. In order of preference the reasons are:

1. Academic curiosity (54.3%)
2. Course teaches skills that might be helpful in obtaining a new job (37.8%)
3. Course is related to current job responsibilities (32.3%)
4. Course relates to study program (30.7%)
5. Help to improve performance in current job (29.1%)
6. Make professional connections (28.3%)
7. Looking to change careers and formal education is too expensive (26.8% each choice)
8. Just for fun (23.6%)
9. Geographically away from institutions (7.9%)

b) Cybersecurity experience

This item gives us information about the experience in the field of Cybersecurity that the students can bring to the course. Table 5.11 displays Cybersecurity experience levels by country, we are combining grad and PhD students in the same category for this analysis, and just making the distinction between undergrad studies and grad studies.

Table 5.11
Participants by Country of residency, English level, degree and MOOC completion

	English level	Highest degree	Cybersecurity experience
USA (28.6%)	Native speaker 61.1%	Undergrad 77.2%	No experience 38.5% Beginning 53.8% Intermediate 0% Advanced 7.7%
		Grad and PhD 22.8%	No experience 50% Beginning 50% Intermediate 0% Advanced 0%
	Non- native speaker 38.9% *Beginning 14.3%* *Intermediate 7.1%* *Advanced 78.6%*	Undergrad 78.6%	No experience 87.5% Beginning 12.5% Intermediate 0% Advanced 0%
		Grad and PhD 21.4%	No experience 0% Beginning 100% Intermediate 0% Advanced 0%
Spain (8.7%)	Non- native speaker 100% *Beginning 25%* *Intermediate 33.3%* *Advanced 41.7%*	Undergrad 33.3%	No experience 50% Beginning 0% Intermediate 50% Advanced 0%
		Grad and PhD 66.7%	No experience 12.5% Beginning 25% Intermediate 62.5% Advanced 0%
India (8.7%)	Non- native speaker 100% *Beginning 9%* *Intermediate 36.4%* *Advanced 54.6%*	Undergrad 54.5%	No experience 33.3% Beginning 16.7% Intermediate 33.3% Advanced 16.7%
		Grad and PhD 45.5%	No experience 40% Beginning 40% Intermediate 0% Advanced 20%
Brazil (7.9%)	Non- native speaker	Undergrad 60%	No experience 0%

	English level	Highest degree	Cybersecurity experience
	100% *Beginning 10%* *Intermediate 60%* *Advanced 30%*		Beginning 60% Intermediate 40% Advanced 0%
		Grad and PhD 40%	No experience 0% Beginning 25% Intermediate 25% Advanced 50%
France (5.6%)	Non- native speaker 100% *Beginning 0%* *Intermediate 75%* *Advanced 25%*	Undergrad 37.5%	No experience 33.3% Beginning 33.3% Intermediate 0% Advanced 33.3%
		Grad and PhD 62.5%	No experience 0% Beginning 80% Intermediate 20% Advanced 0%
UK (4.8%)	Native speaker 33.3%	Undergrad 100%	No experience 0% Beginning 0% Intermediate 100% Advanced 0%
		Grad and PhD 0%	No experience 0% Beginning 0% Intermediate 0% Advanced 0%
	Non- native speaker 66.7% *Beginning 0%* *Intermediate 0%* *Advanced 100%*	Undergrad 50%	No experience 0% Beginning 100% Intermediate 0% Advanced 0%
		Grad and PhD 50%	No experience 50% Beginning 50% Intermediate 0% Advanced 0%

	English level	Highest degree	Cybersecurity experience
Rest (35.7%)	Native speaker 16.4%	Undergrad 100%	No experience 22.3% Beginning 44.4% Intermediate 33.3 Advanced 0%
		Grad 0%	No experience 0% Beginning 0% Intermediate 0% Advanced 0%
	Non- native speaker 83.6% *Beginning 13.2%* *Intermediate 41.3%* *Advanced 45.5%*	Undergrad 54.3%	No experience 6.3% Beginning 56.2% Intermediate 37.5% Advanced 0%
		Grad and PhD 45.7%	No experience 26.7% Beginning 26.7% Intermediate 33.3 Advanced 13.3%

With this new data we can add more information to our student profile (figure 5.4):

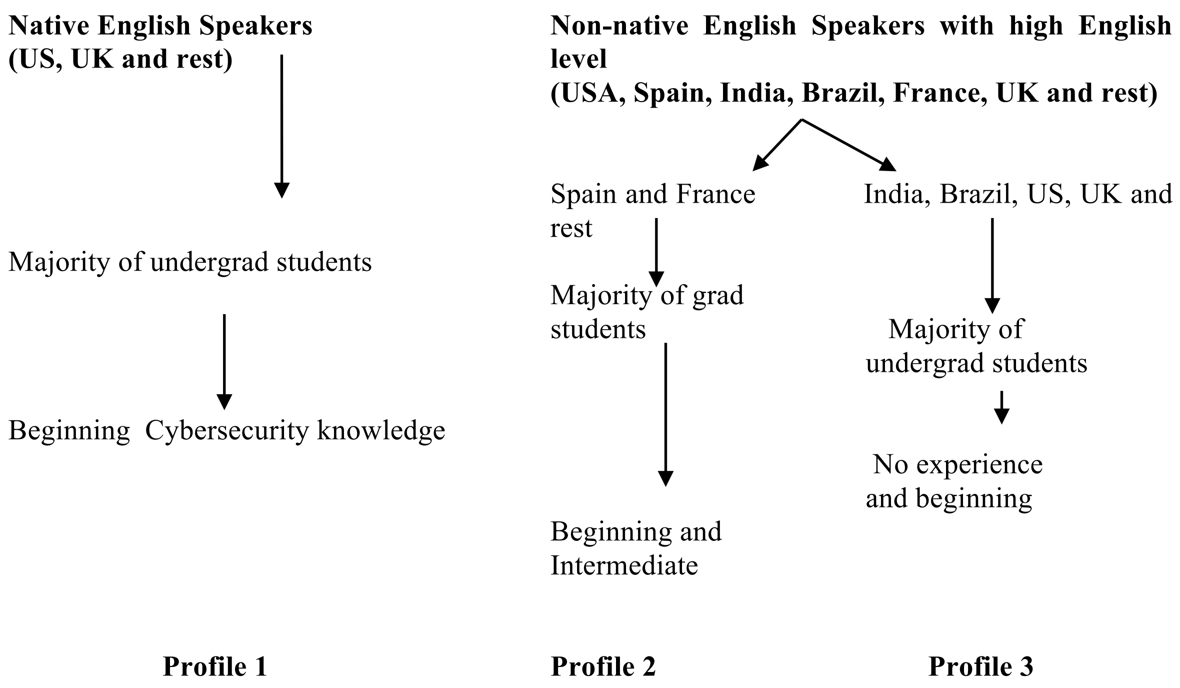


Figure 5.4 Visual of the different MOOC takers' profiles with Cybersecurity experience

c) Goals at registration

This item gives us information about students' goals at registration, displayed below by order of importance.

1. Complete the course (54.3%)
2. Obtain a certificate (38.6%)
3. No expectation of finishing (5.5%)

In table 5.12 we offer information about students that had MOOC completion as a goal, and we will compare them with the actual completion numbers obtained in the following variable " variable 4", item "completion".

Table 5.12
Completion goals by country and level of expertise

	English level	Highest degree	Goal of completion
USA (28.6%)	Native speaker 61.1%	Undergrad 77.2%	91.7%% want to complete the course
		Grad and PhD 22.8%	83.3% want to complete the course
	Non- native speaker 38.9% *Beginning 14.3%* *Intermediate 7.1%* *Advanced 78.6%*	Undergrad 78.6%	100% want to complete the course
		Grad and PhD 21.4%	100% want to complete the course
Spain (8.7%)	Non- native speaker 100% *Beginning 25%* *Intermediate 33.3%* *Advanced 41.7%*	Undergrad 33.3%	100% want to complete the course
		Grad and PhD 66.7%	87.5% want to complete the course

	English level	Highest degree	Goal of completion
India (8.7%)	Non- native speaker 100% *Beginning 9%* *Intermediate 36.4%* *Advanced 54.6%*	Undergrad 54.5% Grad and PhD 45.5%	83.3% want to complete the course 100% want to complete the course
Brazil (7.9%)	Non- native speaker 100% *Beginning 10%* *Intermediate 60%* *Advanced 30%*	Undergrad 60% Grad and PhD 40%	80% want to complete the course 100% want to complete the course
France (5.6%)	Non- native speaker 100% *Beginning 0%* *Intermediate 75%* *Advanced 25%*	Undergrad 37.5% Grad and PhD 62.5%	100% want to complete the course 100% want to complete the course
UK (4.8%)	Native speaker 33.3%	Undergrad 100% Grad and PhD 0%	100% want to complete the course ----
	Non- native speaker 66.7% *Beginning 0%* *Intermediate 0%* *Advanced 100%*	Undergrad 50% Grad and PhD 50%	100% want to complete the course 100% want to complete the course
Rest (35.7%)	Native speaker 16.4%	Undergrad 100% Grad 0%	100% want to complete the course ---
	Non- native speaker 83.6% *Beginning 13.2%* *Intermediate 41.3%* *Advanced 45.5%*	Undergrad 54.3% Grad and PhD 45.7%	88% want to complete the course 100% want to complete the course

From table 5.12 we can state that the majority of students that responded to this survey had MOOC completion as a goal.

Findings from the analysis of "main reasons to register for the MOOC" variable

Related with the variable "main reasons to register for the MOOC" we would like to highlight the following findings:

a) Social and cognitive presence

The majority of the students are taking the MOOC due to academic curiosity (54.3%), to learn new things. We see this goal related to the cognitive presence within the COI framework: educated learners enroll in MOOCs for particular reasons, usually to learn new things (Kop, Fournier & Mak, 2011). Students are interested in the new knowledge that the course will be able to provide, and not so much about making professional connections, around 28%, (related with social presence in COI framework). Sometimes when the course offers total autonomy, and discussions are not highly monitored, students might feel lost and lose interest in the course (Kop, Fournier & Mak, 2011). This might be one of the reasons why students do not look for connections or social interactions when enrolling in a MOOC, they are more interested in learning independently and interacting with the content.

b) Taker profiles and goals

Figure 5.4 summarized the different students' profiles that emerged from the data collected with this instrument. We could highlight three profiles:

- Profile 1: Native English speakers, from US, UK and rest of countries with undergraduate studies and a beginning knowledge about Cybersecurity
- Profile 2: Non-native English speakers from Spain and France, with graduate level studies and beginning/ intermediate Cybersecurity knowledge.
- Profile 3: Non-native speakers from US, India, Brazil, UK and rest of countries with undergraduate studies and no experience or beginning level in Cybersecurity.

Table 5.13 shows the emerging profiles from our results. The table had ben adapted from research in the field and displays the three identified profiles. We classify our emerging profile 2 as subgroup of profile 3. Profile 2 would be students with higher level of education than profile 3, but with similar goals.

Table 5.13
MOOC taker profiles and relation with literature, adapted from (Swope, 2013)

MOOC taker profiles	Information from research in the field	Explanation of reality (positivist exploratory paradigm)
Profile 1	Native English speakers MOOC takers, usually from USA and UK, recently graduated that are looking to continue their college learning	**Main goal**: continue college learning
Profile 2	Highly educated MOOC takers from countries that value free quality education that want a certificate from an American University and that are expanding previous knowledge or acquiring new concepts in a different field of education	Subgroup of profile number 3 formed by students with higher education terminal degrees with same goals as students belonging to profile number 3 **Main goal**: expand education and add new knowledge
Profile 3	MOOC takers from countries that value free quality education that want a certificate from an American University and that are expanding previous knowledge or acquiring new concepts in a different field of education	**Main goal**: obtain a certificate from an American University and acquire job related knowledge to target professional advancement

We display the students' profile information visually in figure 5.5. Profile 2 is a subsection of profile 3 when we look at main goals when taking the MOOC.

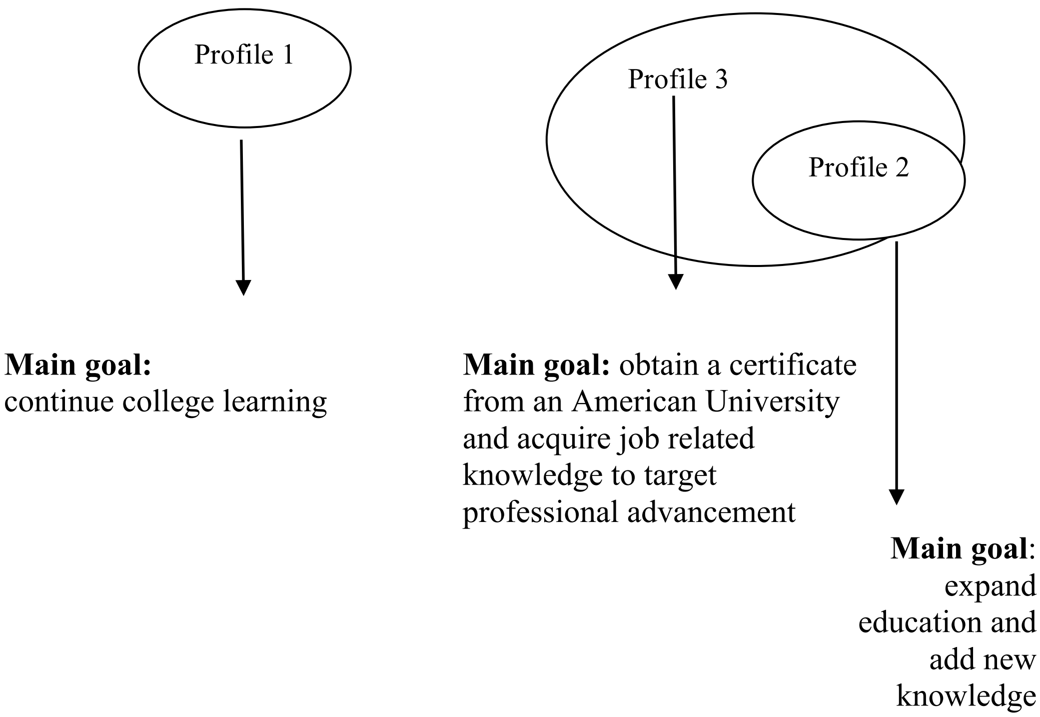


Figure 5.5 MOOC takers' distribution

5.3.3.c Variable A3 analysis: main reasons to keep engaged during the MOOC

This data gives us information about how helpful were the MOOC learning activities. Students highlight which ones were the best tools for their learning.

a) *Learning activities:* this indicator gives us information about students preferences about the different learning activities present on the MOOC.

a) Learning activities

This item gives us information about students' preferences on activities present in the MOOC. By order of preference:

1. Video lectures (78%)
2. Quizzes and readings (66.1% each)
3. Power point presentations (62.2%)
4. Self-checks (48.8%)
5. QA section (39.4%)
6. Discussions (34.6%)

<u>Findings from the analysis of "main reasons to keep engaged during the MOOC" variable</u>

Related with the variable "main reasons to keep engaged during the MOOC" we would like to highlight the following findings:

a) Cognitive presence, teaching presence and social presence

Students seem to value video lectures quizzes, readings and power point presentations at a higher level than self-checks. QA section and discussions interest students the least. This gives us information about the importance of the course cognitive load and content related resources for the students in comparison with the importance of discussions and social interactions in the course.

Relating these results with Marzano's taxonomy, we report that students' Self-system engages with course content at a higher rate when they are presented with video lectures, readings and ppt presentations, and they are not as engaged with discussions type activities. Within the Self-system we find the following characteristics: motivation, importance, efficacy and emotion (Marzano, 2007), therefore we would like to highlight that students think that video lectures, readings and ppts presentations motivate them higher that other activities, have higher importance within their values scale, seem to be more efficient and help them learn better and they feel at ease with the tasks.

When student interact with the course content they are consuming information, and the effort is lower than having to participate in discussions where they need to elaborate on ideas and be proactive about their learning. In order for the students to become interested in discussions MOOC design should provide an easier way of participating in the discussions than just having to deal with thousands of students having online conversations. These unstructured discussions could be a handicap for some of the students and they decide not to participate and just consume content and perform individual activities. Discussions are a valuable tool to promote social learning and co-creation of knowledge, but MOOC discussions are too chaotic to be able to be followed and appropriately use by students. The effort is higher than the rewards and students do not seem particularly interested in the social presence. Besides breaking students into groups and assigning roles within discussions, already explored in recent studies (Guardia, Maina & Sangrà, 2013) we are proposing some new suggestions:

- <u>Instructor's blogging:</u> instead of forcing students to participate in discussions, and alternative could be adding a blog section in the course. The instructor or assigned students would be in charge of posting in reference of a topic or during a particular week. This "forum-like" activity can help scaffolding content for the students and adds flexibility by building some social presence with a cognitive focus.

- News feed in student's dashboard: updating students on what is going on in the course could be beneficial. Having a "newsfeed" type of feature could keep them updated about course topics and emphasize some social interactions.
- Visual representation: webs of knowledge. One of the major concerns from the students seem to the great amount of information that they need to deal with. Visual representations help understanding information better and making emerging ideas clear. This feature could be added to the course for students to have a visual about their progress in the course and their social interactions.

5.3.3.d Variable A4 analysis: main reasons to stop pursuing the MOOC

This data gives us information about if the MOOC had been completed or not, obstacles for completion, student online experience and students plans of taking a MOOC again.

a) *Completion:* this indicator gives us information about students that completed the MOOC or not

b) *Obstacles for completion:* this indicator gives us information about issues that prevent students to complete the course

c) *Student's online experience:* this indicator rates past students' online experience with the goal of assessing if it is an important element for success.

d) *Student plans of taking another MOOC:* this indicator gives us insights on students' future plans to keep learning by taking more MOOCs

c) Completion

This item gives us information about how many students actually finished the MOOC, we are going to compare the percentage of students that finished with the students that had finishing as a goal (table 5.14)

Table 5.14
Completion goals and actual completion by country and level of expertise

	English level	Highest degree	Goal of completion at registration	Completion rate (self reported)
USA (28.6%)	Native speaker 61.1%	Undergrad 77.2%	91.7%% want to complete the course	100%
		Grad and PhD 22.8%	83.3% want to complete the course	83.3%
	Non- native speaker 38.9% *Beginning 14.3%* *Intermediate 7.1%* *Advanced 78.6%*	Undergrad 78.6%	100% want to complete the course	58.3%
		Grad and PhD 21.4%	100% want to complete the course	100%
Spain (8.7%)	Non- native speaker 100% *Beginning 25%* *Intermediate 33.3%* *Advanced 41.7%*	Undergrad 33.3%	100% want to complete the course	100%
		Grad and PhD 66.7%	87.5% want to complete the course	75%
India (8.7%)	Non- native speaker 100% *Beginning 9%* *Intermediate 36.4%* *Advanced 54.6%*	Undergrad 54.5%	83.3% want to complete the course	33.3%
		Grad and PhD 45.5%	100% want to complete the course	40%
Brazil (7.9%)	Non- native speaker 100% *Beginning 10%* *Intermediate 60%* *Advanced 30%*	Undergrad 60%	80% want to complete the course	60%
		Grad and PhD 40%	100% want to complete the course	50%
France (5.6%)	Non- native speaker	Undergrad 37.5%	100% want to	66.7%

	English level	Highest degree	Goal of completion at registration	Completion rate (self reported)
	100% *Beginning 0%* *Intermediate 75%* *Advanced 25%*	Grad and PhD 62.5%	complete the course 100% want to complete the course	100%
UK (4.8%)	Native speaker 33.3%	Undergrad 100%	100% want to complete the course	100%
		Grad and PhD 0%	----	----
	Non- native speaker 66.7% *Beginning 0%* *Intermediate 0%* *Advanced 100%*	Undergrad 50%	100% want to complete the course	66.7%
		Grad and PhD 50%	100% want to complete the course	100%
Rest (35.7%)	Native speaker 16.4%	Undergrad 100%	100% want to complete the course	100%
		Grad 0%	---	
	Non- native speaker 83.6% *Beginning 13.2%* *Intermediate 41.3%* *Advanced 45.5%*	Undergrad 54.3%	88% want to complete the course	68.2%
		Grad and PhD 45.7%	100% want to complete the course	100%

We would input this new data into our students' profiles and display completion information for each of the profiles in Figure 5.6

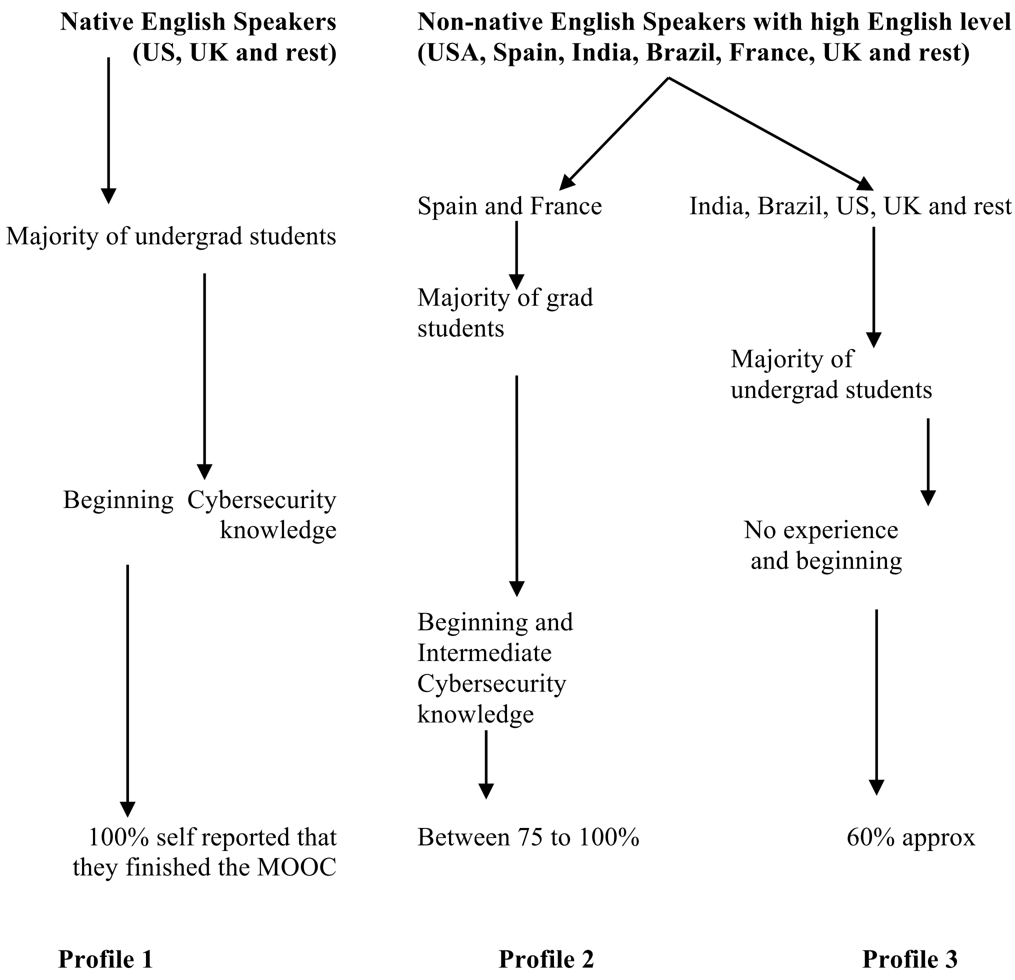


Figure 5.6 Students profiles' and completion rates

Native English speakers self-report a higher percentage of completion than non native speakers.

d) Obstacles for completion

This item gives us information about the main reasons that students reported to be difficulties t finish the MOOC. By order of importance are reported below:

1. Time constrains (25.2%)
2. Conflict with job (10.2%)
3. Connection problems (7.1%)

4. Course workload (3.9%)

e) Students' online experience

This item gives us information about students previous online learning experience related with taking other MOOCs or other online courses. By order of familiarity and percentages this will be:

1. Have taken other MOOCs (52%)
2. Taken other online courses but not for credit (27.6%)
3. Taken other online courses for credit (23.6%)
4. None of the above (18.9%)

f) Students plans of taking another MOOC

This item gives us information about students future goals related with taking more MOOCs as a continuous lifelong learning experience. The responses are displayed below in order of preference:

1. I will keep taking MOOCs (76.4%)
2. I might take another MOOC (20.5%)
3. Not planning on taking more MOOCs (1.6%)

<u>Findings from the analysis of "main reasons to stop pursuing the MOOC" variable</u>

Related with the variable "main reasons to stop pursuing the MOOC" we would like to highlight the following findings:

a) Completion and obstacles

From the data collected in this instrument we can say that the students belonging to profile 1 show higher probabilities of finishing the Introduction to Cybersecurity MOOC than students from other profiles. Students belonging to this profile can be described as: native English speakers, with undergrad studies and beginning knowledge in Cybersecurity. Their main goal at enrolment was to continue college learning.

On the opposite side we find students belonging to profile 3: non-native English speakers, also with undergraduate degrees, with no or very little experience in Cybersecurity. Their main goal at registration was to obtain a certificate from an American University and acquire job related knowledge to target professional advancement.

The main obstacles from completion stated by the students are time constraints (25.2%) and conflict with job duties (10.2%), therefore sometimes personal life or workplace related time constrains challenge MOOC completion.

b) Past online experience

Around 50% of the students have taken online courses before, and even though some students did not finish the MOOC a vast majority (76.1%) stated that they will keep taking MOOCs as a normal practice to expand their education

5.3.3.e Summary of findings for instrument A

Figure 5.7 provides a visual of the findings for each variable:

1.Personal demographic information	**2.Main reason to register for the MOOC**	**3.Main reason to keep engaged during the MOOC**	**4.Main reason to stop pursuing the MOOC**
Age and gender *(already analyzed together with SD instrument results)*	Enrollment	Learning activities	MOOC completion
Country of residency	Cybersecurity experience		Obstacles to completion
Language	Goals at registration		Online experience
Highest degree of education			Taking a MOOC again

- *Undergrad Native English Speakers*
- *Non-native English Speakers with undergrad and grad studies*

- *Not interested in as much in Social Presence*
- *Importance of Cognitive Presence*
- *3 MOOC taker's profiles*

- *Importance of Cognitive Presence*
- *Possible solutions for social and teaching presence*

- *Undergrad native speakers are more likely to finish the MOOC*
- *Students are familiar with online learning*
- *Main difficulties to finish are work[lace and personal life related*

COI

SDL

Marzano's Taxonomy

Figure 5.7 Representation of findings for instrument A

A summary of the major findings for Instrument A would be:

There are two main profiles within the MOOC takers: students that want to continue college learning (Profile 1), and students with interest in obtaining an American College certificate and use it for professional advancement (Profile 3). Both groups show high interest in finishing the course and if they can't accomplish it is because of time constrains and conflict with their jobs.

Variables number 2 and 3 in Instrument A show that students are not as interested in the social presence of the MOOC environments as they are about the cognitive presence. They enroll in the course to learn new concepts in a particular field (academic curiosity 54.3%) and do not think that connections with other participants are crucial for their learning and comprehension (make professional connections 28.3%).

Students value video lectures, quizzes and readings, and power point presentations higher (~68%) than the discussion sections and the QA section (~35%). Main interest of enrolled students is in the cognitive load of the course and not in the student-student interactions. Self-checks had been graded around 50% placing them between the other two groups mentioned previously. By level of interest we could say that students value subdivided content, information delivered in the form of videos, readings and presentations, and they also value interactions (self-checks) still higher than discussions. Establishing a parallelism with Marzano's taxonomy we could classify the previous tasks as shown in figure 5.8.

When the tasks require higher level of cognitive and metacognitive involvement the students seem to be less inclined to participate in the activities. The design of the MOOC should emphasize and support students through these activities now that we know they are not as inclined to try them as they are with some of the more simple ones.

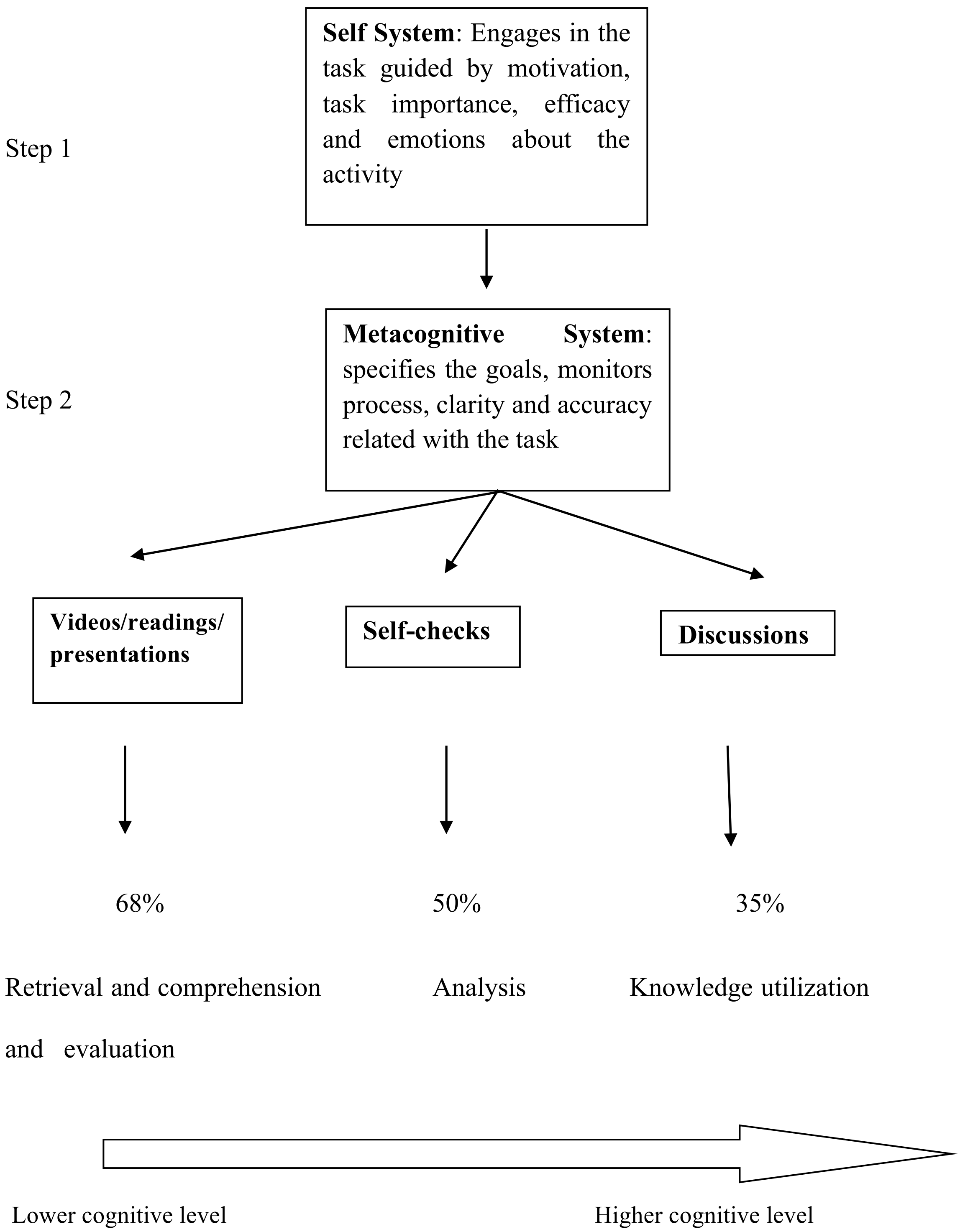


Figure 5.8 Students engagement in each task under a Marzano's taxonomy approach

These results seem to indicate a picture of the COI within MOOCs that is different from the traditional online COI environment (Fig. 5.9) where the three presences complement each other, (Garrison, Anderson & Archer, 2000).

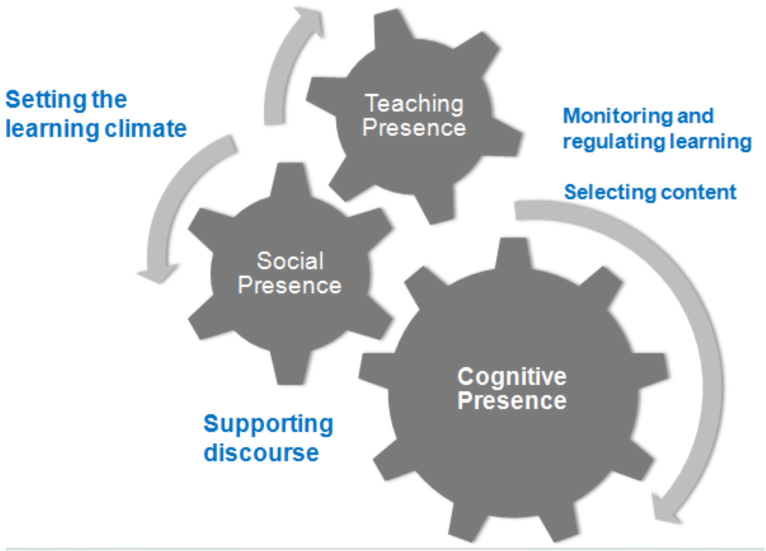


Figure 5.9 COI presences

In MOOC environments, and using our findings from Instrument A, we could start depicting the COI learning experience that students seem to experience (Fig. 5.10). Using our results we would like to highlight the following ideas:

- Cognitive presence has a higher importance for students in this type of online courses (this is why is shown with a larger size than the other two elements)
- Social and teaching presences seem to be perceived as only one presence by the students. The instructor is understood as a guide to help them through the content, and as a supporter of the social group, this is why we compile both presences in one gear.
- Students are aware that they are in charge of their own learning progress, and know how to to identify where do they need help or training in. We

are introducing this new skill in our COI framework as a necessary key element in this type of massive environments.

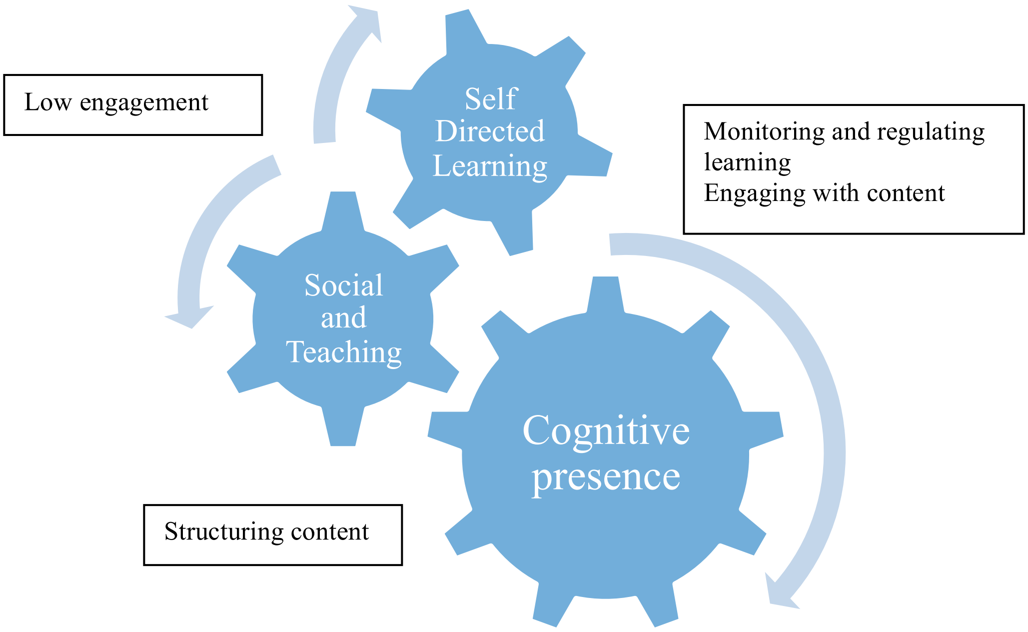


Figure 5.10 COI presences in a MOOC environment

We expect to have a complete picture when we add the findings from Instrument B as well. We provide the analysis of instrument B in next section.

5.3.4 Instrument B: COI presences questionnaire

Table 5.15 shows where this instrument is situated within our design and what question are we trying to respond with its results:

Table 5.15
Analysis design

	Probing Question 1 What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?	Probing Question 2 Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?
Research Questions	**1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC?** **1b. How is the MOOC COI perceived and experienced by MOOC takers?** **Cognitive presence** **Teaching presence** **Social presence** **2a. What is the SDL readiness levels of MOOC takers** **2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?**	3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI? 3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?
Instruments	**Phase II** **Instrument SD: Readiness Scale questionnaire** **Phase III** **Instrument A: Demographic and motivation information** **Instrument B: COI presences questionnaire**	Phase III Instrument C: Student interviews Instrument D: Experts focus groups

The analysis of the information from instrument B is going to be presented by variables (table 5.16):

1. Teaching Presence
2. Social Presence
3. Cognitive Presence

Table 5.16
Analysis of instrument B by variables

1. Teaching Presence	2. Social Presence	3. Cognitive Presence
Instructor as a communicator	Online environment	Content
Instructor as a guide	Online interactions	Own learning capabilities
Instructor as a community builder		

5.3.4.a Variable B1 analysis: teaching presence

This data gives us information about how the students experienced the teaching presence while taking the MOOC. Instructor interactions are explored through the following items:

a) *Instructor as a communicator*: this indicator gives us information about instructor communication skills and ability to reach the students in the online environment.

b) *Instructor as a guide*: this indicator gives us information about how the instructor guides students through the MOOC content and monitors their interactions.

c) *Instructor as a community builder*: this indicator gives us information about the role that the instructor plays within the community of Inquiry and how promotes the sense of community within the students

a) Instructor as a communicator

From the instrument results we would like to highlight communication related with other aspects of the instruction: communication related with course concepts and goals, and communication related with participation in learning activities and course due dates. There is a 12% difference between the student's perceptions related with these two types of instructor communication. They show that the instructor communicates better related with course content and goals than related with course due dates and participation in learning activities; therefore in this case the instructor is emphasizing cognitive presence more than social. (Figure 5.11)

Clearly communicates about course concepts and goals

↓

~ 13% are "neutral" or "disagree" or "strongly disagree"

Clearly communicates about participation in learning activities and course due dates

↓

~ 25% are "neutral" or "disagree" or "strongly disagree" with this statement

Figure 5.11 Instructor communication and other aspects

b) Instructor as a guide

The sub-items within this item that show higher percentage of students agreeing or strongly agreeing are:

- B.1.6: Instructor clearly guides the class towards understanding course topics 74% (“agree and “strongly agree”)
- B.1.9: Instructor clearly encourages course participants to explore new concepts in this course 80% (“agree” and “strongly agree”)

The mentioned sub-items show higher rates than other items related with: engagement, agreements and disagreements on course topics, and keeping students on task. Therefore we conclude that this sub-item from the teaching presence it is also emphasizing cognitive content of the course, therefore related with the cognitive presence in the COI.

Particularly, item B.1.9 refers to the students’ perception on how supportive was the instructor encouraging them to explore new concepts. We would like to connect this item with the idea of Self-directness and how the teaching presence can support this skill.

c) Instructor as a community builder

Within this item, the lowest rated element is related with instructor providing timely feedback (~55%). Within MOOC environments, and due to the elevated participant numbers, instructors struggle to be able to reach all the students and respond to their comments/questions

The rest of the items related with generating sense of community are generally highly rated (~70%), therefore we see this them as depicting how the instructor reinforces social presence for the students

Findings from the analysis of "teaching presence" variable

Related with the variable "teaching presence" we would like to highlight the following findings:

a) How teaching presence relates with the other presences

Figure 5.12 visually displays how teaching presence supports and interacts with the other presences from the students' perspective:

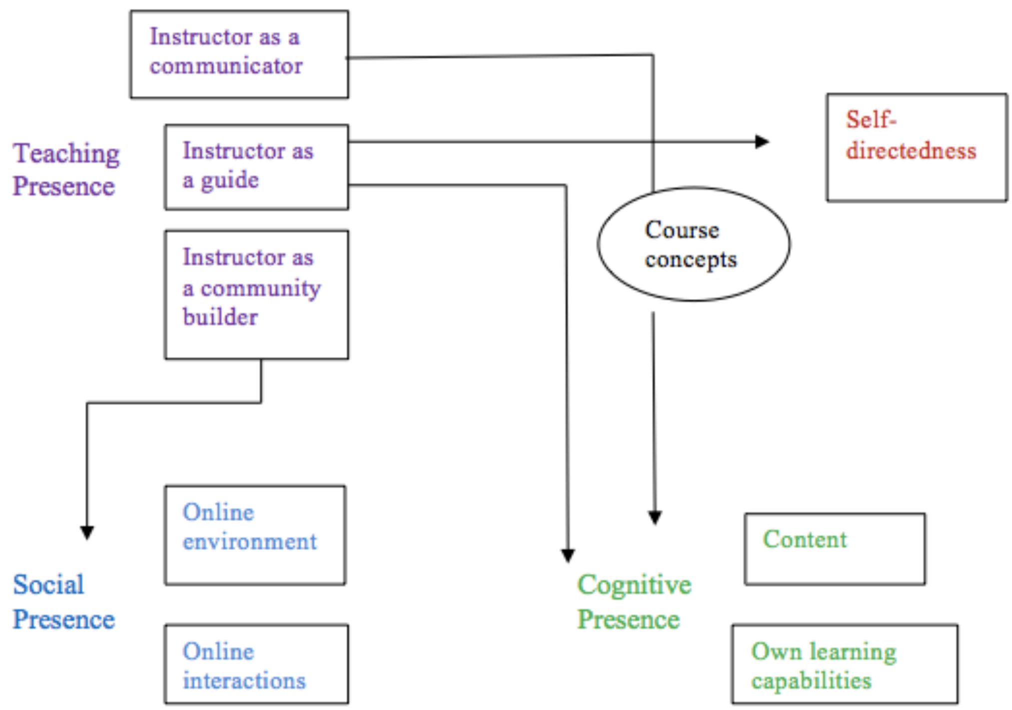


Figure 5.12 Teaching presence relation with the other presences

Teaching presence relates with social and cognitive presences. A snapshot of the teaching presence within a MOOC environment can be presented as:

Teaching presence is built when the instructor communicates and clarifies course content (connection with cognitive presence) and when he/she acts as a guide empowering the students to be self-directed learners (related with self-directedness). It also reinforces the social presence when instructor acts as a community builder and students feel that they belong to the group.

5.3.4.b Variable B2 analysis: social presence

This data gives us information about how the students experienced the social presence while taking the MOOC. Social interactions are explored through the following items

a) *Online environment*: this indicator gives us information about how friendly is the environment to support social community

b) *Online interactions*: this indicator gives us information about how the MOOC activities facilitate socialization within the student population

a) Online environments

The sub-items that we would like to highlight within this topic are related with participating in online discussions. In general, students agree with the idea that online courses are excellent mediums for communications, and they feel comfortable conversing online, and establishing virtual collaborations, but when it comes to participating in the MOOC discussions and interacting with other students in the MOOC the neutral and disagreeing parts of the responses increase their value and becomes comparable to the agreement percentages. This could be an indicator that students are comfortable online as learning spaces, but particularly, MOOC discussions do not provide a very good framework for students to use and feel conformable doing it.

b) Online interactions

Students tend to agree about the idea that discussions create a sense of belonging to the course and they report being able to form an impression about the other participants through discussions. They also state that they feel comfortable interacting with other participants. But students rate with higher “neutral” “disagree” and “strongly disagree” percentages than “agreement” for the following items:

- B.2.7 I felt comfortable disagreeing with other participants ~60% (“neutral”, “disagree” and “strongly disagree”)
- B.2.8.I felt that my point of view was acknowledged by other participants ~62% (“neutral”, “disagree” and “strongly disagree”)

We explain these higher rates related with the possibility that the students did not experience the opportunity of disagree with the other participants or make their point across. Seeing that they rated their interaction in discussions neutral as well, we find this explanation possible.

<u>Findings from the analysis of “social presence” variable</u>

Related with the variable “social presence” we would like to highlight the following findings:

a) How social presence relates with the other presences

Figure 5.13 visually displays how social presence supports and interacts with the other presences from the students’ perspective within the MOOC. Social presence does not reach far to the other presences in this MOOC. The online environment does not seem to particularly promote students interactions in the course and the online interactions are “neutral” or “dsagree” rated with regards to promoting social presence. So far it seems that the key supporter of the online social presence within this MOOC is the instructor when he acts as community builder.

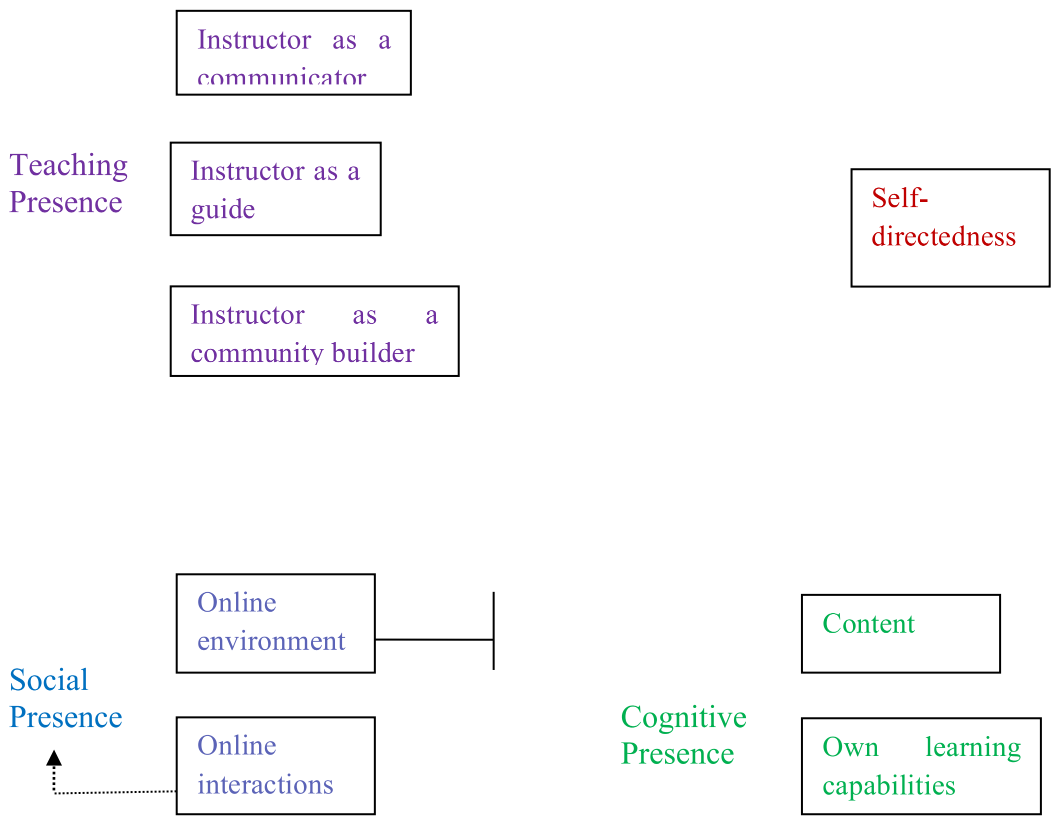


Figure 5.13 Social presence in relation with the other presences

A snapshot of the social presence within a MOOC environment can be presented as:

Social presence is not well supported by a MOOC environment, students do not feel that it is a good setting for interactions although they have past experiences learning online and participating in discussions.

5.3.4.c Variable B3 analysis: cognitive presence

This data gives us information about how the students experienced cognitive presence while taking the MOOC. Cognitive load is explored through the following items

a) *Course content*: this indicator gives us information about how the students interacted and value the course content

b) *Own learning capabilities:* this indicator gives us information about how students use their own learning capabilities and skills to be successful in the course

a) Course content

Students state that course activities sparked their curiosity (75%) and interest (68%) in the course ("agree" and "strongly agree"). Students rated the usefulness of online discussions with the higher disagreement percentages (41.6%) when asked about the usefulness of the discussions and their value to help understanding content in the MOOC ("neutral, "disagree" and "strongly disagree"). The disagreement percentages where higher compared with other items, but students seem to see the value that discussions add related with different perspectives and points of view for particular issues. In this sense they agree on their value.

b) Own learning capabilities

Combining new information to respond to questions in the MOOC is the item that shows the highest ratings from the students. Designing courses that help scaffolding information would benefit students making sense of the information that is presented. Students grade motivation to explore course content very high ~80%, ("agree" and "strongly agree") it seems they are pre-engaged in the content and showed high levels of interests in Cybersecurity. There are also high rates when asked about how the concepts learned in the course can be applied in their jobs or other activities 73% ("agree" and "strongly agree"). Independently looking for information and exploring content related questions are also highly rated for this variable 78% ("agree" and "strongly agree"). We understand that students value self-directedness when exploring MOOC content. Following Marzano's framework, students will engage in a task more likely if they are interested by the topic and intrinsically motivated to learn about it. Figure 5.14 depicts the activities and their classification with Marzano's taxonomy levels

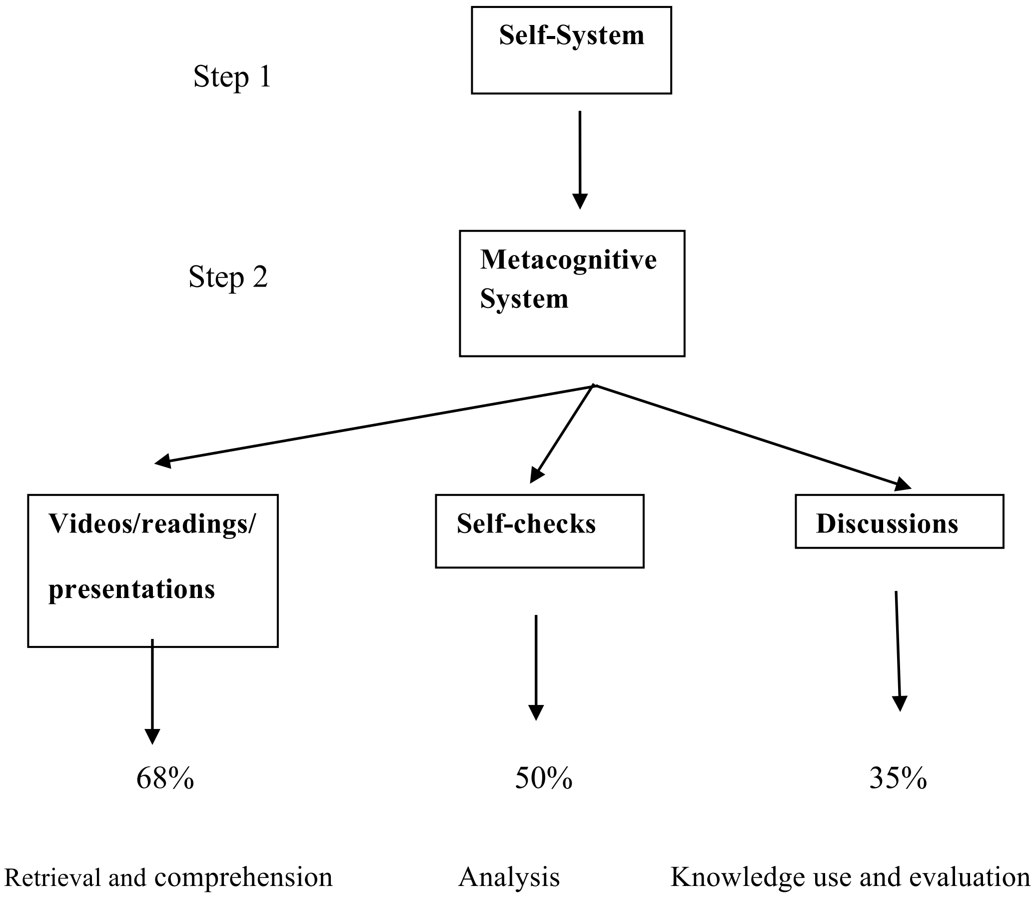


Fig. 5.14 Activities' classification within Marzano's taxonomy.

We would like to explain how each of the activities in the MOOC aligns with this taxonomy. Table 5.17 depicts each of the assignments and classifies them by taxonomy levels. Each of the levels states the type of information processing, mental procedures and psychomotor procedures if any.

Table 5.17

Marzano levels

Videos/readings/presentations. Taxonomy level: Retrieval and comprehension

Information	Mental Procedures	Psychomotor Procedures
Students recognize, integrate and symbolize information from video lectures readings	Students monitor own understanding	No necessary motor skills

and presentations

Self-checks. Taxonomy levels: analysis

Information	Mental Procedures	Psychomotor Procedures
Students match, classify, compose information when experimenting with the different types of self checks	Students monitor own understanding and set own objectives and strategies to gain new knowledge	Be able to use mouse and drag and drop boxes

Discussions. Taxonomy levels: evaluation

Information	Mental Procedures	Psychomotor Procedures
Students make judgments about new knowledge and ideas presented in the discussions	Students check for content quality and accuracy of the acquired knowledge through discussions	Be able to type

As the comprehension levels increase students need to make a bigger effort in involvement and mental procedures used. MOOC environments facilitate content consumption but does not scaffold information enough for the students to be conformable and have the same level of participation in all the activities.

<u>Findings from the analysis of "cognitive presence" variable</u>

Related with the variable "cognitive presence" we would like to highlight the following findings (Fig. 5.15):

How cognitive presence relates with the other presences

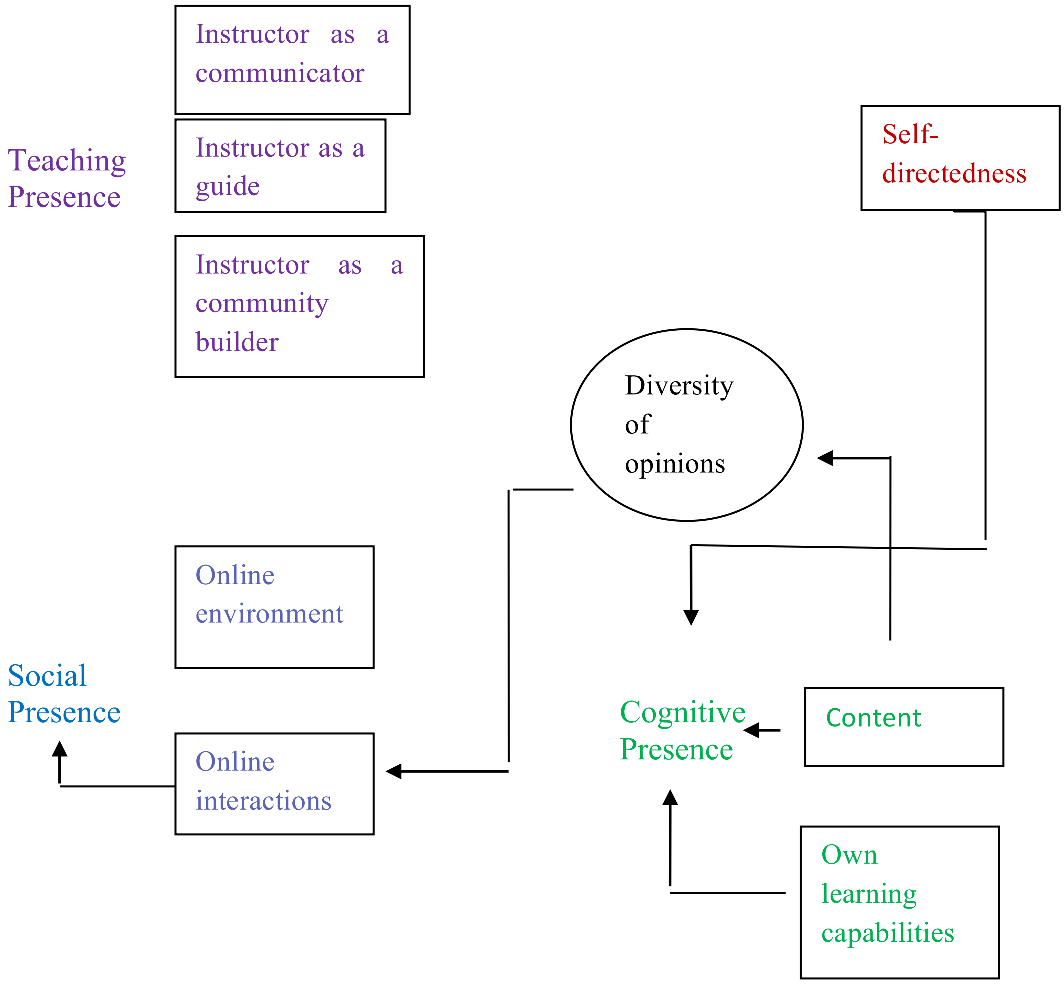


Figure 5.15 Cognitive presence in relation with the other presences

A snapshot of the cognitive presence within a MOOC environment can be presented as:

Cognitive presence is supported by content of the course and related with social presence through the acknowledgement that discussions add diversity of perspectives and points of view, and they enriched the overall content of the course. Students engage with course content independently mainly through readings, videos and presentations.

5.3.4.d Summary of findings for instrument B

Figure 5.16 provides a visual of the findings for each variable:

1. Teaching Presence	2. Social Presence	3. Cognitive Presence
Instructor as a communicator	Online environment	Content
Instructor as a guide	Online interactions	Own learning capabilities
Instructor as a community builder		

• *Relates with social, cognitive presences and self-directedness*	• *Online environment does not specially support social presence* • *Teaching presence (instructor as a community builder) supports social interactions*	• *Importance of being self-directed* • *Relates with social presence through diversity of opinions in discussions*

Figure 5.16 Representation of findings for instrument B

After analyzing these results our proposal for the COI framework in MOOC environments would be the following one (Figure 5.17):

Cognitive and teaching presences are more prominent and noticeable from the students' perspective than social presence. Another emerging skill or "presence" seems to be Self-directedness: students rate the items that relate independent use of information in the higher end of the scale and MOOC's seem to be an online environment that provides this kind of flexibility.

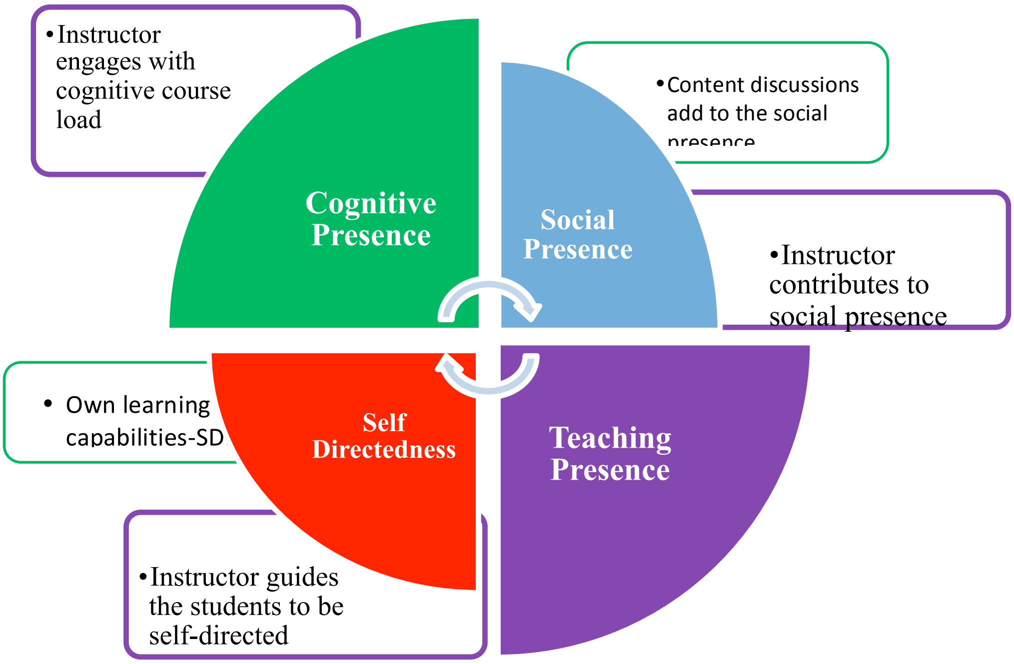


Figure 5.17 COI in a MOOC a

If we compare this figure with the one we provided early in the chapter, Fig. 5.9, we see that they are slightly different. In the first one we combined teaching and social presence as one key element. In the one presented now, we are separating teaching and social presence, but stating that teaching presence seems to be more important for students than social presence (larger size in Fig. 5.10). The reason for this change is that students value discussions as a way of sharing different perspective and points of view related with the course content. Even though they think discussions are a challenge, they still see a value in this activity, related with the cognitive load of the course.

5.4.- Responses to research questions 1 and 2

After analyzing Instruments SD, A and B we would like to compile our findings and give responses to our research questions related with the above mentioned instruments (Table 5.18):

Table 5.18
Research questions 1 and 2

Research Questions	1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC? 1b. How is the MOOC COI perceived and experienced by MOOC takers? Cognitive presence Teaching presence Social presence 2a. What is the SDL readiness level of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?

Research Question 1a.
What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC?

Male student with an average age of 40 years old. He struggles sometimes keeping up with all the resources available, and working online as a team member although he is usually intrinsically motivated. He is able to identify own strengths and weaknesses and assess and monitor his learning progress. Complex information does not capture his attention and he rather participates in simulations and case studies than online role-playing. Not really interested in participating in MOOC discussions, and it is not too familiar with the usage of cmaps as a learning aid.

In more detail, and related with goals to start and keep engaged during the MOOC, we identified three types of students' profiles (Fig. 5.18):

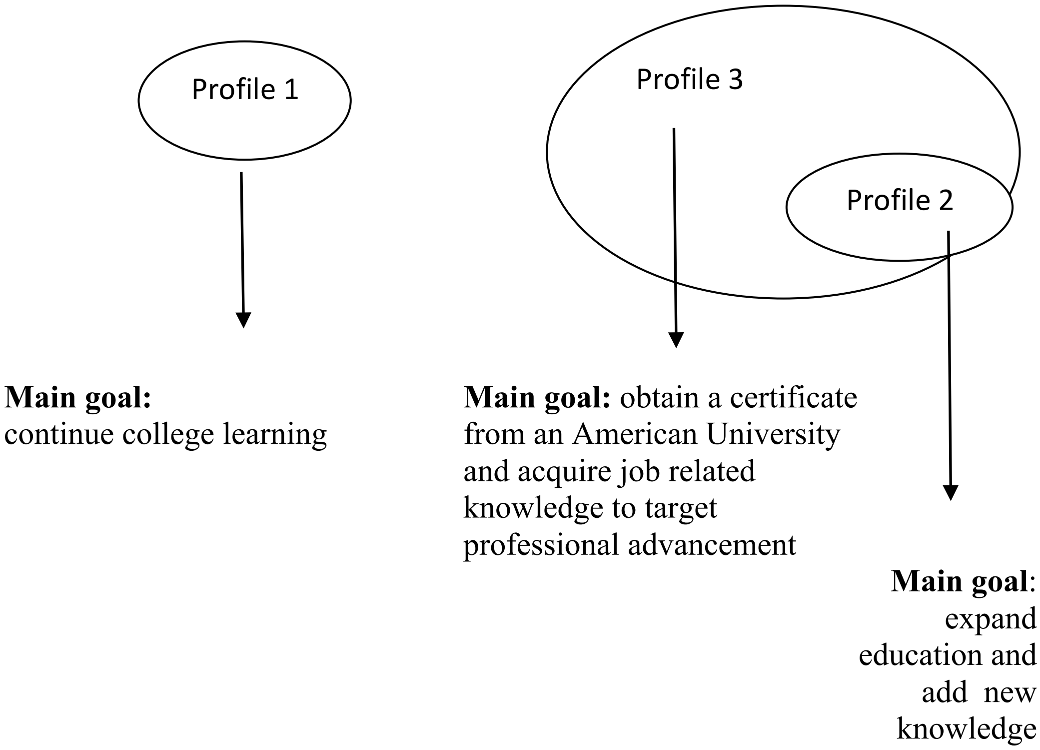


Figure 5.18 Students' profiles

Students keep engaged during the MOOC due to some of the activities offered: video lectures, readings, and power point presentations. This is why we see higher engagement with the cognitive presence than with the social presence.

Students belonging to profile 1 show higher probabilities of finishing the Introduction to Cybersecurity MOOC than students from other profiles. Students belonging to this profile can be described as: native English speakers, with undergrad studies and beginning knowledge in Cybersecurity. Their main goal at enrolment was to continue college learning.

On the other side we find students belonging to profile 3: non-native English speakers, also with undergraduate degrees, with no or very little experience in

Cybersecurity. Their main goal at registration was to obtain a certificate from an American University and acquire job related knowledge to target professional advancement.

The main obstacles from completion stated by the students are time constraints (25.2%) and conflict with job duties (10.2%), therefore sometimes personal life or workplace related time constrains challenge MOOC completion.

Research Question 1b.
How is the MOOC COI perceived and experienced by MOOC takers?

The COI environment for this particular MOOC can be depicted as (Fig 5.19). Cognitive and teaching presences are predominant in front of social presence. We have also included self-directedness as well: it is mentioned by the students with their different ratings for different items that being able to learn independently and explore materials by their own are helping them learn and progress through the course. We understand this skill as a possible new presence that relates with the other three:

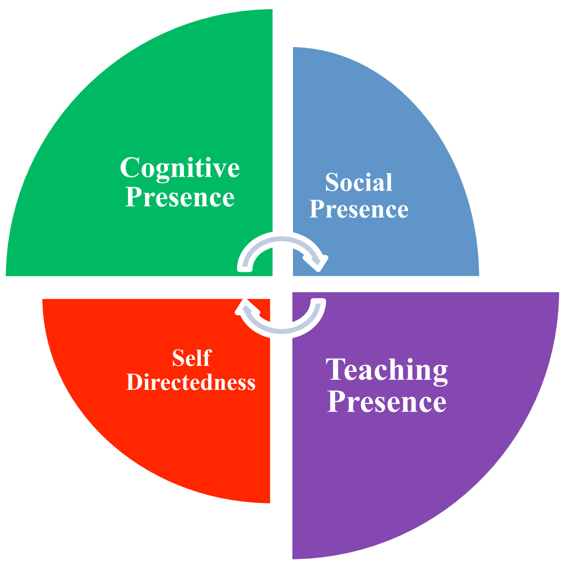


Figure 5.19 COI perceived in a MOOC

Each presence relates with the other ones as follows:

1. Cognitive Presence
    a. With Teaching Presence: Instructor shows a higher involvement when communicating content related ideas than social or schedule related issues. In this sense the instructors supports and relates students with the cognitive presence of the course. Instructor guides students through the content of the course.
    b. With Self-directedness: This particular MOOC has been designed with the goal of being flexible for the students and let them explore materials independently. The cognitive load of the course is easily accessed by the students independently.
    c. With Social Presence: the only connection seems to be that the diversity of viewpoints around the content in the discussions relate the social environment of the course with the course content. Data percentages are not high for this this connection, but they are noticeable.
2. Teaching Presence
    a. With Self-directedness: When the instructor acts as a guide, he/she encourages the students to be self-directed in the sense of exploring some of the materials and expand independently in some of the topics. In this sense he/she relates teaching presence with self-directedness.
    b. With Social Presence: instructor is the key element that builds community within this environment. By communicating with the

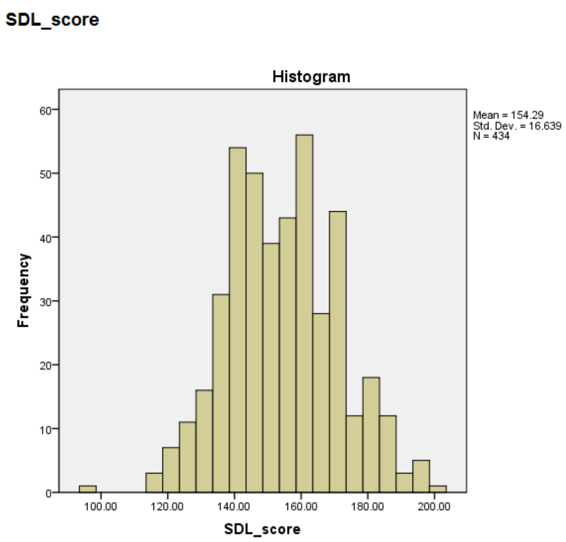
students, responding to questions and/or posting announcements and sending emails the instructor is the piece that builds community within the MOOC. Student to student communication does not seem as important within this presence

3. Self-directedness

    a. With Social Presence: there is no indicator that relates self-directedness with social presence in the MOOC. They are mutually excluding, therefore no connection could be made between them.

Research Question 2a.
What is the SDL readiness level of MOOC takers?

From the data we collected we can describe the level of SDL of MOOC takers as depicted in the histogram below (Fig. 5.20) with an average of 154.29. The accepted ordinary average is 129 (fig. 5.21), therefore this gives us and indicator that the students taking the test have higher than the average SDL skills.



N=434, Mean=154.29, Std. dev 16.6

Figure 5.20 SDL in MOOC takers

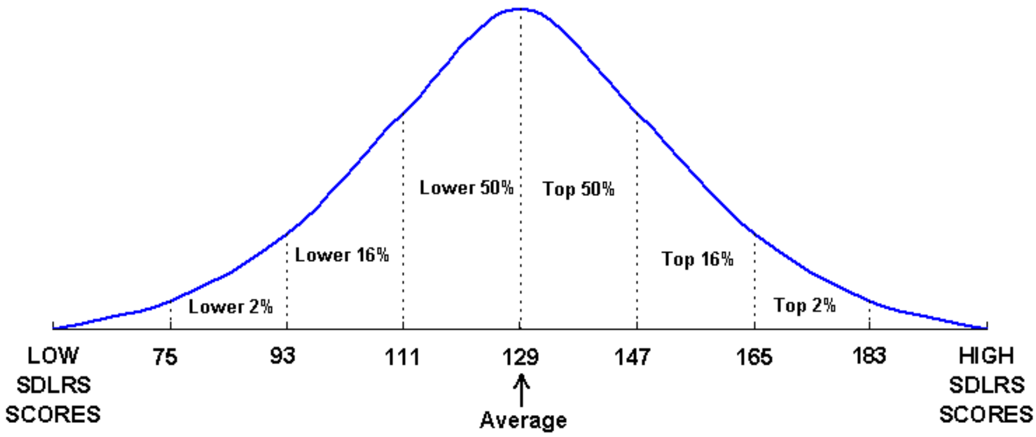


Figure 5.21 SDL averages

Guglielmino & Associates, LLC. (n.d.). *Learning Preference Assessment* [graph]. Retrieved from http://www.lpasdlrs.com/

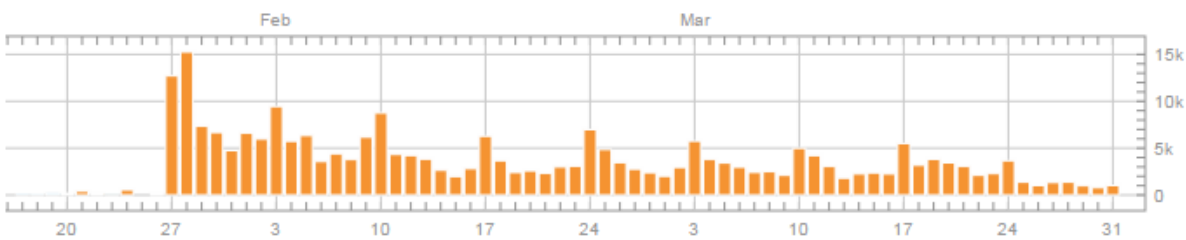
Students with high SDL rates are able to set their own learning goals and plan accordingly to implement and accomplish them. Students taking the MOOC fall into the top 16% of the model distribution.

We could conclude that the SDL readiness of students taking the MOOC is higher than the average, giving us an indication of these students' skills and preferences. This result indicates that students inclined to enroll in a MOOC and be interested enough that they decide to take this survey tool like to learn independently and are able to set own goals, assessing their strengths and weaknesses. This information should be used when designing MOOCs, and making sure we scaffold the information and the activities in a way these students can be more successful.

Research question 2.b
What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?

In this research we have chosen to use the quizzes taken as an indicator of SDL and willingness to finish the MOOC. After analyzing the data, we can conclude students that stay in the MOOC for 4 or 5 modules (weeks) show statistical differences related with MOOC completion with the other students.

We would like to recover figure 4.8 from chapter 4 displaying active students per week to show some patters that might be able to support this statement (Fig. 5.22)



Week1 Week2 Week3 Week4 Week5 Week6 Week7 Week8
x axis: weeks
y axis: number of participants

Fig.5.22 Active students per week from Chapter 4. Image retrieved from https://learn.canvas.net/courses/95/analytics

If we analyze the data form week 4 to 8 (weeks 1, 2 and 3 were discarded from the analysis) we can see that the attendance is consistent. At the beginning of each week there are higher picks of participation due to the release of each of the modules, but during the weeks there is persistent and similar student participation. Data shows that once the numbers stabilize (after week 3) students persist in the course. Even through we do not have conclusive data to assure that higher SDL skills imply more probability to finish the MOOC we would like to argue that if students stay for more than 4 modules, it seems more probable for them to finish the MOOC, but this is a judgment call after analyzing data and being involved with the MOOC. More research and secondary analysis should be conducted to corroborate this statement.

Once we responded to the research questions 1a, 1b, 2a and 2b related with probing question 1, we are going to start analyzing the instruments related with research questions 3a and 3b and probing question 2 in the next section. Our final conclusions for probing question 1 are provided in next chapter, Chapter 6: Main conclusions, limitations and future research

5.5.- Discussion about probing question number 2

The second probing question we would like to respond to is:

> "Could MOOCs designed using Marzano's learning taxonomy empower student's SDL skills and make them more successful in these open environments?"

In order to do so, we are going to analyze the findings from research questions 3a and 3b (table 5.19)

Table 5.19

Probing Question 2

	Probing Question 2 **Could MOOCs designed using Marzano's learning taxonomy empower student's SDL skills and make them more successful in these open environments?**
Research Questions	3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI? 3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?
Instruments	Phase III Instrument C: Student interviews Instrument D: Experts focus groups

5.5.1 Instrument C: Student interviews

Table 5.20 shows where this instrument is situated within our design and what question are we trying to respond with its results:

Table 5.20
Analysis design

	Probing Question 1 What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?	**Probing Question 2** **Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?**
Research Questions	1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC? 1b. How is the MOOC COI perceived and experienced by MOOC takers? Cognitive presence Teaching presence Social presence 2a. What is the SDL readiness levels of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?	**3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI?** **3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?**
Instruments	Phase II Instrument SD: Readiness Scale questionnaire Phase III Instrument A: Demographic and motivation information Instrument B: COI presences questionnaire	**Phase III** **Instrument C: Student interviews** **Instrument D: Experts focus groups**

The analysis of the information from the Instrument C is going to be done using the theory\framework we presented in Chapter 4 after the coding and analysis of the codes, a constant comparison analysis (Glaser & Straus, 1967, Boeije, 2002) Table 5.21 gives definitions and examples of each of the final codes, already classified in common themes or families.

Table 5.21
Final codes definitions and examples

Codes	Definition	Examples
Social Presence		
Community	This code captures information about how the students experience sense of community within the MOOC	"Making contributions and I also appreciated the contribution of other learners" (3.3)
Diversity	This code captures information about how the students experience diversity of ideas and opinions within the MOOC	"Very important, because it gave me an opportunity to look at the viewpoints of others"(5.4)
Online Communications	This code captures information about how the students experience online communication within the MOOC	"Yes, the forums were very useful to this [communication]." (4.4) "I had ways to express my opinions accordingly" (4.4)
Cognitive Presence		
Course Content	This code captures information about how the students interact with the course content	"I learned about what contracts are and the problems they can impose when they branch out" (6.1)
Course Design	This code captures information about students comments on course design	Yes, but having done one [discussion] per week was enough for me express my opinion and thoughts (4.2)
SDL		
Research	This code captures information about strategies that the students use to research information independently outside of the MOOC	"looking for more information elsewhere when a subject was interesting and not enough detailed"(6.2)
Previous Knowledge	This code captures information about strategies that the students use to build on previous knowledge	"Cybersecurity course enriched my earlier degree course in IT security (6.7)

Organization	This code captures information about strategies that the students use to organize themselves to be successful in the MOOC	"I made sure or it was my goal to finish going through the materials at most in the first three days of every week "(9.5)
Keep up to Date	This code captures information about strategies that the students use to keep up with new concepts in the filed	Keep me informed and instructed about, enlarge my view to a general coverage of the subject and learn new things. (9.2)
Learning Progress	This code captures information about strategies that the students use to monitor their own progress	"Yes, sort of. As I am not a native English speaker I've had to turn around sometimes some questions, where the text it was not clear for me"(10.7)
Personal Life		
Work Issues	This code captures information about work issues that prevented the students to finish the MOOC	"No I tried to work when I had time-I work full time"(9.3)
Value Judgment	This code captures information about value judgments that students share about their participation in the MOOC	"I like the online class " (6.9) "I took the course very serious" (7.5)
Real life Connections	This code captures information about life connections the students made while taking the course	"Learned safety issues for my servers, tips, and improvements I can apply in my work"(6.8)

Now that we have an overall idea of the type of students that are taking the MOOC (profiles already discussed in instrument A and B) we would like to explore the main concerns and approaches to learning that they seem to prefer. Our final goal in this part of the research is to suggest some improvements to MOOC design. The MOOC Community of Learning (MCL) appears to be composed by two main pieces: "COI" and "Personal Approach to Learning":

- COI: related with our original variables 1C: sense of community of learning, 2C: open communication and 3C: group cohesion, and our social and cognitive presence code families
- Personal approach to learning: related with variable 4C: self-

directedness and the new emerging code family that we found from the coding process, "personal life"

Figure 5.23 shows this classification visually:

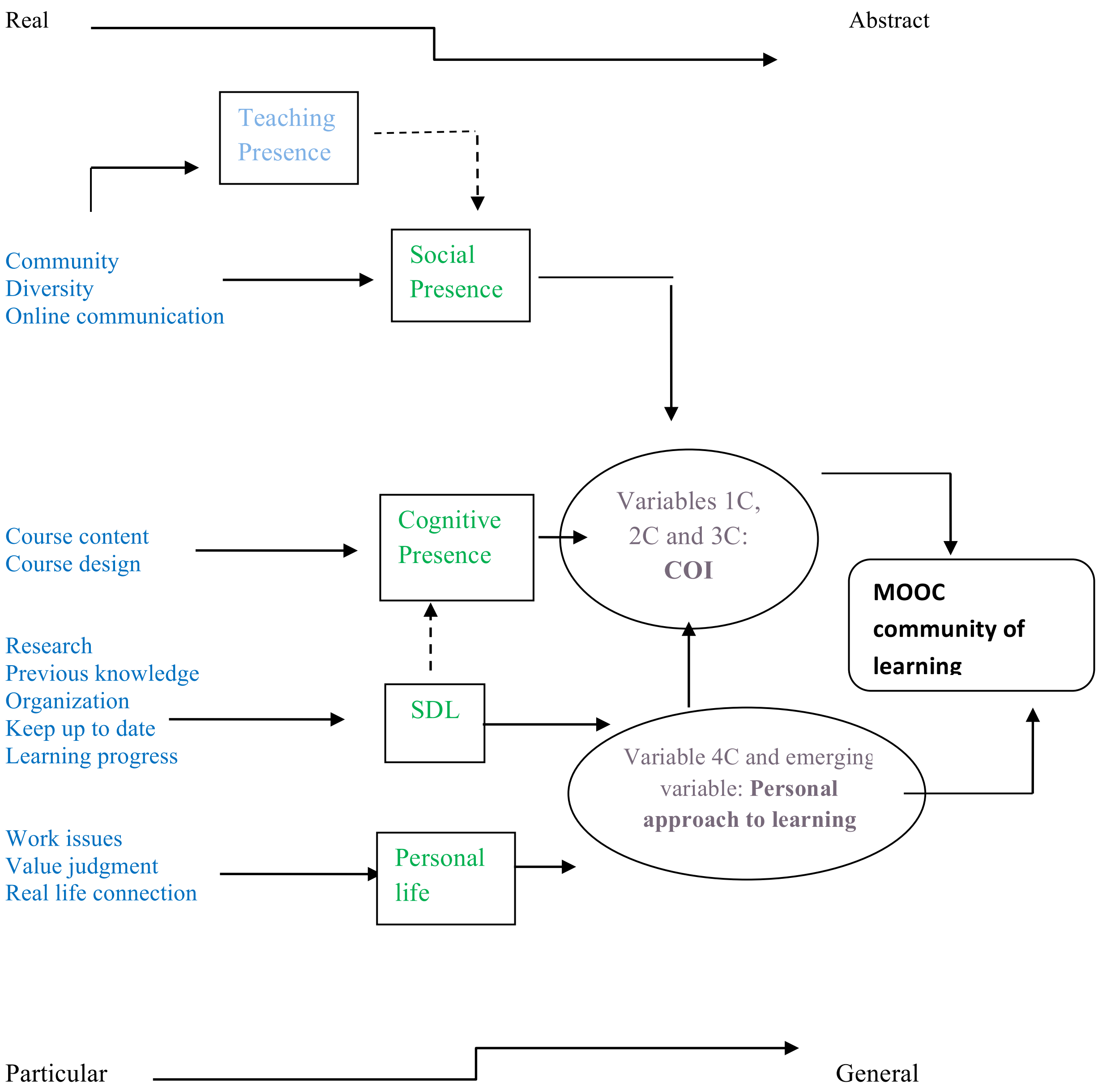


Figure 5.23 Codes to theory framework

The following sections show the analysis of each of the pieces.

5.5.1.a Variable C1, C2 and C3 analysis: sense of community of learning, open communication and group cohesion

We have decided to analyze our variables 1,2 and 3 for instrument C together due to the results of our coding analysis. Our codes related to these variables had been classified under two families: social presence and cognitive presence, and we understand that these two common themes relate with our three initial variables (Table 5.22).

Table 5.22
1C, 2C, 3C variables and codes

Instrument C variables	Social Presence	Cognitive Presence
1C: Sense of community	Community(10)	Course content (14)
2C: Open communication	Diversity(9)	Course design (5)
3C: Group cohesion	Online Communication(11)	

As we can see in Fig. 5.19, the three presences are represented in the community, teaching and social presence are related in the sense that the instructor builds community with his interactions, but they are not very numerous. The cognitive presence is related with SDL as a way that the students prefer to learn.

"Community", "diversity" and "online communication" are the three codes that shape the social presence of the COI within this MOOC. Teaching presence is highly related with this presence. If we look back at our picture for COI within a MOOC that we presented in the conclusions for Instrument B (Fig. 5.24) we can see that the teaching presence interacts and supports each of the other ones: cognitive, social an even the self-directedness skill that resulted from our analysis. We would like to highlight that the results from instrument C support the ones we presented within our analysis of previous instruments.

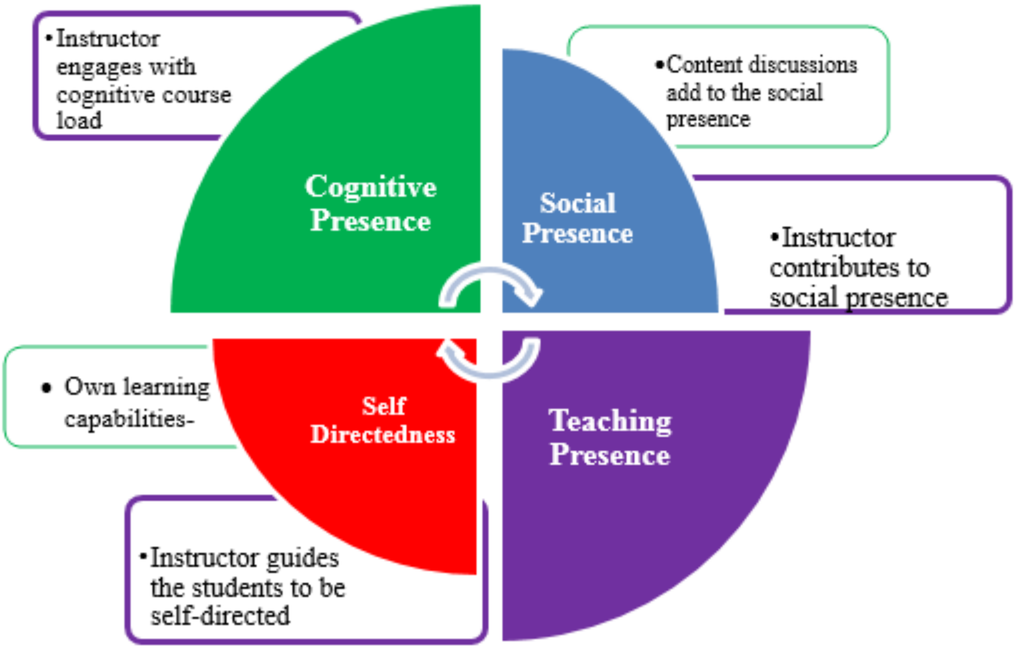


Figure 5.24 COI image from instrument B

Related with the cognitive presence and its codes: “course content” and course design”, students highlight the importance of how the course is designs and the content provided. In Fig. 5.19 we show that cognitive presence is somehow related with the SDL skills, as students seem to indicate, see below some examples:

- Q6-Student 2: “I've learn by studying the course materials, looking for more information elsewhere when a subject was interesting and not enough detailed.”
- Q7-Student 3: “I appreciate the frequent input from the instructor from time to time

  I made some researches on my own on the Internet”
- Q7-Student 7: “ I learned al lot from stopping and going through the material the next day instead of trying to rip through the material”

We understand there might be an inclination to expand research, and course content doing own research, and independent study as is shown visually in Fig. 5.19. The following section analyzes variable 4C

5.5.1.b Variable C4 analysis: Self-directedness

Our codes related to this variable belong to the SDL family (Table 5.23).

Table 5.23
4C variable and codes

Instrument C variables	SDL
4C: Self-directedness	Research(5)
	Previous knowledge(2)
	Organization(6)
	Keep up to date (4)
	Learning progress(9)

Independent learning seems to be well known and accepted by the students in the MOOC, use of previous knowledge, self-organization, monitoring their own progress and keeping up to date are common codes that appear in the interviews. Related with being able to complete or not the MOOC, students mention personal issues that prevent them of finishing: time constrictions, family and work issues (these codes will be analyzed in next section). With the idea of designing better MOOC courses that scaffold students' learning process, and founding our proposal in the codes from our analysis we conclude that students identify the following areas as important when taking the MOOC:

- <u>Research:</u> This code captures information about strategies that the students use to research information independently outside of the MOOC
- <u>Previous knowledge:</u> This code captures information about strategies that the students use to build on previous knowledge
- <u>Organization:</u> This code captures information about strategies that the students use to organize themselves to be successful in the MOOC
- <u>Keep up to date:</u> This code captures information about strategies that the students use to keep up with new concepts in the filed
- <u>Learning progress:</u> This code captures information about strategies that the students use to monitor their own progress

Table 5.24 shows a proposal to support students taking the MOOC. Marzano's taxonomy levels, and associated assignments/assessments to reinforce the themes are also displayed

Table 5.24
Design proposal for a MOOC

	SDL themes	Marzano's Systems of Thinking	Desired Outcomes	Assignments/ assessments
Cognition Focus	**Research** **Previous knowledge**	Cognitive: Retrieval and comprehension	C. 1 Locate and share external resources related with Module topics	Mini discussions by interest groups (C.1 and C.2)
			C.2 Explain cybersecurity topics that you are familiar with to the rest of the students	Essay type of assessment: reflective piece, opinion or similar (C.1 and C.2)

Metacognition Focus	**Organization** **Keep up to date** **Learning Progress**	Metacognitive: specify goals and process monitoring	M.1 Plan own learning process: particular planning M2. Assess own learning progress monitoring acquired knowledge	Create own schedule at the beginning of the MOOC (M.1) Create life long learning plan with the help of the instructor or TA (M.1) Quizzes and self-assessments (M.2)

Following our goal of reflect on reality and promote change, within the critical theory paradigm of our research, we suggest that the presented outcomes in table 5.22 could introduce improvements in the MOOC design and support students' learning, and completion issues. Some of the main problems for completion stated by the students are collected in the following section and form an emerging variable.

5.5.1.c New variable analysis: personal life

From our coding a new variable has emerged from the units of analysis, this element was not included at the beginning of the research when we designed the variables we wanted to explore. This component has been coded as "personal life" and collects issues and problems mentioned by students that interfere with MOOC completion, table 5.25:

Table 5.25
Emerging variable and codes

Instrument C variables	Personal life
Emerging variable: personal life	Work issues(5) Previous knowledge(2) Organization(6) Keep up to date (4) Learning progress(9)

With the idea of suggesting improvements to the MOOC design, and incorporating the findings from this emerging variable, we are adding some new outcomes and assignments that could help students overcome some of the mentioned issues (table 5.23).

Table 5.26
Design proposal for a MOOC with emerging variable results

	Personal life themes	Marzano's Systems of Thinking	Desired Outcomes	Assignments/ assessments
Self-focus	**Work Issues** **Value Judgment** **Real life Connections**	Self	S.1 Plan own learning process: extensive planning S.2 Connections with real life examples S.3 Connection with the work place	Create own schedule at the beginning of the MOOC. (M.1) Add own information about time to spend and other duties, plan for the future (S.1) Use articles, current studies in the field in the assignments (discussions and quizzes) as much as possible (S.2) Let students discuss about own personal issues, create a forum to share challenges and offer solutions (S.3)

5.5.1.d Summary of findings for instrument C

Figure 5.25 provides a visual of the findings for each variable:

Social Presence	Cognitive Presence	SDL	Personal life
Community	Course content	Research	Work issues
Diversity	Course design	Previous knowledge	Value judgment
Online communication		Organization	Real life connection
		Keep up to date	
		Learning progress	

- *Teaching presence complements social presence*
- *Students relate social presence with SDL*

- *Improve MOOC design to support students SDL inclinations*

- *Improve MOOC design to support students issues for completion and support personal life situations*

Figure 5.25 Representation of findings for instrument C

This instrument lets us refine our MOOC design and be able to propose some interventions and new outcomes to redesign the MOOC if we want to run it again.

5.5.2 Instrument D: Student interviews

Table 5.27 shows where this instrument is situated within our design and what question are we trying to respond with its results:

Table 5.27
Analysis design

	Probing Question 1 What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?	**Probing Question 2** **Could we design better MOOCs by using Marzano's learning taxonomy, and empower students to be self-directed learners and to be more successful in these open environments?**
Research Questions	1a.What is the demographic information of MOOC takers and why are they motivated or unmotivated to take or withdraw from the MOOC? 1b. How is the MOOC COI perceived and experienced by MOOC takers? Cognitive presence Teaching presence Social presence 2a. What is the SDL readiness levels of MOOC takers 2b. What type of relationship exists between the degree of completion of a MOOC and the degree of SDL readiness in MOOC takers?	**3a. How can we change processes or practices that specifically facilitate student engagement in a MOOC COI?** **3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?**
Instruments	Phase II Instrument SD: Readiness Scale questionnaire Phase III Instrument A: Demographic and motivation information Instrument B: COI presences questionnaire	**Phase III** **Instrument C: Student interviews** **Instrument D: Experts focus groups**

The analysis of the information from Instrument D uses the theory\framework we presented in Chapter 4. Table 5.28 presents a summary of the consensus and no consensus on the different questions that we asked the experts:

Table 5.28
Matrix for assessing level of consensus in a focus group adapted from Onwuegbuzie et al. (2008).

	Focus group question	Main emerging ideas	Consensus between participants
Cognitive presence	Variable 1D: processes or practices to capture students attention Triggering event		
	1. What pedagogical techniques have you used when teaching (instructor) or designing (ID and SME) the MOOC to motivate students and first capture their attention early on?	It is challenging to engage each of the students Initial communication seems to work (first announcement and discussions)	Yes
	Variable 2D: content quality and design of the MOOC Exploration		
	2. How would you compare the MOOC content relative to traditional face-to-face formats?	From the content creator point of view MOOCs are harder to design Program director and instructor think that MOOCs are similar to other traditional online courses	No
	3.What do you think are the particular strengths of the content provided in this MOOC? Any weaknesses?	More freedom for the students, important community of learning and content richness	Yes
	4. How well is this MOOC aligned with Marzano's taxonomy?	The panel of experts is not familiar with Marzano's taxonomy	Yes

	Variable 3D: Learning activities aligned with course goals Integration **5. How would you rate the learning outcomes for the course compared to more traditional courses?** **6.How well do they align with the outcomes of the modules?** **7. Do you have any suggestions for different types of activities that might work better?**	Same rigor They are created from student perspective, good alignments Add games, some small group activities, add students presentations	Yes Yes Yes
	Variable 4D: New ideas students take after the MOOC Resolution **8.What do you think the students benefit the most when they took this MOOC? What evidences do you have?**	Each expert highlighted a different item: Course clear organization and content broken down, participants diversity, focused on personal interests Evidences are the assignments' results	No
	9.What new/main concepts do you think the students learned during the MOOC?	Basic cyber concepts not high level but introductory, and some extra independent research	Yes
	10. What are some of the advantages of MOOC's for students	Work around personal schedules, flexibility, testing out new areas with an emphasis in the STEM field	Yes
Teaching presence	Variable 5D: Design and organization **11.How would you rate the design and organization of the MOOC? Does it facilitate your teaching through the MOOC**	SMEs should teach the MOOC for the first time, but there is good alignment between content and outcomes	Yes
	12.What parts (module notes, videos, self-checks, quizzes, discussions) could have we designed better?	Add weekly surveys about student satisfaction, revisit outcomes alignment, improve course navigation	Yes

	Variable 6D: Processes or practices to facilitate community of learning		
	13. What are some ways an instructor can facilitate student engagement despite the size of the classroom?	Asking student for feedback, expecting less interactions because they are challenging and instructor needs to extend himself more than in other environments	Yes
	14. How does the size of the group affects/challenges discussions? What strategies do you use to overcome the challenge of size?	Harder/ more opportunities to have interactions. Instructor states that could add more students because the class size was not a challenge. Problems with authenticity	No
	15. Any other variables that are challenging? Education level, geographic situation…	MOOCs attract students that are not physically close	Yes
	Variable 7D: Instructor opinion about possible direct instruction within the MOOC		
	16. Please explain from what extend the MOOC gave you opportunities for direct instruction?	Use personal experiences and share with the group, also use announcements, emails to encourage participation	Yes
	17. Can you provide specific examples of methods of direct instruction that you used? How did you manage direct instruction?	Ideally students should be able to ask the content creator	Yes

From the data displayed in the previous table (Table 5.25) we will group the ideas that show group consensus and the ones that have a diversity of opinions and we will discuss possible improvements and MOOC teaching and content enhancements.

5.5.2.a Group agreement analysis

We are going to start analyzing the group agreements and we will proceed to analyze the disagreements and propose possible solutions. Regarding group agreements (see table 5.29)

Table 5.29
Agreements

Focus group question	Main emerging ideas
Triggering event	
1. What pedagogical techniques have you used when teaching (instructor) or designing (ID and SME) the MOOC to motivate students and first capture their attention early on?	It is challenging to engage each of the students Initial communication seems to work (first announcement and discussions)
Exploration	
3.What do you think are the particular strengths of the content provided in this MOOC? Any weaknesses?	More freedom for the students, important community of learning and content richness
4. How well is this MOOC aligned with Marzano's taxonomy?	The panel of experts is not familiar with Marzano's taxonomy
Integration	
5. How would you rate the learning outcomes for the course compared to more traditional courses?	Same rigor
6.How well do they align with the outcomes of the modules?	They are created from student perspective, good alignments
7. Do you have any suggestions for different types of activities that might work better?	Add games, some small group activities, add students presentations
Resolution	
9.What new/main concepts do you think the students learned during the MOOC?	Basic cyber concepts not high level but introductory, and some extra independent research
10. What are some of the advantages of MOOC's for students	Work around personal schedules, flexibility, testing out new areas with an emphasis in the STEM field

Focus group question	Main emerging ideas
Design and organization	
11.How would you rate the design and organization of the MOOC? Does it facilitate your teaching through the MOOC	SMEs should teach the MOOC for the first time, but there is good alignment between content and outcomes
12.What parts (module notes, videos, self-checks, quizzes, discussions) could have we designed better?	Add weekly surveys about student satisfaction, revisit outcomes alignment, improve course navigation
Processes or practices to facilitate community of learning	
13. What are some ways an instructor can facilitate student engagement despite the size of the classroom?	Asking student for feedback, expecting less interactions because they are challenging and instructor needs to extend himself more than in other environments
15. Any other variables that are challenging? Education level, geographic situation…	MOOCs attract students that are not physically close
Instructor opinion about possible direct instruction within the MOOC	
16. Please explain from what extend the MOOC gave you opportunities for direct instruction?	Use personal experiences and share with the group, also use announcements, emails to encourage participation
17. Can you provide specific examples of methods of direct instruction that you used? How did you manage direct instruction?	Ideally students should be able to ask the content creator

Triggering event

The experts agree that capturing students’ attention is crucial during the first days of the course. MOOCs loose a great percentage of students during the first few weeks of the course, it could be as high as half of the students enrolled (Liyanagunawardena, Parslow & Williams, 2014). Engaging them with announcements and well developed discussions could help improving the persistency of the students through the course modules, especially during the first crucial weeks.

Exploration

The experts agree that MOOC environments offer richness of content and a good environment to build community of learning. When they are asked about Marzano's taxonomy as a framework for design neither of them are familiar with this classification.

Integration

Outcomes and content rigor is understood as very similar to the ones offered in standard online classes. The panel suggests to add some activities for small groups, games and students presentations.

Resolution

The panel emphasizes that the main content students take from the MOOC is basic knowledge on cybersecurity. They also mention that some students performed independent research outside of the MOOC to expand on some contents. MOOCs are a good resource when students need a flexible course that adapts to their own schedule and the panel sees some potential for STEM subjects in these environments.

Design and organization

An interesting suggestion for the panel is that the SME that developed the course content could be the instructor for the first time that the course runs; this way he/she is very familiar with the activities, content etc. and can modify, or clarify for the students as needed. Students' weekly surveys requesting feedback about the week's readings and activities is also another suggestion. Be proactive and in a continuously improving cycle could help design better MOOCs.

Processes and practices to facilitate community of learning

Having students from different backgrounds and nationalities seems to be a key element identified by the panel as influencing MOOCs positively. Feedback from the students was identified again as an important practice within this courses, and making sure expectations on communications with the instructor are clear from the beginning could also improve students' understanding and expectations.

Direct instruction within the MOOC

Instructor experience in the field should also be an important teaching element in discussions and announcements. Showing expertise and relating theory with practice can help students understand and connect some of the ideas together. During the MOOC students did not have access to the content creators, and a suggestion might be that we could add this possibility to new rounds. In Figure 5.26 we present a visual representation of the agreement themes that emerged during the focus group discussion.

Cognitive Presence

Triggering event

- Announcements
- Well-designed discussions

Exploration

- Content richness
- Community of learning

Panel not familiar with Marzano's taxonomy

Integration

- Similar rigor to other online courses

Panel suggests to add:

- Games
- Small group activities
- Students presentations

Resolution

- Students learn about basic Cybersecurity content
- Offers flexibility

Panel suggests STEM contents for MOOCs

Teaching Presence

Design and organization

- Offer students surveys weekly to continuously improve

Panel suggests content creator to be the first instructor

Processes and practices to facilitate community of learning

- Communicate expectations
- Receive feedback from the students
- Students' diversity

Direct instruction within the MOOC

- Instructor's expertise in the field
- Be able to contact content creator

Figure 5.26 Agreements summary

5.5.2.b Group disagreement analysis

Related with the disagreements with the expert focus group we summarize the findings in the following table (5.30)

Table 5.30
Disagreements

Focus group question	Main emerging ideas
Exploration	
2. How would you compare the MOOC content relative to traditional face-to-face formats?	From the content creator point of view MOOCs are harder to design Program director and instructor think that MOOCs are similar to other traditional online courses
Resolution	
8.What do you think the students benefit the most when they took this MOOC? What evidences do you have?	Each expert highlighted a different item: Course clear organization and content broken down, participants diversity, focused on personal interests Evidences are the assignments' results
Processes or practices to facilitate community of learning	
14. How does the size of the group affects/challenges discussions? What strategies do you use to overcome the challenge of size?	Harder/ more opportunities to have interactions. Instructor states that could add more students because the class size was not a challenge. Problems with authenticity

Exploration

Content creator states that MOOCs are harder to design that regular online courses. Quality needs to be similar to the regular online courses, but the assignments and activities and how the information is delivered needs to be designed knowing that thousands of students will be taking the course with just one instructor. This situation is challenging.

On the other hand instructor and program director believe that MOOCs are not so different that regular online courses. Research in the field (McAuley, Stewart, Siemens & Cormier, 2010; Macleod, Haywood, Woodgate & Alkhatnai, 2014; Guardia, Maina & Sangrà, 2013) state that MOOCs are much more than a traditional online course, they offer the possibility of engaging a variety of students in a flexible and organic learning environment. In this sense we are also inclined to define MOOCs as a different phenomenon than traditional online courses due to their unique characteristics: open resources, massive, and no fees, to just mention a few.

Resolution

The best resources for the students when they enroll in the MOOC that have been mentioned by the panel are: clear organization of the course, content display, participants' diversity and the students' focus on personal interest than bring to the group. We could call this intrinsic motivation (Marzano, 2001; Simmering, Posey & Piccoli, 2009)

Processes or practices to facilitate community of learning

We obtain diversity of opinions during this discussion in the focus group. The panel does not agree on if the class size offers good opportunities for more interactions and "teachable moments" or it is a challenging situation with so many students. Students' authenticity is seen as a major issue with this courses. This comments are aligned with research in the field, and there is still not a clear answer for these two issues. Kop, Fourier and Mak (2011) state that having a big class size adds noise to the learning structure and does not benefit the learner. Suggestions on using visual analytic tools to represent interactions and facilitate students understanding of their tasks are also made. Organizing MOOCs using a linear design seems to help some of the students with navigation and understanding requirements and deliverables. (Guo, Reinecke, 2014).

Student authentication is another issue that the panel mentions a something that could be improved. Making sure that students taking the quizzes and participating in the activities are the same ones as the ones requesting some type of certification or in some instances, credit is a key issue and still not resolved. There are some systems being tested (Miguel, Caballé & Prieto, 2013) that study authentication and track students participation in MOOCs. Some early suggestions are the use of biometric information, double confirmation of identity with a password and SMS, using a camera to capture students when taking the tests, or a personal user certificate.

In Figure 5.27 we present a visual representation of the disagreement themes that emerged during the focus group discussion

Cognitive Presence

Exploration

- MOOCs are harder to design than traditional online courses
- MOOCs are quite different from traditional online courses

Resolution

- Clear organization and content display
- Participants' diversity
- Participants' intrinsic motivation

Teaching Presence

Processes or practices to facilitate community of learning

- Course size is a challenge
- Students authentication

Figure 5.27 Disagreements summary

We would like to add the results from our focus group on the two presences to our vision of COI in MOOCs. The previous version of COI in MOOCs incorporated our results from previous instruments: Instrument A, B and C. Now we present Table 5.31 that incorporates all our previous insights and the panel's suggestions on how to design better MOOCs, increase students' engagement and align them to Marzano's taxonomy. This is just a summary of our findings. When we respond to the research questions number 3a and 3b we will be providing our proposal to better engage students in a COI within MOOCs (3a) and how the alignments of the MOOC activities with Marzano's taxonomy could improve students' success (3b).

5.5.2.c Summary of findings for instrument D

Table 5.31
Summary of final COI results

COI in MOOCs				
	Social Presence	**Cognitive Presence**	**Teaching Presence**	**SDL**
Characteristics	Sense of community Sense of diversity Online communication	Content richness Discussions and activities design Flexibility STEM contents	Design and organization Process and practices to facilitate community Direct instruction within the MOOC	Use of previous knowledge Self-organization Monitoring own progress Keeping up to date
Students	Low engagement	Engage with content mainly through videos, ppts and readings	Engage with instructor	Monitoring and regulating own learning
Instructor	Reinforces it by building community	Structuring and clarifying content Discussing content with students	x	Guides students to be more self-directed learners
Content	Course discussions emphasize content Content interests students more than social interactions	x	Instructor emphasizes content	MOOC designed to emphasize SDL procedures when going through the materials

Once we have classified and define each of the presences in the MOOC and related them with students, instructor and content we would like to offer improvements to the course in each of the areas. These suggestions should be understood as best practices in the MOOC design field. They are based in our research and the literature review we conducted during this study.

MOOC design to improve social presence

In order for the students to become interested in discussions MOOC design should provide an easier way of participating in the discussions than just having to deal with thousands of students having online conversations. These unstructured discussions could be a handicap for some of the students and they decide not to participate and just consume content and perform individual activities. Discussions are a valuable tool to promote social learning and co-creation of knowledge, but MOOC discussions are too chaotic to be able to be followed and appropriately use by students. The effort is higher than the rewards and students do not seem particularly interested in the social presence. Besides breaking students into groups and assigning roles within discussions, already explored in recent studies (Guardia, Maina & Sangrà, 2013) we are proposing some new suggestions:

1. Instructor's blogging: instead of forcing students to participate in discussions, and alternative could be adding a blog section in the course. The instructor or assigned students would be in charge of posting in reference of a topic or during a particular week. This "forum-like" activity can help scaffolding content for the students and adds flexibility by building some social presence with a cognitive focus.
2. News feed in student's dashboard: updating students on what is going on in the course could be beneficial. Having a "newsfeed" type of feature could keep them updated about course topics and emphasize some social interactions.
3. Visual representation: webs of knowledge. One of the major concerns from the students seem to the great amount of information that they need

to deal with. Visual representations help understanding information better and making emerging ideas clear. This feature could be added to the course for students to have a visual about their progress in the course and their social interactions.

MOOC design to improve teaching presence

1. Improve activities
    a. Group activities: Discussion forums, peer-review activities, or social networking with the creation of "interest groups" (Guardia, Maina & Sangrà, 2013).
    b. Students prefer case studies and simulations instead of role playing activities. It is difficult to find peers that share same interests and motivations, therefore learning is accomplished by defining self-directed goals and using the optional social interactions to support engagement if needed (McAuley, Stewart, Siemens & Cormier, 2010).
    c. Students seem to value video lectures quizzes, readings and power point presentations at a higher level than self-checks. QA section and discussions interest students the least.

MOOC design to increase cognitive presence and SDL friendliness

1. Help students to keep up with load adjustment.

Create special activities to reduce the amount of information students are required to process (Carver & Turoff, 2007). Computers are capable to help with some tasks and free up our cognitive capability and make learning and information retrieval easier. Some of the suggested special activities could be:

- Adaptive learning quizzes self-checks
- Gaming and simulation exercises

2. Handling information complexity
    a. Prioritizing information and deciding how should be presented to the students. decisions (Pentina & Tarafdar, 2014)
    b. MOOC takers expect learning not to be a linear process; and they recognize that knowledge builds on previous learned ideas. The learning cycle within MOOC environments is as follows: new knowledge builds on previous understanding, but this previous understanding can be reevaluated and revisited while learning new concepts.
3. In order to support students' own learning we suggest the following improvements for the MOOC:
    a. Media technology enhanced learning captures students' attention and retention (Guardia, Maina & Sangrà, 2013).
    b. Marzano's taxonomy takes into account the intrinsic motivation that students bring to the tasks (the MOOC) and offers levels of through processing and levels of task classification to design assignments and outcomes for the course
    c. The majority of the students are taking the MOOC due to academic curiosity (54.3%), to learn new things. This goal is related to the cognitive presence within the COI framework

4. By level of interest we could say that students value subdivided content, information delivered in the form of videos, readings and presentations, and they also value interactions (self-checks) still higher than discussions.
5. When the tasks require higher level of cognitive and metacognitive involvement the students seem to be less inclined to participate in the activities. The design of the MOOC should emphasize and support students through these activities now that we know they are not as inclined to try them as they are with some of the more simple ones.
6. The use of conceptual maps in MOOCs seem to aid the students keep up with the course content, and it is recommended as a tool to condense and graphically organize information for the students (Barrachina, Conejero, Jordan & Murillo-Arcilla, 2015).

5.6.- Responses to research questions 3

Research Question 3a.
How can we change processes or practices that specifically facilitate student engagement in a MOOC COI?

Research Question 3b.
3b. Would the alignment of MOOCs to Marzano's learning taxonomy improve students' success?

In order to respond to this question we are going to suggest some enhancements to the current MOOC, based on the results from our study and show their alignments with Marzano's taxonomy. In question 3b we will relate these advancements with student success and explore how a better design could enhance students' chances of being successful. Table 5.32 shows the alignments and presents the responses to questions 3a and 3b.

Table 5.32
MOOC improvements and Marzano alignments

MOOC new/existing activities	Alignment with Marzano's taxonomy Key words	Student outcomes Key words
Improvements in social presence	**Cognitive system of thinking:**	**Improved mental procedures:**
1. Assign roles in discussions	Evaluation	Organization
2. Break students in to smaller groups	Evaluation	Organization
3. Teacher blogging	Information Retrieval	Access to information
4. News feed	Comprehension	Easier information processing
5. Use webs of knowledge	Knowledge utilization	Visual information processing
Improvements in teaching presence	**Cognitive system of thinking:**	**Improved mental procedures:**
1. Group activities	Analysis	Interpersonal communication

MOOC new/existing activities	Alignment with Marzano's taxonomy Key words	Student outcomes Key words
2. Case studies and simulations	Evaluation	Information application and understanding
3. Use video lectures, readings, quizzes and ppts [existing activity]	Information retrieval	Easy access and use
Improvements in cognitive presence and SDL friendliness	**Cognitive system of thinking:**	**Improved mental procedures:**
1. Special activities [adaptive software activities]	Evaluation	Richness of options
2. Information selections [scaffold information for the students]	Information retrieval	Aids with cognitive load
3. Media technology [use simulations, gamming, scenarios]	Application	Content enhancement
4. Conceptual maps	Visual	Reach different learning styles

Once we have presented this analysis we would like to suggest some improvements to the course outcomes that we established at the begging of this investigation without knowing the results of the analysis. If we could implement all of the suggestions the new outcomes are displayed in table 5.33:

Table 5.33
First and modified course outcomes

Initial Course Outcomes	Modified Course Outcomes
1.Examine the fundamental concepts and elements of cybersecurity from a people, process, and technology perspective.	1.Examine the fundamental concepts and elements of cybersecurity from a people, process, and technology perspective using information from webs of knowledge and teacher blogging resources.
2.Apply a holistic view of the concepts and terminologies of cybersecurity.	2.Apply a holistic view of the concepts and terminologies of cybersecurity by attempting different roles and situations within discussions.
3.Examine basic threats and protection mechanisms for physical, personal, computer, and application level security.	3.As a team member examine basic threats and protection mechanisms for physical, personal, computer, and application level security.
4.Identify basic threats and protection mechanisms for Internet, network, mobile, wireless, and web security.	4.Create a presentation to identify basic threats and protection mechanisms for Internet, network, mobile, wireless, and web security.
5.Apply the basic principles of information security in defending against cybersecurity threats and protecting information assets.	5.In the context of a computer simulation, apply the basic principles of information security in defending against cybersecurity threats and protecting information assets.
6.Investigate common cybersecurity laws, standards, and best practices	6.Investigate common cybersecurity laws, standards, and best practices using adaptive learning software as an aid

5.7.- Summary

This chapter presented the analysis of results from our study, gave insights and completed some of the knowledge gaps present in the research field. We resolved our research questions with the main goal of responding to our two probing questions; the responses to the probing questions will be provided in next chapter, chapter 6. From the findings from our research we can conclude that:

- The role of SDL in a COI environment seems to be integrated and related with the cognitive presence. SDL presents itself as a key element for students to be more successful in these environments.
- MOOC takers' profiles had been identified, and success rates related with active time in the MOOC and quizzes taken.
- Designing MOOCs using Marzano's taxonomy had been suggested as a way of support students skills and enhance course design
- **Research questions had been answered:**
  - 1a. MOOC students are mainly males, and main motivation to keep engaged during the MOOC is to adquire job related knowledge and/or a certification
  - 1b. Teaching and cognitive presence are more important and valued by the students than social. SDL emerges as an important skills for the students when taking MOOCs
  - 2a. MOOC students have high SDL grades

- 2b. There is no conlusive information relating number of quizzes taken and persistency in the MOOC. Some explanations for these results had been provided.
- 3a and 3b Marzano’s taxonomy has been suggested as a good approach to design MOOCs. Some processes and practices can be changed and enhanced in order to help the students be successful in these types of enviroments

Main conclusions, limitations and future research

#6

Chapter 6: Main Conclusions, Limitations and Future Research

6.1.- Abstract

With this chapter we present the final responses to our probing questions, and relate them with our research journey and personal experience while conducting the dissertation. Some surprising results and emerging big ideas are also exposed together with our contribution to the gap of knowledge. Limitations and future lines of investigation are presented with our arguments, and proposal for new research.

Resumen

Con este capítulo presentamos las respuesta finales a nuestras preguntas de investigación genéricas, y las relacionamos con nuestro viaje a lo largo de esta tesis. Mencionamos también algunos resultados sorprendentes y no esperados, así cómo "grandes ideas" emergentes relacionándolas con la ventana de investigación y nuestra contribución al campo de investigación educativa. Limitaciones y líneas futuras de investigación son presentadas con nuestros argumentos y propuestas de nuevas investigaciones

6.2.- Introduction

In this chapter we would like to wrap up the study and offer some insights about our journey, the research limitations and possible lines for future research. We would like to mention some of the issues encountered during the research and our own reflections during this journey.

6.3.- Big ideas

In this section we would like to highlight some general ideas that had emerged in the study, and that they are somehow common themes in the research:

- Coping with complex information and managing all available resources appears to be a struggle for the MOOC students (Instrument SD: variable 1 and variable 2)
- Students do not value participating in discussions as much as engaging with content and with the instructor. (Instrument A: variable 2, Instrument B: variable 2)
    - The value seen in discussion is a space to be exposed to different perspectives and points of view related with course content.
- We should be able to humanize MOOCs, because as they are right now do not satisfy some of the presences to assure a good online experience for our students (Instrument B: variable 2)
- Students that take MOOCs seem to have higher SDL grades than the average, and indicator that we should design this courses supporting this type of learning if we want to increase students' success.

6.4.- Responses to probing question 1

We would like to present responses to the first probing question in our research (Table. 6.1) by breaking it up in two main questions:

Table 6.1
Probing question 1

Probing Question 1
What is the role of SDL in relation to the other three presences in a COI framework and how does this competence impact MOOC success rates?

- **What is the role of SDL in relation to the other three presences in a COI framework?**

The role of SDL in COI frameworks for MOOCs could be understood as a necessary emerging learning approach/skill. MOOC students monitor and regulate own learning; instructor guides them through the materials with the goal of supporting their learning, as they become more independent learners. MOOC design should offer opportunities for the students to become more independent learners. Table 6.2 shows how this study relates SDL with the other COI presences in a MOOC environment:

Table 6.2
SDL relation with COI

COI in MOOCs	
	SDL
Students (social presence)	Monitoring and regulating own learning
Instructor (teaching presence)	Guides students to be more self-directed learners
Content (cognitive presence)	MOOC designed to emphasize SDL procedures when going through the materials

- **How does this competence [SDL] impact MOOC success rates?**

We can't conclude that higher levels of SDL impact success rates in MOOC environments, but we can share some of the findings from our research.

Firstly, our results indicate that students that took this particular MOOC score higher than the average SDL rates as it is shown in figure 5.16. From the ANOVA results we can conclude that there are significant differences within some groups of quiz takers and the final scores obtained in the SDL survey (significant level of 0.003, $p=0.003< 0.05$). We can't conclude at this point that higher levels of SDL skills implies higher probabilities of finishing the MOOC, mainly because the correlations only offers information about differences, but not degrees. Another factor that influences this result is that participants in this particular MOOC show higher degrees of SDL than the expected average; therefore they might have already an intrinsic motivation to finish the course due to their personality and learning approach.

6.5.- Responses to proving question 2

The previous research questions are related to the second probing question that we would like to resolve with this research (table 6.3):

Table 6.3
Probing question 2

Probing Question 2
Could MOOCs designed using Marzano's learning taxonomy empower student's SDL skills and make them more successful in these open environments?

After analyzing our research questions we can state a few big ideas from the results:

1. Students in this MOOC already show higher levels of SDL skills and they are aware that it is their job to be in charge of their learning progress. Some of their own suggestions retrieved form the questionnaires could help improve the MOOC design. These improvements will make it easier to follow course content and participate in course activities.
2. Marzano's taxonomy emphasizes that tasks are more interesting to students if they are inclined and engaged to start working. Aligning activities to the taxonomy and using students and experts suggestions to achieve this situation will also improve student engagement. We already presented this proposal in Table 5.29 Chapter 5.

6.6.- Contribution to the knowledge gap

In our introductory chapter to this dissertation we stated the gaps of knowledge in the field that could be found in the literature, and now we complement our table with our contributions showed below (Table 6.4 and Table 6.5):

Table 6.4
Knowledge gaps and own contributions

• Relate MOOCs with social and teaching presence	• **We have explored this relationship with our instruments and state some conclusions that give a new picture for the COI environments within MOOCs**
• Explore individual traits instead of group behavior	• **We are presenting detailed profiles of MOOC participants, and emphasizing that individual characteristics shape the way students interact with MOOC content** • **With our experts' group analysis we conducted a consensus and disagreement analysis where each of their voices was taken into consideration, therefore analyzing individuals' opinions and thoughts**
• Teaching role redefined	• **Our results indicate that the instructor has an important role as students' guide through the courses content and as a social key element as well. In MOOC environments the teaching presence seems not to be a key presence but instead complements and enhances the other two.** • **Instructor presence supports students SDL skills**
• Relate knowledge construction with personalized learning and Marzano's taxonomy	• **We presented some enhancements to the current MOOC in order to align activities and levels of though processing with Marzano's taxonomy, where the emphasis is in the Self system and the abilities of independent learning**
• Better definition of social presence	• **Social presence seems to be less important for the students within these environments than the other two. It is mainly supported by the instructor and students' interactions with course content** •
• Exploration of learning experiences	• **This particular gap has not been deeply explored in our research and se suggest that could be a line of investigation for future research**
• Add new data on students engagement and motivation	• **Some of our questions in instrument A explored students engagement and intrinsic motivation, interest in the topic and self-directedness emerged as key characteristics**

Table 6.5 retrieved from Chapter 2 in our literature review shows a summary of best practices to achieve COI in traditional online environments and MOOCs. We are now completing it with our comments and suggested changes after our research:

Table 6.5
COI presences and best practices

Presences	Definition	Best practices for achievement in traditional online courses	Best practices for achievement in MOOCs	Comments from our research
Social				
	Ability that students have to present themselves as a real person in online environments	Better results if it is achieved at the begging of the course Influenced by teacher interaction and SDL	Challenging to achieve due to group size	**Yes, and students are ware of this situation and do not seem to expect high degree of socialization**
			SDL seems to help students to interact in an organized manner with their peers	**SDL is a skill that moves students to be independent learners. Should be supported in MOOC environments and students should be encouraged to develop it**
Teaching				
	Facilitation of the education experience by the instructor of the course	Facilitated by the instructor and students	Student interactions are less frequent	**Teacher student interactions are far less frequent**
			New roles appearing: curator of content, technology expert, facilitator, guide	**Instructor acts as a guide through course content and emphasizing SDL skills**

Presences	Definition	Best practices for achievement in traditional online courses	Best practices for achievement in MOOCs	Comments from our research
Cognitive	How students construct meaning through their interactions with the other two presences	Construct meaning thought communications	Good course content design empowers the other two presences	**Cognitive presence is the dominant. The other two support and expand on this one**

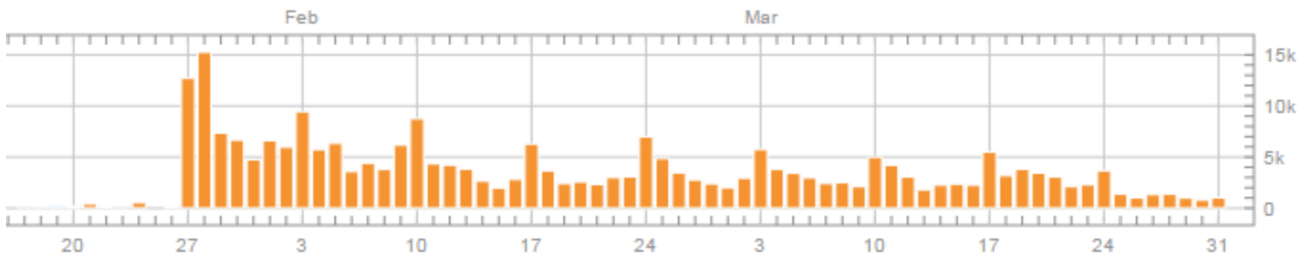
6.7.- Research boundaries and future lines of investigation

There are some limits in the research that we would like to mention; the main one being that the results might be not generalizable.

- Generalization: our study had been performed in one particular MOOC and during one semester. We would like to suggest further investigations in following offerings of the same MOOC.
- Case study: we only performed our research in one MOOC using it as a case study. Even though our potential participants where the whole MOOC population (3,320 students enrolled) due to the nature of these type of courses and participants only 434 students returned the SD instrument. Our of our goals was to correlate this instrument with the amount of quizzes taken, this situation reduced our sample number to 234, and some cribbage we did with the data, just using results from week 3 to week 8 made our final section to be just 135. This number is just 4% of the total number of students enrolled, a low participation percentage. Although we agree and acknowledge that this is a low number, we would like to mention that MOOC online environments have completion rates between 5-8% (Adams, Yin, Vargas Madriz, & Mullen, 2014), therefore our numbers are not surprising, but should be mentioned as a limitation for the study.
- Student interviews: having MOOC students to agree to participate in a discussion with the researcher was a challenge. Due to time differences and problems connecting with them via Skype and phone the student interviews were sent by email and explain to the participants that they

should respond as they would do in a face-to-face interview. We are happy with the results, and we think that it was the only possible way of conducting those interviews. Now, after we have performed the interviews and collected the data, an even though we find the results interesting and they add value and help completing the research we think that another instrument could have been used. We are suggesting the creation of a section within the MOOC where students could respond to some of the questions we posed for them while they take the MOOC. This is a design issue, and was not included in our first round, now we think that it could be an improvement of the course for next rounds.

- Usage of quizzes as students' persistence in the MOOC: we have chosen quizzes taken as independent variable for our correlation study. It was the only traceable indicator besides log in time that we could access in the MOOC. We worked with what we could at that point, but we suggest that other variables could be chosen if possible, and results might give more information than with the current research. We understand this as a technical issue and could not do anything to solve it. The variables we think could give good insights for a future study are: discussion participation, student feedback during the course, participation on self-checks. These variables could give us information about completion and persistency, but also information to complete social presence results.
- Course announcements: at the beginning of each week a course announcement was sent by the instructor, and we can see that student visits to the course are higher the first day of the week than during other times (Fig. 6.1)



Week1 Week2 Week3 Week4 Week5 Week6 Week7 Week8

x axis: weeks
y axis: number of participants

Figure.6.1 Active students per week from Chapter 4. Image retrieved from https://learn.canvas.net/courses/95/analytics

We have knowledge that other announcements were sent during the week at different points in the course, and we are suggesting that they could influence student behavior. For future research we would like to see an study on how this instructor actions can modify student conducts, this will help collecting more data on teaching presence and how interacts with the other two presences.

- Social presence: the findings around this presence had been unanticipated. Although literature in the field seems to indicate that students look for and suffer from the lack of social interaction (Brinton, Chiang, Jain, Lam, Liu & Wong, 2014), our results seem to indicate that students are aware that massive courses are not going to offer opportunities for social interactions. Some research in the field seems to indicate that MOOCs should be designed differently and offer opportunities for more social interactions, we disagree and suggest that, because students do not seem specially interested in socialization, we should emphasize teacher and cognitive presence and support them with activities that empower students to become independent learners.

6.8.- Self-reflections during the journey

During the last year I had been immersed in the creation of this dissertation and this has given me the opportunity of learning about me, my style as a researcher and my own limitations. Handling different sources of information and deciding which ones to use and for what reasons had ben a difficult task. Deciding the theoretical framework that will shape methodology and instruments had also been challenging. Moreover, showing my thought processing and being able to clearly explain the choices I am making during the research had been my main goal during this study.

At the end of this research I would like to share what my final idea of the "research concept" and "scholarly papers" are and summarized with a visual representation (Fig. 6.2)

From the research issue

↓

Decide the research design

↓

Drawn factual conclusions

↓

Relate with interpretative conclusions

↓

Reach final conceptual conclusions

Figure 6.2 Personal research view

After reaching the conceptual conclusions, research design and research issue can be shaped and questioned again.

6.9.- Summary

Chapter 6 presented our responses to probing questions and some developing concepts emerged during the research.

- **Probing question 1**: We explored the role of SDL togueter with the other presences in a COI framework finding that it seems a necessary skill for the students to help them be successful in MOOCs
- **Probing question 2**: we did not find conclusive results on how SDL impacts success rates, but there are some findings form the research that could explain some type of relation between persistency in the MOOC and higher SDL grade.

Our final big ideas, limitations and future research are also explained. Findings about the COI in MOOC's and how the SDL competence interacts with the different presences have been explored and explained, and we explored the additions to the knowedledge gap from our research. Our reflections through the journey and final vision of what scholarly research means had also been presented.

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#7

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Annex

#8

A.- MOOC Syllabus

SYLLABUS FOR Introduction to Cybersecurity

CREDIT HOURS: 1

INSTRUCTOR INFORMATION:

A short bio, contact information, office hours, course guidelines, etc. for your instructor may be found in the *Introductions* discussion area in this module.

I. COURSE DESCRIPTION

The course introduces students to the basic and fundamental concepts of cyber security. The intention of the course is to provide students with an overview of the evolving and dynamic field of cybersecurity. Students will learn about the common cyber-attacks and the techniques for identifying, detecting and defending against cyber security threats. The course will also focus on providing students with a basic understanding of personal, physical, network, web and wireless security. The students will also be introduced to cybersecurity standards and law. The knowledge gained in this course will provide students with a concrete foundation to further master the concepts of cybersecurity

PREREQUISITES

None.

REQUIRED KNOWLEDGE

Basic computer knowledge.

II. COURSE OUTCOMES

Upon completion of this course, students should be able to:

1. Examine the fundamental concepts and elements of cyber security from a people, process and technology perspective
2. Acquire a holistic view of the concepts and terminologies of cybersecurity
3. Examine basic threats and protection mechanisms for physical, personal, computer and application level security
4. Examine basic threats and protection mechanisms for Internet, network, mobile, wireless and web security
5. Apply the basic principles of information security in defending against cyber security threats and protecting information assets

6. Investigate common cybersecurity laws, standards and best practices **(**

III. MATERIALS

There is no textbook requirement for the course. The module materials and supplemental reading materials in the course should provide the necessary knowledge to complete the course.

Weeks start on Monday and end on Sunday, ET, US.

Week	Module & Title	Assignments	Online Discussions	Course Outcomes Related to this Module
	Module 1: Introduction to Cybersecurity	Quiz 1	M1D1: Cybersecurity Attacks M1D2: Cyber security and the challenges of securing Information	1,2
	Module 2: The Big Picture of Cybersecurity	Quiz 2	M2D1: Job Area in Cybersecurity M2D2: Challenges and Responsibility of protecting cyber space	1,2
	Module 3: Personal and Physical Security	Quiz 3	M3D1: Mobile Device Protection M3D2: Use of Social Media	3,4,5
	Module 4: Computer and Application Security	Quiz 4	M4D1: Computer application attack M4D2: Proactive and reactive measures of protection	3,4,5
	Module 5: Web Security		M5D1:	3,4,5

	Quiz 5	M5D2:	
Module 6: Network Security	Quiz 6	M6D1: Identify Network Attacks M6D2: Securing networks	3,4,5
Module 7: Mobile and Wireless Security	Quiz 7	M7D1: Balancing security and convenience M7D2: Perspectives on Bring Your Own Device	3,4,5
Module 8: Cybersecurity Standards and Law	Quiz 8	M8D1: Cyberterrorism	3,6

IV. GRADING

EXCELSIOR COLLEGE GRADING POLICY

Available grades:
A = 90–100%
B = 80–89%
C = 70–79%
D = 60–69%
F = below 60%

GRADE WEIGHTS

Activity/Assessment	% of final grade
Quizzes	50
Participation in Weekly Online Discussions	50
Total	100%

RUBRICS USED IN THIS COURSE:

Discussion Rubric

V. COURSE REQUIREMENTS

COURSE ACTIVITIES:

Before beginning your course work, be sure to review the Excelsior College Guidelines for Online Interaction (a.k.a. Online Etiquette or "Netiquette"). If you have any questions regarding these guidelines, please feel free to direct them to your instructor.

All papers in this course are subject to anti-plagiarism software.

Quizzes – 50%

Every module except will include a 20 question multiple choice question quiz that will cover the concepts addressed in the specific module. You will have one hour to complete the quiz.

Online un-proctored assessments will test you on what you have learned in the course. If you navigate away from a quiz or exam while taking the assessment, you may be locked out. Your instructor has sole discretion, and only under exceptional circumstances, to reset an incomplete examination. To request a reset, you must contact your instructor.

Participation in Weekly Online Discussions – 50%

A series of discussion questions will be posted during the course.

*By registering for a web-based course, you have made a commitment to participate regularly with your instructor and other students in online discussions. You will be expected to use online course tools (**Discussions** and **Chat** rooms) to interact with your peers and work collaboratively to improve your understanding of underlying course ideas and issues.*

*To lessen the risk of losing your work, do not write major discussions directly into a discussion post. Instead, compose and check your work in other software (such as a word processor) and then use the **Create Message** button and copy and paste your text into the new post.*

FORMATTING AND STYLE FOR WRITTEN ASSIGNMENTS:

Some assignments in this course require APA style for formatting and references. You should be prepared to learn the necessary elements of APA style, and the course provides tools and guidelines to this end.

Unless otherwise specified, online discussion postings and responses do not require APA formatting or formal citations and references. You should always clearly state the basis, in the course material or your own research, for what you write in discussion postings.

B.- MOOC module notes sample

Module Introduction

Today our daily lives, economic vitality, and national security all revolve around technology. We perform transactions with organizations across the world, so that millions of dollars and important information travel through cyberspace. Our dependency on technology means we need a stable, safe, and resilient cyberspace. Today, computers and networks are being misused at a growing rate by employees and cybercriminals. Cyber intrusions and attacks have increased dramatically over the last decade, exposing sensitive personal and business information, disrupting critical operations, and imposing high costs on the economy. Preventing this misuse of information requires an increased expertise among information technology professionals so that they can successfully defend against any computer attack. In this module, you will learn about the fundamentals of cybersecurity and basic threats. You will also examine the importance of building a comprehensive security plan that integrates people, processes and technology.

Module Outcomes

- Define cybersecurity using examples and explain its importance.
- Identify the challenges in securing information, using examples and illustrations.
- Define and investigate cybersecurity concepts.
- Analyze cybersecurity attackers and attack sources such as cyber criminals, script kiddies, spies, insiders, cyber terrorists, hactivists, and international threats.
- Examine the importance of building a comprehensive security plan and analyze the importance of integrating people, processes and technology.

Learning Assessment Activities

Read the following:

- PowerPoint presentations for the assigned readings:
  - Module 1 PPT

- Read the following article:

Vasilogambros, M. (2013). America's 3 biggest cybersecurity vulnerabilities. *National Journal*. Retrieved from http://www.nationaljournal.com/whitehouse/america-s-3-biggest-cybersecurity-vunerabilities-20130313

View the following video:

- CNBC. (2011, June 14). Code wars: America's cyber threat [Video file]. Retrieved from http://www.youtube.com/watch?v=bKcftAcAmBI

Participate in the following discussions:

- M1D1: Cybersecurity Attacks

  Identify a specific industry sector that you believe is highly susceptible to cybersecurity attacks. Discuss the need and importance of implementing cybersecurity protection measures in the particular industry sector.

- M1D2: Cybersecurity and the Challenges of Securing Information.

- Who are the people behind computer attacks and how can we stop them?

Submit the following:

- M1A1 Quiz

CYBERSECURITY BASICS

Cybersecurity is a very important topic today. A great number of people depend on technology to conduct their everyday business transactions; when the process is interrupted it can cost an organization millions of dollars. Prior to learning more about cybersecurity, it is essential to examine what cybersecurity is, as well as its related terms. The NIST (National Institute for Standards and Security) defines cybersecurity and its related terms as follows:

- **Cyberspace**: A global domain within the information environment consisting of the interdependent network of information system infrastructures including the Internet, telecommunications networks, computer systems, and embedded processors and controllers.

SOURCE: CNSSI-4009

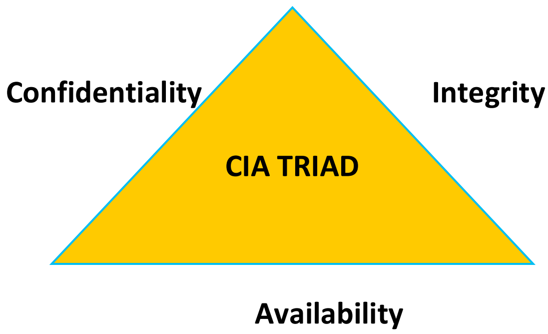
- **Cyber Attack**: An attack, via cyberspace, targeting an enterprise's use of cyberspace for the purpose of disrupting, disabling, destroying, or maliciously controlling a computing environment/infrastructure, or destroying the integrity of the data or stealing controlled information. SOURCE: CNSS-4009
- **Cybersecurity**: The ability to protect or defend the use of cyberspace from cyber attacks. SOURCE: CNSSI-4009
- **Information Assurance**: Measures that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation. These measures include providing for restoration of information systems by incorporating protection, detection, and reaction capabilities. SOURCE: SP 800-59; CNSSI-4009
- **Information Security**: The protection of information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide confidentiality, integrity, and availability. SOURCE: SP 800-37; SP 800-53; SP 800-53A; SP 800-18; SP 800-60; CNSSI-4009; FIPS 200; FIPS 199; 44 U.S.C., Sec. 3542
- **Computer Security**: Measures and controls that ensure confidentiality, integrity, and availability of information system assets including hardware, software, firmware, and information being processed, stored, and communicated. SOURCE: CNSSI-4009

It is critical that you understand how computer security works and what can be used to guard an organization's most important asset. By understanding the tools available to fight a computer attack and the tools used by hackers to conduct these attacks, you will be more prepared to deal with security attacks.

The security of an organization's information begins with its employees; employees are the biggest threat to an organization's information. The organization must guard against its employees misusing information and accessing information they do not need to know. This must be an ongoing process so that employees do not compromise the information, or download a malware that can give criminals access to this information.

Computers and networks have been so misused by a vast amount of people today that viruses have become a multibillion dollar problem. Identity theft involves using someone's personal information, such as social security number, to establish bank or credit card accounts which are then left unpaid. Identity theft today poses a serious threat for personal finances and creates liabilities for organizations that house personal information. People's personal information is sold in the black market to the highest bidder. To deter thieves from stealing your identity, you must safeguard your information. One key aspect of information security is to preserve the confidentiality, integrity, and availability of the organization's information. It is important to assure that the organization's and customers' information is authentic and complete, is available, and is shared only among authorized personnel.

At the heart of any information security program is the need to maintain the confidentiality, integrity and availability (CIA) of information assets. Whenever a new information system is implemented or changes are made, it is critical to ensure that the goals of CIA are addressed adequately. The figure below illustrates the CIA triad of confidentiality, integrity and availability.



Confidentiality: This dimension of information security entails limiting access to information to only authorized users and preventing access to or disclosure of information by unauthorized users. The authentication of the right users can be implemented with the use of user IDs and passwords. The concepts of confidentiality are not limited to passwords but also extend to data privacy and privacy protection.

Availability: This dimension of information security focuses on ensuring the availability of information resources at all times. It is important to ensure that information systems' resources and critical infrastructure are available when needed, no matter what time of day. The availability of information assets can be a health and safety issue in time-sensitive and medical environments. As the sophistication of attack vectors increases, it is critical to safeguard the availability of information assets at all times. It is also important to keep in mind that disruptions in availability of services are not always of malicious origin, and can arise from other sources, such as natural disasters and accidents.

Integrity: Integrity means that the information is correct and no unauthorized user has altered it. This dimension of information security refers to the "trustworthiness" of information resources and focuses on data integrity, specifically ensuring that data has not been changed inappropriately or by accident. This also includes verifying that the data actually originated from the entity it is claiming to be from.

INFORMATION SECURITY BASIC TERMINOLOGIES

Today, achieving confidentiality is harder than ever because computers or devices that connect to the Internet are everywhere. Each one of these devices can perform an operation that can compromise confidentiality in one way or another. The basic terms in information security that are important to understand are defined below:

- **Access Control**: These are rules and policies that limit access to information to those with the "need to know".
- **Authentication**: The process of identifying the identity or role someone has.
- **Authorization**: Determines whether an identity should be granted access to a specific resource.
- **Asset:** The valuable information resource that needs to be protected from attacks. Some examples of assets include credit card information databases, social security databases and so on.
- **Vulnerability:** The weakness present in a system that allows the attacker to bypass any security protection mechanisms.
- **Exploit:** The method used in order to cause unintended behavior or harm to a computer system as a result of taking advantage of a vulnerability.
- **Risk:** The potential for harmful outcomes resulting from an attack.
- **Threat:** The possible action that can cause harm, resulting from exploiting a vulnerability.
- **Threat agent**: The individual or group responsible for causing a threat.

SOURCES OF CYBER SECURITY ATTACKS

- **Hackers/Cyber Criminals**: These are the individuals responsible for cyber attacks.

- **Insiders**: An insider attack is a security breach that is caused or facilitated by an employee or someone from within the organization.

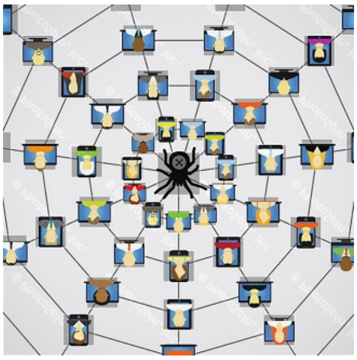
- **Script Kiddies**: In addition to hackers, there are other individuals called script kiddies who launch malware attacks. This attacker uses existing, well-known, easy to find programs and scripts to search for weaknesses in computers on the Internet. For hackers, script kiddies are low-level individuals that set back the art of hacking, make hackers look bad, and bring the wrath of the authorities on the hacker community.

- **Hactivists**: A hactivist is a person who gains unauthorized access to computer files or networks in order to further social or political ends.

- **Government Agencies**: Government agencies have become a cyber threat because some countries have now formed teams of cyber experts to try to steal other governments' secrets from their computer systems.

- **International Threats:** A cyber attack can come from any country around the world. Cybersecurity is a global problem that affects all international countries. Since different countries have different laws and punishments regarding cybercriminals, it is hard to bring them to justice.

GENERAL CYBERSECURITY ATTACKS



File Number: 743_4023379

There are many types of computer attacks we must guard against on an everyday basis. Examples of these attacks are Trojan horses (which come in with other software), viruses (which reproduce themselves by attaching to other executable files), worms (self-reproducing programs) or logic bombs (which are dormant until triggered by an event). Most of the time, when an individual or a group breaks into an organization's computer system, the aim is the modification, destruction, disclosure, interception, interruption, or fabrication of the organization's data.

Match the Definition with the Proper Term	
Modification	Accessing the data in a system and changing it in an unauthorized manner.
Destruction	Destroying the hardware, data, or software with malicious intent.
Disclosure	The unauthorized disclosure of information in your system.
Interception	This happens when an unauthorized person or software gains access to your system to steal or modify the information in it.
Interruption	An organization is denied access to their information.
Fabrication	Additional data is added to your network, records, or databases by unauthorized personnel.

Cybersecurity attacks can be launched by a number of techniques such as malware, social engineering, phishing and so on.

Malware: A general term for malicious computer programs that are used to compromise computer systems and gain access to system information or cause damage to computer systems. Malware is short for "malicious software". It is a general term which includes many forms of software causing harm including, but not limited to, viruses, worms, Trojan horses, rootkits, and spyware. Malware may be used to target people, processes, and/or technology, but the ultimate goal usually is to either gain unauthorized administrative access to a system or obtain certain types of protected data.

For general information about malware, the SANS Institute website offers a variety of helpful resources, including this Malware FAQ, at http://www.sans.org/security-resources/malwarefaq/ and this white paper on viruses, at http://www.sans.org/reading_room/whitepapers/incident/malware-101-viruses_32848.

- **Virus**: A computer virus is a code that replicates itself by modifying other files or programs. One distinguishing property of a virus is that for it to work, it needs user assistance, usually when a user shares an email or through a USB drive. Viruses are one of the most well-known forms of malware, and quite common. The term virus is a broad categorization, which includes many subcategories. Viruses are parasitic in nature, and they have the ability to copy themselves to other programs. Viruses do not always have an automatic characteristic-property and many times require a host program, system, and user to continue to replicate. An example of a virus is ILOVEYOU, which disguised itself as a text file in an email. When opened, it would automatically send itself to every contact in the address book of the infected user.

For more information, please read Microsoft's definition of a virus from the Safety and Security Center here: http://www.microsoft.com/security/pc-security/virus-whatis.aspx

- **Worm:** A worm is a type of malware which is intended to self-replicate many times, thus consuming valuable system memory and disk space. A computer worm generally spreads by injecting itself in other programs without human interaction. Worms usually spread by exploiting vulnerabilities in applications of computers connected to the Internet. Once the worm has infected the computer, it propagates by infecting other computers by connecting to them over the Internet. According to Gibson (2005), the "difference between a worm and a virus is that a worm self-propagates, whereas a virus has traditionally been defined as: the user has to do something to get themselves infected." Examples of known worms are Flame and Conficker.

  For more information about worms, please read the transcript of Steve Gibson's Security Now Podcast #1 here: https://www.grc.com/sn/sn-001.txt. (Please note audio files of this podcast are also available.)
  For more information about the Flame worm, please read Steve Gibson's discussion of the Windows Flame worm here: https://www.grc.com/sn/sn-357.txt

Gibson, S. (2005, August 19). As the worm turns: The first Internet worms of 2005 [Podcast transcript]. *Security Now!* Episode 1. Retrieved from https://www.grc.com/sn/sn-001.txt

- **Trojan Horse**: Trojan horse programs, sometimes referred to as Trojans, are malicious programs which the user unwittingly installs on his or her computer because he has been tricked into thinking the program is actually something else. For example, someone downloads what they believe to be a free game, and discovers (after their computer starts to perform erratically) that it's actually a Trojan they have downloaded. Free programs and files may be accompanied by a Trojan type of malware. After opening or installing a program, the user may inadvertently install Trojan malware. Trojans allows an attacker to remotely monitor and control the infected computer. Once a computer becomes infected with a Trojan, it could become a zombie. It is called a zombie because the compromised systems can execute attacker instructions without the knowledge of the end-user. The zombie often joins the ranks of a botnet (a group of infected zombie machines), which can be used by the attacker (aka the bot-herder) to launch and/or pivot attacks against other targets. A few examples of Trojans are SubSeven, NetBus, Net-devil, and BO2K.

For more information, please read the *Logic Bombs, Trojan Horses, and Trap Doors* article by Stephen Northcutt on the SANS Institute website:
http://www.sans.edu/research/security-laboratory/article/log-bmb-trp-door

- **Rootkit**: A type of malware which uses stealth techniques to give the attacker administrative control of the compromised system, hide its presence from the end-user, and avoid detection using ordinary anti-malware tools. Operating system files, Windows registry entries, whole processes, and drivers can be loaded and running on the compromised computer system. They can remain completely undetectable due to the fact that the rootkit has the capability to dictate to the operating system what will be displayed to the end-user. Two examples of rootkits are Adore and Hacker-Defender.

Read more about rootkits in this transcription of a Security Now podcast episode from Steve Gibson:
https://www.grc.com/sn/sn-009.txt
(Please note that audio files of this podcast are also available.)

In addition, you may find this video by John Strand on the Hacker Defender rootkit helpful:
http://www.youtube.com/watch?v=NJNYHpFipjM

Here is a link to Pauldotcom.com Episode 226, with a technical segment on iPhone Application Reversing and Rootkits by Eric Monti:
http://pauldotcom.com/wiki/index.php/Episode226

Finally, take a look at the SANS Institute white paper, *Linux RootKits For Beginners: From Prevention to Removal* here:
http://www.sans.org/reading_room/whitepapers/linux/linux-rootkits-beginners-prevention-removal_901

- **Spyware**: Spyware seeks to gather information about an organization or person without their prior consent or knowledge. Sometimes, spyware is included with legitimate software, but without the distributor of the product making the user aware that this activity is taking place.

Here is a US-CERT article on Spyware:
http://www.us-cert.gov/sites/default/files/publications/spywarehome_0905.pdf

Here is a US-CERT article on securing your browser:
http://www.us-cert.gov/publications/securing-your-web-browser

Check out this paper on cookies from GIAC:
http://www.giac.org/paper/gsec/226/cookie-crumbs-introduction-cookies/100727

Social Engineering (SE) is the art and science of exploiting humans. This type of attack aims to trick an authorized user into revealing sensitive personal, business, and/or financial information, which the user otherwise would not disclose. The attack may be physical, meaning the attacker physically engages with the target user by means of impersonation, friendship, or another relationship. On the other hand, the attack could be executed by using technology like email, a fake login website, SMS, VoIP, or other technology to trick the target into revealing information.

For further reference, please visit the *Social Engineering Framework*, at the Social Engineer website, which provides details on this type of attack at http://www.social-engineer.org/framework/Social_Engineering_Framework

- **Phishing**: A form of social engineering (SE). In a phishing scam, the attacker uses a phony email, which appears to be legitimate, to lure the user into clicking on a link or opening a file, which can lead to violating the confidentiality, integrity, or availability of the data.
  For example, an attacker may send an email to a victim which appears to be coming from the victim's bank. It asks them to click on a link to conduct a mandatory account verification by logging into their account. The victim clicks on the link, does what is asked, clicks submit to enter the banking website, but receives an error that the credentials were

incorrect. What the victim may not realize is that they sent their bank credentials to an attacker, perhaps in a foreign country.

For more information about phishing and protection tips, visit the anti-phishing website antiphishing.org, here: http://www.antiphishing.org/

These are just a few of the cyber attacks that most people hear about and that organizations have to deal with on a daily basis. In Module 3, which deals with personal security, you will learn more about these threats. Without the proper security in place and properly trained personnel, databases that hold critical information can be hacked at any moment.

CHALLENGES IN CYBERSECURITY

One of the biggest challenges with providing strong computer security is in not knowing if the designed software or hardware will provide the intended security. Technology is a fast changing world where every day cyber criminals try to come up with new technology to hack into your computer systems. Not knowing if the developed hardware or software will provide the needed security results in many unanticipated security vulnerabilities. This is why is it is critical for software developers and programmers to stay informed of changes and new malware. Malware that is hidden can lay dormant for any amount of time collecting information or waiting to attack your organization's systems. Some of the major challenges in cybersecurity are identified below:

- **Evolving and dynamic nature of cybersecurity threats**: The rapid evolution and dynamic nature of cybersecurity requires that information technology professionals stay ahead of cybercriminals and stop them from accomplishing their mission. Today, because people are so dependent on technology, it is hard to keep up with new changes and technologies. With a growing cyber world, new and more advanced attacks are constantly born; the only way to stop these attacks is to always stay a step ahead of cyber criminals. This is where having the proper personnel and skills are critical for an organization.

- **Information explosion**: The number of devices connected to the Internet has increased tremendously and the amount of information stored electronically is immensely vast. Additionally, the volume of banking and monetary transactions that occur across the Internet on devices ranging from laptops, tablets, mobile phones and more have greatly increased, further making the Internet a playground for cybercriminals.

- **Increased availability of hacking tools**: Unlike the old days when hackers needed to be well-versed in computer systems and programming, today's information environment makes available a wide variety of automated and user-friendly hacking tools. Due to the availability and ease of use of these tools, even inexperienced computer users are able to easily scan networks to detect vulnerable systems to plan and launch cyber attacks.

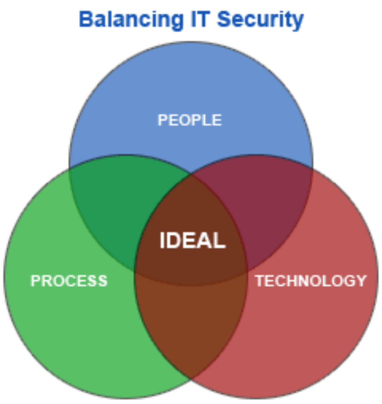
- **People factor**: People are considered the weakest link in security, and a large number of cyber attacks are attributed to user negligence or lack of cybersecurity awareness. Training users to apply cybersecurity principles can be challenging and requires people to be motivated towards applying security best practices at work.

- **Lack of cybersecurity workforce**: Not having the appropriate amount of personnel with the right skills can hinder an organization. There is currently a shortage in the cybersecurity workforce. With the vast growth in cybersecurity attacks, not having the personnel in place to recover and prevent them can cost organizations millions of dollars.

- **International spectrum**: One of the biggest challenges in cybersecurity is bringing cyber criminals to justice. This is a hard task because different countries have different laws. In some countries, cyber crimes are not considered to be real crimes. Bringing a cyber criminal to justice is time consuming, and it may be impossible to definitively identify the entity or individual directing the attack.

BEST PRACTICES IN CYBERSECURITY

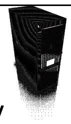
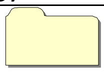
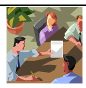
The figure below illustrates a balanced security model, which assures the security of people, processes, and technology. This is what we need to keep in mind when considering implementing cybersecurity best practices in organizations.



Balanced security model: people, processes, and technology.
IIS Hacks. (n.d.). [Untitled Venn diagram illustration of balanced security model between people, processes, and technology]. Retrieved from http://www.iishacks.com/wp-content/uploads/2009/11/balancing-it-security-venn.gif

In order to demonstrate the importance of people, processes and technology in cybersecurity, let us consider a simple precautionary method of requiring employees to change their passwords every three months. Table 1 shows the interdependence and roles of these three elements in an organization in order to successfully implement the password policy.

Table 1: Technology, Process and People in Cybersecurity

Element	Role
Technology 	The right technology, configuration, maintenance, and integration into the existing environment.
Processes 	The policies that define the scope and usage, applicability, and exceptions.
People 	Awareness and end user acceptance, and the technical personnel required to maintain the system.

As illustrated in the above figure, the right balance of technology, processes and people are needed in order to successfully implement cybersecurity programs in organizations. If the technology part is implemented without the right process and without considering the people factor, the cybersecurity initiative will not be successful. This view is applicable to almost all security procedure implementations in organizations, and therefore it is important for cybersecurity personnel in organizations to understand the dependence and integration of these elements.

The cyber threats that organizations have to deal with are rapidly changing and evolving in complexity. Today cyber criminals, script kiddies, spies, insiders, cyber terrorists, hactivists, and other international threats are some of the groups that threaten an organization. The monetary gains that can be acquired from selling an organization's or a country's information are so large that many people dedicate their lives to stealing information or causing harm to the systems that house this information. Building a comprehensive security plan and integrating people, processes and technology into it is critical to protecting the organization's systems and information.

Many factors play a critical part in guarding organizational information; one these factors is training. Many organizations struggle to have personnel follow good information security practices; this is mainly because employees are poorly trained. Properly training personnel to follow policies and protocols helps to stop employees from making mistakes that can cost an organization millions of dollars. To be able to have employees guard your organizational information properly, training is vital. Training helps to keep employees informed and helps them to recognize possible threats.

Fighting cyber-crime is an ongoing battle that every organization is trying to win. An organization must understand the current cyber threat landscape and have insight in building, implementing and maintaining a layered security defense against fast growing cyber attacks. Today, with countries trying to acquire trade secrets to stay ahead of the competition, it is critical that the government, as well as U.S. organizations, guard their critical assets from outsiders. Adding to the threat of other organizations and countries trying to acquire your information, there is also the human factor. Human lack of knowledge, mistakes, and malicious intent are what cause most of the information security and privacy breaches. Today it is so difficult to defend against computer attacks due to greater sophistication in the attacks, the simplicity of attack tools and user confusion. These are factors that give a hacker or cyber criminal the upper hand in many situations. The more prepared we are, and the more we know, we will be better able to combat those cyber criminals that would attack our systems and software. The best way to defend against any attack is to prevent it in the first place. Building the proper plan and having the proper team to support this plan will help the organization guard its systems and information.

DISCUSSION QUESTIONS

- M1D1: Cybersecurity Attacks

Identify a specific industry sector that you believe is highly susceptible to cybersecurity attacks and discuss the need and importance of implementing cybersecurity protection measures in the particular industry sector.

- M1D2: Cybersecurity and the Challenges of Securing Information.

Who are the people behind computer attacks and how can we stop them?

C.- Intrument validations by panel of experts

Demographic survey and motivation to take the MOOC

Instrument for Q0

Si us plau valideu l'instrument corresponent a la Q0 de la recerca. Indiqueu Y-si, o N- no per als indicadors. Si us plau acompanyeu els indicadors no validats dels vostres comentaris.

Aquest instrument està relacionat amb la següent pregunta de recerca:

Q0. Demographic information and motivation to take the MOOC

Criteria	Indicator (code)	Description	Item	Sub items	(Y/N)	Comments
Demographics	Personal Information	Personal information related to MOOC takers	1.Age			Will you ask this as an open-ended question or will you give respondents forced options? If so, what ranges are more relevant? If open-ended, be sure to prompt respondent to answer in years.
			2.Gender			
			3.Country of residency from where you took the MOOC			Will you get this data from IP addresses too? What country did you reside in when taking this course?
			4.Are you a native English speaker?	a. Yes b. No c. No, but I have a good English level		Is English your first language? If no, how would you rate your English proficiency? Beginning Intermediate Advanced
			5. Highest degree	a. Less than High School b. High School c. Associate degree d. Bachelor degree e. Master degree f. PhD g. Other		This question as stated is not exhaustive. If someone did not receive any degree, they would end up having to choose other. Probably better written as follows: • Less than high school • High school degree or equivalent (e.g. GED) • Some college but no degree • Associate degree

						• Bachelor degree • Master degree • Ph.D. • Other: •
Motivation	Motivation at registration	Main reasons to be compelled to register for the MOOC	6. Why did you register for the MOOC?(check all that apply)	a. General interest in the field b. Traditional courses are too expensive c. Just for fun d. Improve performance in my work e. Geographically not close to educational institutions f. Change careers		Might be worthwhile taking a look at the Patterns of Adaptive Learning Scales (PALS) This is going to be a check all that apply? Is enrollment a better word than register? For a) I would use topic instead of field For b) consider using "formal education" is too expensive. Traditional courses may be up for interpretation as to what that means For c) consider phrasing: Thought the course would be fun. For d) do you want to know if it will improve performance at work or relevant to work For e) I am not geographically close to educational institutions f) Looking to change careers Additional possible: The course relates to my current academic program The course relates to my current job responsibilities The skills from this course may be helpful in obtaining a new job I probably would add an "other" category just to see what kind of information you get, maybe there are other reasons that you cannot envision. Will be difficult to analyze, but possibly interesting and justified given that it is a relatively new field
			7.What were your main goals at	a. Complete the course b. Obtain a		What about to expand knowledge on an existing topic?

			registration?	certificate of completion c. Peruse the contents d. Read articles and watch videos e. Participate in the discussions f. Make professional connections		Academic curiosity? How is the previous question differentiated from this question? What's difference between motivation and goals? My suggestion would be to combine the two questions to get at a student's intent on taking the course If you keep this question separate, I would add an "other" category in order to be exhaustive
	Motivation during the MOOC	Reasons why they kept engaged during the MOOC	8.How did you keep engaged during the time you were taking the MOOC?	a. Participate in discussions b. Peruse module content c. Ask questions to your instructor d. Other		I would also include the specific activities and expectations tied to this specific course so that all relevant items are here. I think you might want might want to think about specific items that might be tied to social, cognitive, and teaching presence here too. Look at Kizilcec, Piech, and Schneider on a classification of engagement for MOOC learners Another option: I interacted with friends
			9.What part did you find more interesting?	a. Videos b. Discussions c. Self-checks d. Quizzes e. Readings f. Other		Use these above I, but think about phrasing
	Demotivatio n	Reasons why they decided not to pursue the MOOC anymore	10.Did you complete the course?	a. Yes b. No		Does completion follow a cohort model? Can a student complete earlier? If yes, do you want to know how quickly they moved through course?
			11.If you answered no, what were the main obstacles for completion?	a. MOOC content b. Work issues c. Technology unfamiliar d. Connection problems e. Family issues f. Others		Some additional items Difficulty of the material Depth of material Clarity of instructor Knowledge of instructor Course workload Course pacing Technical issues • Work issues might be misinterpreted. Conflict with my job I think you probably want a few items here: Some that focus on social presence, some that focus on

						teaching presence, and some that focus on cognitive presence In addition to the other reasons mentioned above, the life circumstances questions.
			12.If you did not finish the course, would you have been more inclined to finish if:	a. It was shorter b. It was open longer c. If you could chose what modules to take and in what order d. Other		

Student interviews (Codes come from literature): Lurker, Passive participant, Active Participant, Drop in

Instrument for Q3 and Q4

Si us plau valideu l'instrument corresponent a la Q3 i Q4 de la recerca. Indiqueu Y-si, o N- no per als indicadors. Si us plau acompanyeu els indicadors no validats dels vostres comentaris. Aquest instrument està relacionat amb les següents preguntes de recerca:

Q3.How can we change processes or practices that specifically facilitate student engagement in a MOOC Community of Learning?

Q4. How well is the MOOC aligned with Marzano's learning taxonomy?

Creiem que per la natura de l'instrument aquest sembla adreçar les dues preguntes

Criteria	Indicator (code)	Description	Item	Validated (Y/N)	Comments
Social Presence	Personal/affective	Personal opinion from MOOC takers about sense of community of learning,	1.Did you experience a sense of community while taking the MOOC? Why , why not 2. Do you think discussions helped you to experience some learning community?		- As this is an interview, I suggest to deep in participants experience by asking open questions focusing onkey points. For example: What have you experienced…? And after listening introduce the idea 'sense of community' if necessary, such as others. - Same in Q2: - What have been the role of discussion in your learning…?
	Open communication	Personal opinion about being able to express opinion freely	3. Did you feel free to communicate your opinion with the rest of students? Welcoming environment 4. Did you participate in the discussions? Why, why not?		- Is not a good idea to return to a commented topic as discussion is. You need to be coherent on your interview. - In Q2 your

Criteria	Indicator (code)	Description	Item	Validated (Y/N)	Comments
					assumed that they did.
	Group cohesion	Personal opinion about the importance of belonging to a group when taking the MOOC	5. Did you feel that you belonged to the group during your MOOC? 6. Was important for you to have other students input and communication?		- You need to know why they have felt... am I right? Avoid yes/no questions in interview, you need to create sense.
	Self-directness	Independent learning during the MOOC	7. Did you learn independently during the MOOC? 8.What strategies did you use to learn independently during the MOOC if any?		- How (and what) did you learn during the MOOC? What strategies…? And after his response go into precise outcomes as independent or autonomous learning.

Focus group: Subject Matter Expert, Faculty Program Director, Instructional Designer and Instructors (Codes come from literature)

Instrument for Q3 and Q4

Si us plau valideu l'instrument corresponent a la Q3 i Q4 de la recerca. Indiqueu Y-si, o N- no per als indicadors. Si us plau acompanyeu els indicadors no validats dels vostres comentaris. Aquest instrument està relacionat amb les següents preguntes de recerca:

Q3.How can we change processes or practices that specifically facilitate student engagement in a MOOC Community of Learning?

Q4. How well is the MOOC aligned with Marzano's learning taxonomy?

Creiem que per la natura de l'instrument aquest sembla adreçar les dues preguntes

Criteria	Indicator (code)	Description	Item	Validated (Y/N)	Comments
Cognitive Presence	Triggering event	Processes or practices used to capture students attention	1.What techniques have you used when teaching or designing the MOOC to motivate students and first capture their attention?		-There are two completely different focuses in the question: teaching or designing (you mean –and?-.
	Exploration	Personal opinions for focus group members on de content quality and design of the MOOC	2.How would you rate the content, and how it is displayed in this MOOC. Could we have done it better? How?		
	Integration	Discussion about learning activities and align with goals of the course	3.What are your thoughts about the learning activities in the MOOC? 4.How well do they align with the outcomes of the course?		- You assume course outcomes? If not you need to have that info.
	Resolution	What new ideas students took with them after the MOOC. Learning	5.What do you think the students benefit the most when they took		- What do you think or what evidences you have? I believe they will manage these data for sure

Criteria	**Indicator (code)**	**Description**	**Item**	**Validated (Y/N)**	**Comments**
		measurement	this MOOC? 6.What new/main concepts do you think the students learned during the MOOC?		
Teaching Presence	Design and organization	Thoughts on the design and organization of the MOOC, content delivery related items	7.How would you rate the design and organization of the MOOC? 8.What could have we designed better?		- I don't really understand Q8
	Facilitating discourse	Processes or practices to facilitate community of learning	9. Instructor. How was your role as a facilitator? Challenges, successes? 10. Is the size of the students' cohort a challenge for discussions? 11. Any other variables that are challenging? Education level, geographic situation…		- Q10 is answered by a yes or no and you may avoid that type of question in a focus group. - 'How does the size… affects or challenges discussion?'
	Direct instruction	Instructors opinion about possible direct instruction within the MOOC	12. Would you say that the MOOC gave you opportunities for direct instruction? Please explain		- From what extent the MOOC has facilitate…?

D.- Focus groups' transcripts

Focus group with Experts

Date: 02.19.15

Time: 2pm-3pm EST

MEMBER 1: Good morning, uh…this is Member 1.

MODERATOR: Oh hi, yeah this is Moderator. How are you?

MEMBER 1: Pretty good, yourself?

MODERATOR: Good, good. I don't hear you very well. I feel like kind of—I don't know.

MEMBER 1: Let me uh…what about now?

MODERATOR: The volume? Yeah that's better, much better.

MEMBER 1: Oh, okay.

MODERATOR: Okay, so yeah thank you for agreeing on you know…doing this conference.

MEMBER 1: Oh no problem.

MODERATOR: Um, and then, I just wanted to let you know that I'm going to be recording it. Is that—is that okay with you?

MEMBER 1: Yes

MEMBER 3: Absolutely

MEMBER 2: Hi, Moderator?

MODERATOR: Hi, Member 2, how are you?

MEMBER 2: Good, good. How are you?

MODERATOR: Good, I thought—I thought we might have reschedule or something. I don't know.

MEMBER 2: No, no, no. I think I saw the meeting and I thought that maybe you would might call me. And I was just working on something and sort of lost track so thank you for yeah, for chatting me.

MODERATOR: All right, it's going take 30 minutes or so but…

MEMBER 2: Sure, no problem, yeah.

MODERATOR: But this is going to be done.

MEMBER 2: No problem. No problem at all. I'm happy to help.

MODERATOR: Good. So you—you already got the message that I will be recording the—the call—

MEMBER 2: Yes.

MODERATOR: --are you okay with that?

MEMBER 2: I am. Sure, no problem.

MODERATOR: Okay, good. So…I just have a few questions. Um, it's not going to take more than hopefully 30 minutes um, about the MOOC, this question is for the SME's when you designed it.

MEMBER 1: Yes.

MODERATOR: Okay. So, how do you compare the MOOC content with face-to-face courses if you have experience with that? Is it the same or…?

MEMBER 3: Well having been on both sides of the—of the desk while teaching in person and online and being a student both online and in person…you know, I think that the advantage of the online setting is, you know, is the ability to attract an array of students instead of just that one, you know, population that might be local. I think that the engagement part of this was a little tough for this particular course. I have not run into this issue in the past. Usually, students are motivated so there isn't a whole lot of difference between the two. I think that the main difference is the population of students is a little different so…

MEMBER 2: Um, yeah pretty much I think that uh the face to face—I don't know like…I've never taught any courses face to face for Introduction to Cybersecurity. But I have a similar course that we offer online um so the contents are pretty much…I would say no different in terms of the content covered in the MOOC course or any Introduction to Cybersecurity course that um other colleges or universities would offer face to face. Um specifically you are just asking me about the content but I think the main difference would be in other areas.

MODERATOR: Okay so what—what—what—what areas? What do you think?

MEMBER 2: Yeah, I think that the areas would be probably the level of interaction, um, would be one. But I think somehow in the MOOC environment, especially given the large number of students, it's not feasible to have such a course in a face to face environment so definitely one big difference would be the size of the—of the class. Um, but in the MOOC, and also in terms of even the size…I think the interaction opportunities are more in the MOOC than in the face to face because you can really discuss with anybody in the course anytime you want. You can quickly send a message and that way you open the channel of communication. But on the other hand in the face to face you are limited to seeing each other just within that space and time where you're mostly engaged in lectures or completing activities so um the peer to peer interaction I think would be higher in the MOOC. It provides more opportunities. Um but for the instructor perspective, I think in the face to face, there might be more opportunities for a student to make more um…make really face to face interact. There's a different level of communication that occurs. You can really get to know maybe your instructor a little bit more but again, it's also possible in the online but it's just that more like you will stop by after class and ask a question…but on the other hand maybe in the online, some people may be reluctant because you don't get that face to face interaction but the communication channel is always open so if they want to, I think, they can still initiate that um through the face…I mean, sorry…the MOOC as well. But it's just that the large number of students is—will also be a challenge for the instructor to reach and—and engage the students, you know? Uh, one on one.

MEMBER 1: Well, I think that uh…well face to face is harder than with the MOOC, the student reads the book then uh goes and answers the questions. With the face to face, if they have any additional questions they will have the instructor which that's something that the MOOC doesn't provide because there's not an instructor.

MODERATOR: Oh, we had an instructor, we did.

MEMBER 1: Oh, okay.

MODERATOR: We had an instructor but the um you know, we had around 4000 students—

MEMBER 1: Wow.

MODERATOR: So, you know if…yeah exactly (laughs) so there was an instructor but it was just a facilitator, basically. And even though he was very good and very active and was there every day…um I can understand when you say that the interactions were much, much more lower than…a face-to-face, yeah.

MEMBER 1: Well yeah because the thing is that—is that with the face-to-face at least the instru—the student is able to ask the question to the person who put this—the MOOC together—

MODERATOR: Right.

MEMBER 1: --put the class together so—

MODERATOR: Oh, I see.

MEMBER 1: and it will get a better answer from it. Having uh, having someone…a facilitator is great…you don't have the—the SME on the subject to really…go into the uh question and really explain, probably more than what you need but give you a better understanding of it.

MODERATOR: Ok, I know what you mean. So maybe it could be a good idea to maybe have one of the SMEs teach…teach the MOOC or be the facilitator?

MEMBER 1: Yes, yes.

MODERATOR: So, member when you were teaching the MOOC, did you use any special techniques to engage the students or make them star—you know, stay engaged in the course?

MEMBER 3: Well I—I extended myself a bit more than I normally would in other teaching environments because the—the group, uh…this was the initial course and we had some issues in terms of—of attracting students. There wasn't a lot of promoting the course so I think that there was a bit of confusion early going. I spent quite a bit of time reaching out to students, sending them emails, encouraging them to participate, talking about the topic each week. So a little different in terms of what I'd normally expect where you'd typically have students who wouldn't really need all that prompting.

MODERATOR: Okay, so you sent emails and then you posted announcements, something like that?

MEMBER 3: Yeah, I would post an announcement at the beginning. I would talk a little bit about what the course was going to be about and then I would send out emails throughout the week to try and engage students a little more.

MODERATOR: Yeah, okay. So what do you think—what do you think some of the strengths or weaknesses of—of the modules that you created? Um, do you want to share them with me? Any strengths or weaknesses you—

MEMBER 1: I think that that—the strengths come when that uh...the student is able to…to work more around their schedule. Even though we're an online school and a lot of the courses are online um…you know when you have a—a professor and the student has to abide by "Okay, I need to get this done by this time and this done by this time". Every week they have to be turning something in. Where with the MOOC, they don't get that regimental. Yes they have to turn certain things in on time but it's not as regimental as the face to face.

MODERATOR: Yeah, so, in particular with this MOOC, do you see any strengths or weaknesses that you thought about? That we could do this better?

MEMBER 3: Well, there were a couple of things that were very, very good. One, I thought was that the particular assignments that we were looking at with eight modules were really a perfect fit for this audience. They were too, uh, too deep. They were light. They were interesting so I think that they engaged students really in what I think they were looking for. The problem with this particular course, being the first, was that there were a few bugs with it. I think that some of the students had trouble navigating; they weren't really sure where they were supposed to go. They had some difficulty posting and I had difficulty, as you may recall, we had a problem with the grading system. So I couldn't give any kind of a pass/fail or any kind of grade but I was doing tended to give more of a narrative each week for every student that participated. So that little bump, I think, caused some distraction, probably less participation than we might have had otherwise. But, overall, I thought that the modules themselves were extremely well designed and were really perfect for a broad audience. Now if we were dealing with people with a little more uh, you know, experience and background then no, I think it would have been too light but this was—it was an intro to the subject and I thought that was perfect.

MODERATOR: Mm-hmm. Yeah, no, I agree there is more freedom and they choose what they can do and they decide. Yeah. That’s true.

MEMBER 1: Uh, I think so.

MEMBER 2: Yeah, I guess so. Like the strength I would say in the MOOC is the large number of uh students that are able to participate in the course and also another strength would be for students to get in with a whole group of people from maybe different countries, different cultures so you get to really interact with a lot of different people and a lot of them share their discussions so you can really read and learn from multiple perspectives. Just because of the element of discussing so I think that’s one major strength and also, the other strength that, you know, from an online perspective…it’s asking from us is that you can really learn and speak what you want to learn so you’re not just told to sit and go through something you already know.

MODERATOR: So what about weakness…oh, sorry. Sorry. Go ahead.

MEMBER 2: Weakness? Um…I would say again is probably the lack of face to face. Also, the large number of people can be an advantage and disadvantage because uh maybe you loss the one on one attention or the instructor might not can discussions so you can’t get that attention so you really, really have to maybe strive to stand out. Um, that's one disadvantage. Um and maybe there are also other disadvantages. We've been looking at it from a learner perspective but not looking at it from an educational perspective.

MODERATOR: Oh, both. Both.

MEMBER 2: Oh. So then from the educational perspective, the authenticity, right? How do you know that really that someone has really learned or achieved their outcomes? You know, I mean we can't have the chance to know but I'm looking at really some um…technologies or tools that really test the integrity of the learner that they are like, the one who's completing it. It can always be a question whether in terms of they achieved those goals, you know? Um, that would be also another for the MOOC and like I said the large number can be both an advantage and disadvantage um point also, you know um...

MODERATOR: Mm-hmm. Yeah, no, I agree there is more freedom and they choose what they can do and they decide. Yeah. That's true. So um, I guess…are you familiar with Bloom's Taxonomy? You probably are.

MEMBER 1: Uh, I think so.

MEMBER 2: Yes, yes.

MODERATOR: Okay, so in this when we designed the MOOC, we followed another taxonomy. It's called Marzano's taxonomy. I was wondering if you know about this one.

MEMBER 2: Um…no, sorry I don't know about that taxonomy.

MEMBER 1: Uh…I don't.

MODERATOR: You don't?

MEMBER 1: Not—not off the top of my head right now.

MODERATOR: Okay that's the taxonomy we use when we finally put all the modules together that's the one that we follow. I was just wondering if you knew about it but that's fine.

MEMBER 2: Right. I'm more familiar with Bloom's—I guess I'm more familiar with the Bloom's taxonomy than the other one.

MEMBER 1: I think I did read about it but uh—

MODERATOR: Right.

MEMBER 1: --it's been a while

MODERATOR: I know…it's—it's just another learning taxonomy, small focus, to empower the students to be self-directed learners. And just, you know, pick and choose what they really want to learn about. So we thought that, for a MOOC, that was more convenient. I was just wondering if you knew about it. That's fine. Um (clears throat)…okay so when you was designing your modules, how well do you think your content was aligned with the outcomes for the module? Did you create the outcomes? I know it was a long time ago. (laughs) So you might have to…

MEMBER 1: I think it's possible I…did create the outcomes. Maybe what I looked at was mostly, you know…For me, as a student, what I thinking it was really important that I would get out of the class that would help me out for future courses. And uh…planned it out as if I were.

MODERATOR: So you tried to design the content around like to fulfill—to fulfill these outcomes…

MEMBER 1: Yes.

MODERATOR: --with the student perspective in mind?

MEMBER 1: Yes.

MODERATOR: Yeah. So the next question is about the learning outcomes. Do you think the learning outcomes can compare with the traditional courses, even the online courses? Or face to face, are they comparable?

MEMBER 2: Yes. Yeah, definitely they are comparable. Yes.

MODERATOR: And do you think they align with the—with the content of the course? Do you think the outcomes we had—

MEMBER 2: Yes.

MODERATOR: --they align with the idea and the content and everything?

MEMBER 2: Yes. Right. I think that—I mean there's always room for—we can always improve things but at least with my involvement with the MOOC in those early stages I think—I think there was a good alignment between the course outcomes and more—yeah, I'm sorry the course outcomes—and the…yeah, course outcomes than was powered in the course. Uh, but then again as I said there's always room for improvement from an assessment perspective in all those areas but…At least from my perspective, I thought that yes, they was aligned.

MODERATOR: Okay, um, so in the modules, I guess you remember, we had the module notes, the discussion questions, we had a quiz at the end…for each module and then we had self-checks, self-activities. So can you think about any other activities that we could have in the modules besides the ones we designed? Anything else we could have or…

MEMBER 1: I think that the activities we have were pretty good because I mean, they went back and for everything that you—you just read and reinforcing everything you just read. So um, I think it was pretty good.

MEMBER 2: Um…I don't know, maybe some games? Or you know, like group gaming where students, you know, who are online can um team up and play together some intro games or a large activity or something. It's hard to get that, I know it's expensive, but that might be one addition probably. And also, maybe, like…we have the lectures but maybe those lectures could use uh…maybe more like, whiteboard features and things like that so when the presenter is talking, like you know in the side you can have uh the—the whiteboard feature or something that really explains what we are talking about, you know?

MODERATOR: Yeah. Yeah. Maybe breaking in them in smaller groups? That would help with the interactivity that you were mentioning before.

MEMBER 3: One thing—one thing I would add when you're talking about doing something different…I think that, and you may have done this since, but I would uh…specifically I would define the amount of time I would expect the participant would be to invest in taking the course.

MODERATOR: Oh, I see.

MEMBER 3: I think that some students might have shied away because they thought it might have been more time-consuming than it actually was. So I think that—

MODERATOR: How long do you think that they spend per week?

MEMBER 3: In my view, I think that any participant could have gotten what they needed from this course easily within a two hour investment per week. What I was pleased with is that many of the students who participated, you know went on and did other research and brought that into the course as they were answering questions. I was very impressed with that.

MODERATOR: Okay, um…let me see, I'm just going to skip the questions I had for the instructor. What about the—the organization? I guess you…did you see the whole MOOC created at the end?

MEMBER 1: I believe that—I believe that, yes I did because we had to approve and make sure that everything was right.

MODERATOR: So how would you rate the design and the organization of the MOOC? Do you think it's clear for the students?

MEMBER 1: Yes. I think it's clear for the students. It provides them, just like a regular course, for everything that they need up to…you know well everything they need to learn for that week and uh, what they need for the test. So, it was good.

MEMBER 2: Yeah, I think it's pretty well-organized and easy for the instructor to follow. We try to break it by the outcomes and it can be organized by the modules into different topics and everything. So…um…from my perspective, I thought it was quite organized. But again, there's always room for improvement based on the feedback we can get from the instructor who taught it because he really went through that experience. But uh…I speak from an outsider—like being involved in the design. I think it was quite well designed and uh…for the—for the instructor, you know, to go through and he can understand what we are covering, you know what the address typicals we have the…. code…module outcomes and then we have, you know, the activities that talk about what's really covered in the module. So it provides a good map for them. You know, but I don't know but maybe somebody could, taking an online course for the first time, they could always do…confusion. So maybe if there is like…orientation or something that first time teachers can do…like we have an Excelsior course that they can do. They can do for the first time.

MODERATOR: Yeah, okay. Sounds good. So I guess…well, you already spoke about this but how would you rate the design and organization of the MOOC? I mean, it was easy for you to teach what you understood following the system, it was an easy way for you to teach?

MEMBER 3: Yeah. Yes, absolutely. I thought it was very simple, easy. It wasn't time-consuming on my end and I think that except for the lengthy narratives that I offered to each student. We certainly could have increased the population and the participation numbers with that sole instructor the course was easy to manage. I would have felt comfortable doubling, or even tripling, the size of the participant grouping without any issue just because it was so well organized. Whoever wrote this course did an excellent job.

MODERATOR: Yeah, we had four experts writing the course so each of them were experts in one of the topics or two of the topics. And then we put everything together so yeah, we had four or five people working on the content. Um so from the activities that we saw…well not the activities but the module notes, the self-checks, the videos—which one do you think was more effective with the students? And which ones could we maybe do a better job?

MEMBER 3: Yeah, it's hard for me to put them one against the other. I personally thought that when we got into the area of cyberattacks and identifying and detecting stuff, that was really well done and engaging. I think that the students really liked that. Additionally, the networks—the wireless security was very well done. Overall, I wouldn't pick any that were poorly done. I think they were all well done but those two or three were really stick out in my mind. I mean it's been a while since I did this one but the cyberattack one was exceptional.

MODERATOR: Yup. No, I agree. I also had to go back and check the activities and what did we do a long time ago. I'm curious if this MOOC gave you opportunities to directly interact with the students but you already said that you could do that…through emails and just communicating in the course.

MEMBER 3: I offered my phone as well but I didn't get any takers on that. But I extended that out further because I was concerned about losing our grouping but no one took me up on that one but they seemed appreciative.

MODERATOR: Okay. Okay, so I ask you about the activities and anything we could have designed better. Do you have any suggestions or any insight about that?

MEMBER 1: Well, I think that, one thing that I think that would be good is that maybe…weekly...or...yeah weekly survey with the students to say “you know what? This wasn’t clear for me. I would like this explained more.” You know, just to get the students’ feedback during that week. So that, you know, we could make changes that week at the—per week we could make changes because if we allow more than a week’s time then they’ll forget about it. And you won’t really get fresh feedback so I think that a weekly feedback would be nice.

MODERATOR: Yeah, I know…that’s a good suggestion. I—I kind of agree with you so yeah I—we could ask the students what their opinions were. What was working, what was not working? Then we can—we can act and change stuff for them for next module? Yeah. I agree that’s, that’s a good suggestion. Um so now, not--not thinking about the MOOC, the cybersecurity MOOC, but thinking about MOOCs in general, um what’s your opinion about the…MOOCs? Um…do you think they have value?

MEMBER 1: Yeah, I think they have value. Not everybody has their schedule where they can do things at a certain speed so the MOOCs are a good fit for those people. So that’s not the issue. So that uh I still believe that having a professional there that they can go back to because I mean when I teach some of the courses, students sometimes they have questions and they want to elaborate more on the question that’s provided is. They want more feedback and uh the professor could do that right away. Which is—

Moderator (interrupting): Right.

MEMBER 1: …which is, it helps them out a lot.

MODERATOR: So you think that the size of the class, having 3000, 4000 students, that could be something that is a challenge?

MEMBER 1: Yes, because I mean even if you have a facilitator, how does that facilitator answer, you know, any issue if any issue comes up…how can that one person---

MODERATOR: Right.

MEMBER 1: --answer to so, you know, to so many students?

MODERATOR: Yeah so the size could be a challenge and um, having—having the opportunity of asking questions and clarifying that could be something that could be challenging as well.

MEMBER 1: Yeah.

MODERATOR: Right? Okay. Okay so go ahead.

MEMBER 1: What I was saying about the MOOC, is uh I've seen this in other universities where they have courses called Fast Tracks which is like classes that are only taught on the weekend. What they do is that they cram everything into uh two days for like a month and boom, the class is done in like a month or two. And that's kind of how the MOOC works but it's so quick that either the student gets it or they don't get it, they just move on.

MODERATOR: Right, no…yeah, yeah. I think RPI had an executive MBA that they did on the weekends and it was pretty condensed. So you think that's more similar to the MOOC um style or what the MOOC offers? Like, information condensed?

MEMBER 1: Yes.

MODERATOR: Okay.

MEMBER 1: Definitely.

MODERATOR: So…yeah. Um…so my last question is about MOOCs in general. What are your thoughts about that? Are they like, a good tool to have? Are they helping students learn in general? Not just for this particular MOOC, but just in general—about MOOCs in general. What do you think about that?

MEMBER 2: Yeah, I think MOOCS are a good educational tool to reach a large group of people and also, maybe…It's very helpful in general for the STEM field. Um, specifically when you're trying to attract people because a lot of times people they don't get into one area of study because they are afraid they don't know what's covered and so they don't want to take the risk of testing and going through the whole process. But the MOOC provides the uh opportunity for someone to experience that area of knowledge for free. Um and to know it's like testing the waters and, you know, you can see if you really like this area. And that really provides like a gateway to them so I think specifically the STEM is good. Any other areas too, you know. It's beneficial for someone trying to know what—I think introductory courses are great. I think we should have more intro courses in other areas…um…for people. Um, so…

MODERATOR: Do you think if we go to higher levels maybe MOOC—MOOCs are not so…appropriate?

MEMBER 2: I—that's my thought because higher levels courses are for a lot of complex content and it may be that one on one in a smaller class size might help with addressing the challenges that come across. So maybe for higher level courses I would stay away from MOOCs until we have some sort of course advance user technology like maybe adaptive learning or something of that nature. Um, because when you have such number of people it creates—it's all too easy for people to get frustrated and turned off. You know, like from that subject area. So maybe intro and basic concepts would be great as MOOCs, you know, and maybe for the higher level maybe stay away and try to condense the class size and use other learning techniques that would help meet the challenge for the learners.

MODERATOR: Okay. Um so these were my questions do you have any questions for me?

MEMBER 1: Um, no but if you guys need help for anything else, please feel free to contact me and let me know, that's not an issue.

MODERATOR: Yeah, we had very good feedback from students about the content. Like the modules well, they well…um they were well designed…not very difficult but challenging at the same time. So, feedback was pretty good. So I guess—

MEMBER 2: Uh, not really actually.

MEMBER 1: Well, that's great then!

MODERATOR: Yeah, mm-hmm.

MEMBER 1: If the students felt that way then we did a good job.

MODERATOR: Yeah, we are running…we did run the MOOC twice and we are going to run it a third time. So, it's popular.

MEMBER 1: That's good!

MODERATOR: Yeah, yeah, it's good. Okay so well thank you for your time.

MEMBER 1: Oh well…no problem.

MODERATOR: I really appreciate it.

MEMBER 1: No problem.

MODERATOR: Thank you!

MEMBER 1: (inaudible)

MODERATOR: You too, bye.

E.- First and second rounds of codings for student interviews

Codes Round 1

Question	ID	Transcript	Code
1.Did you finish the MOOC? If not please let me know what happened, why did you not finish	1	Yes I did	---
	2	Yes	---
	3	No. My work hours got in the way with multiple schedule changing and I lost track of time for due times	Work issues
	4	Yes I finished the MOOC	Assert
	5	Yes, I finished the course because I was interested in it	Reasons to finish the MOOC
	6	Yes	Assert
	7	*No response*	---
	8	*No response*	---
	9	*Yes*	Assert
2.Did you experience a sense of community while taking the MOOC? Why, why not?	1	Yes, everybody contributing ideas was fun and helpful	Open communication
	2	Yes, I gained much experience with the course	Course content
	3	Yes	Assert
	4	Somehow but learners here do not interact very much	Sense of community
	5	At the time I was first starting I did have sense of community	Sense of community
	6	Yes, because the community was interested in information security.	Sense of community, course content
		And no, because I haven't really exchange a lot in the forum	Sense of community, Online discussion
	7	Sort of- I read other posts from people all over the world	Diversity
	8	Yes I experienced it	Assert
	9	No, I did not take the class for the community but for me	Future goals

Question	ID	Transcript	Code
3.What has been the role of discussion in your learning? Do you think discussion helped you to experience some learning community	1	Yes, because other persons shared their views on various discussions that gave a sense of issues and solutions going on around me,	Sense of community Online discussions
		like the areas that focus on how to put security measures in place to help alleviate cyber attacks	Course content
	2	Yes, I think they are fundamental for learning	Learning
	3	Making contributions	Interacting in the MOOC
		and I also appreciated the contribution of other learners	Sense of community
	4	*No response*	---
	5	*No response*	---
	6	They provided fresh insights into other perspectives. It helps you think outside the box	Innovative thinking
	7	Yes of course	Assert
	8	Yes, the discussion aspect is very good. Just like college on-line setting	f2f college Online discussion
	9	No really, no	Negation
4.Were you given enough opportunities to express your opinions and thoughts within the course? Please explain	1	Yes. There was	Assert
		or I did not experience restriction whatsoever. there was no slight indication of the same	Open communication issues
	2	Yes, but having done one per week was enough for me express my opinion and thoughts	Online discussions Suggestions
	3	Not really due to my hectic work schedule, that has prevented me during the time to adequately finish the MOOC	Work issues
	4	Yes, the forums were very useful to this.	Online discussions
		I had ways to express my opinions accordingly	Open communication
	5	Yes, all my doubts and opinions I could express satisfactorily	Open communication
	6	No response	---

Question	ID	Transcript	Code
	7	I suppose so.	Assert
	8	I haven't communicated enough,	Value judgment
		as I was involved in other time consuming projects at the same time	Work issues
	9	I only expressed myself once	Online discussions
5.How important was communication with other students or receiving their input?	1	Fantastic, I had no problem with that	Value judgment
	2	Information sharing with the students was something wonderful	Open communication
	3	It was good while I did attend the course	Work issues
	4	Very important, because it gave me an opportunity to look at the viewpoints of others in the industry, as well as other professionals	Diversity Real-life connection Sense of community
	5	Was interesting, I am looking to other points of view when possible, for covering a more large spectrum, or get new ideas, or just like you for analyzing how others think/act	Diversity Sense of community Innovative thinking
	6	In order to know the different thoughts on the subjects	Diversity Course content
	7	I liked the diversity offered by this online course. different experiences from across the globe enriched the learning	Diversity
	8	As I said a fresh insight is needed to understand some material so you can move out of your own perspective	Innovative thinking Course content
	9	[communication was] not very important to me	Value judgement
6.How and what did you learn during the MOOC	1	I learned about what contracts are and the problems they can impose when they branch out	Course content
	2	I've learn by studying the course materials,	Learning
		looking for more information elsewhere when a subject was interesting and not enough detailed.	SDL
		What I've learn, honestly it will be difficult to produce you a list	Value judgment
	3	Notions on security, of course. People concerns about them	Course content Sense of community

Question	ID	Transcript	Code
	4	I learned the importance cyber attacks prevention. Also, how to… they could happen, even in a secure environment. Some of the things to put in place so that cyber criminals and hackers could not get in	Course content
	5	The MOOC really opened my eyes to having knowledge of Cybersecurity	Value judgment Course content
	6	I learned through the articles and the handouts	Course materials
	7	So far I have completed two courses and I appreciate them.	Value judgment
	8	cybersecurity course enriched my earlier degree course in IT security	Purpose of taking course
	9	Learned safety issues for my servers, tips, and improvements I can apply in my work	Real-life connection Course content
		I like the online class	Value judgement
		But I am not big on discussions, everyone has an oppinion	Online discussions
7.How much did you learn on your own, versus from your instructor of through interactions with other students	1	I learned a lot from the instructor as well as other students	Sense of community
	2	During the course, not so much, maybe 1-2 hours/week in addition to course.	Learning time
		It happens that I have learn before the course about this subject	SDL
	3	Well, the materials provided were not voluminous yet so rich.	Course materials
		I appreciate the frequent input from the instructor from time to time	Instructor presence
	4	I made some researches on my own on the internet	SDL
	5	I took the course very serious	Goals
		and go through and read several times	Learning strategies
	6	*No response*	---
	7	I learned a lot from stopping and going through the material the next day instead of trying to rip through the material	SDL Course materials
	8	*No response*	---

Question	ID	Transcript	Code
	9	I read all the material and refresh myself	Learning strategies
8. What strategies did you use to learn independently during the MOOC if any?	1	I did documentation research on internet to help me cross-thinking	SDL-research
	2	I organized myself to study every day	SDL-organization
	3	For one, I made sure I had the hard copy of the material and accessed any link provide	Course materials SDL-organization
	4	I read and hear all videos or materials and took the tests	Course materials
	5	I read the books pertaining to the course	Course materials
	6	After my weekly assignment I would read everything over and over again	Course materials
	7	I read some articles on cybersecurity on the internet	SDL-research
	8	Mostly prevention against cyber crime	Course materials
	9	None	Negation
9. Did you set up goals for your learning? How did you monitor your progress?	1	My goal was to take the exam after the course but unfortunately I did not pass the first time	Goals
	2	In general speaking, yes, I do have a goal while learning information security. That is to complete my practical and theoretical knowledge about the subject with other notions which I have not had the chance to cover before, keep me informed and instructed about, enlarge my view to a general coverage of the subject and learn new things. In one course I don't have specifically any goal except those upper.	Goals
	3	No I tried to work when I had time-I work full time	Work issues
	4	Monitoring the progress inside a course can be done by evaluating a function of speed-easiness-good answers on quizzes, the degree of understanding the material, the degree of challenge as new questions are appearing.	SDL-monitor own progress
		But I think an evaluation of progress is hard to get outside of the real world, to measure progress one must face real threats/attacks	Connection with real-life
	5	I made sure or it was my goal to finish going through the materials at most in the	Goals

Question	ID	Transcript	Code
		first three days of every week	
		and then engage in discussion whenever situations allowed	Online discussion
	6	Yes, I monitored my progress based on all of the things that I learned. Also,	SDL- monitor own progress
		I tested what I learned on the quizzes	Connection with real-life
	7	Established to study 1 hour per	SDL-organization
	8	Through the grades that I reached	SDL- monitor own progress
	9	Did not have a scope but follow the material to make these tests	Organization
10.Did you experience any challenges? Please explain	1	Yes, I wanted to have as much knowledge as possible	Goal
	2	During some of the quizzes.	Course materials
	3	Work schedule was the biggest challenge	Work issues
	4	Yes, mainly on the more technical subjects.	Course content
	5	My challenges was at the exam (Introduction to cybersecurity), some of the questions during the exam I did not study in the MOOC course.	Course content Course design
	6	It was interesting trying to figure out how the courts would rule.	Course content
	7	Yes, sort of. As I am not a native English speaker I've had to turn around sometimes some questions, where the text it was not clear for me	Language barrier
	8	Not really	---
	9	I had to study	Learning strategies
11.Do you want to add anything else?	1	I really enjoyed the course and I learned a lot from the instructor and the students.	Social presence Instructor presence
		I would love to take another course.	Future goals
	2	No, thank you.	---
	3	I wonder if I can get certified course via email	Goal
	4	For those of us who want to take the exam after the course should be given hits what to	Course content Course design

Question	ID	Transcript	Code
		expect or if we can expand our reading beyond MOOC.	
	5	Thank you for the course, again, and also, don't hesitate to make other courses on this subject, some more specialized.	Recommendations
	6	I do not understand exactly what the question is asking	Language barrier
	7	*No response*	---
	8	*No response*	---
	9	*No response*	---

Codes Round 2

Question	ID	Transcript	Code
1.Did you finish the MOOC? If not please let me know what happened, why did you not finish	1	Yes I did	---
	2	Yes	---
	3	No. My work hours got in the way with multiple schedule changing and I lost track of time for due times	Work issues
	4	Yes I finished the MOOC	Assert
	5	Yes, I finished the course because I was interested in it	Reasons to finish the MOOC
	6	Yes	Assert
	7	*No response*	---
	8	*No response*	---
	9	Yes	Assert
2.Did you experience a sense of community while taking the MOOC? Why, why not?	1	Yes, everybody contributing ideas was fun and helpful	Open communication
	2	Yes, I gained much experience with the course	Course content

Question	ID	Transcript	Code
	3	Yes	Assert
	4	Somehow but learners here do not interact very much	Communication
	5	At the time I was first starting I did have sense of community	Sense of community
	6	Yes, because the community was interested in information security.	~~Sense of community~~ Course content
		And no, because I haven't really exchange a lot in the forum	Communication
	7	Sort of- I read other posts from people all over the world	Diversity
	8	Yes I experienced it	Assert
	9	No I did not take the class for the community but for me	Future goals
3.What has been the role of discussion in your learning? Do you think discussion helped you to experience some learning community	1	Yes, because other persons shared their views on various discussions	~~Sense of community~~ Diversity Online discussions
		that gave a sense of issues and solutions going on around me,	Course content
		like the areas that focus on how to put security measures in place to help alleviate cyber attacks	Course content
	2	Yes, I think they [discussions] are fundamental for learning	Online discussions
	3	Making contributions and I also appreciated the contribution of other learners	Interacting in the MOOC
	4	*No response*	---
	5	*No response*	---
	6	They provided fresh insights into other perspectives.	Diversity
		It helps you think outside the box	Innovative thinking
	7	Yes of course	Assert
	8	Yes, the discussion aspect is very good.	Online discussion
		Just like college in on-line setting	Value judgment

Question	ID	Transcript	Code
	9	No really no	Negation
4.Were you given enough opportunities to express your opinions and thoughts within the course? Please explain	1	Yes. There was	Assert
		or I did not experience restriction whatsoever. there was no slight indication of the same	Open communication ~~issues~~
	2	Yes, but having done one per week was enough for me express my opinion and thoughts	Assert ~~Online discussions~~ Content Suggestions
	3	Not really due to my hectic work schedule, that has prevented me during the time to adequately finish the MOOC	Work issues
	4	Yes, the forums were very useful to this.	Online discussions
		I had ways to express my opinions accordingly	Open communication
	5	Yes, all my doubts and opinions I could express satisfactorily	Open communication
	6	No response	---
	7	I suppose so.	~~Assert~~ Value judgment
	8	I haven't communicated enough,	Value judgment
		as I was involved in other time consuming projects at the same time	Work issues
	9	I only expressed myself once	Online discussions
5.How important was communication with other students or receiving their input?	1	Fantastic, I had no problem with that	Value judgment
	2	Information sharing with the students was something wonderful	Open communication
	3	It was good while I did attend the course	~~Work~~ Time issues
	4	Very important, because it gave me an opportunity to look at the viewpoints of others in the industry, as well as other professionals	Diversity Real-life connection ~~Sense of community~~
	5	Was interesting,	Value judgment
		I am looking to other points of view when possible,	Learning strategies
		for covering a more large spectrum, or get	Diversity

Question	ID	Transcript	Code
		new ideas,	~~Sense of community~~
		or just like you for analyzing how others think/act	Innovative thinking
	6	In order to know the different thoughts on the subjects	Diversity Course content
	7	I liked the diversity offered by this online course. different experiences from across the globe enriched the learning	Diversity
	8	As I said a fresh insight is needed to understand some material so you can move out of your own perspective	Innovative thinking Course content
	9	[communicate was] not very important to me	Value judgement
6.How and what did you learn during the MOOC	1	I learned about what contracts are and the problems they can impose when they branch out	Course content
	2	I've learn by studying the course materials,	Learning strategies
		looking for more information elsewhere when a subject was interesting and not enough detailed.	SDL
		What I've learn, honestly it will be difficult to produce you a list	Value judgment
	3	Notions on security, of course. People concerns about them	Course content ~~Sense of community~~
	4	I learned the importance cyber attacks prevention. Also, how to… they could happen, even in a secure environment. Some of the things to put in place so that cyber criminals and hackers could not get in	Course content
	5	The MOOC really opened my eyes to having knowledge of Cybersecurity	Value judgment Course content
	6	I learned through the articles and the handouts	~~Course materials~~ Learning strategies
	7	So far I have completed two courses and I appreciate them.	Value judgment
	8	cybersecurity course enriched my earlier degree course in IT security	~~Purpose of taking course~~ Value judgment
	9	Learned safety issues for my servers, tips, and improvements I can apply in my work	Real-life connection Course content

Question	ID	Transcript	Code
		I like the online class	Value judgement
		But I am not big on discussions, everyone has an oppinion	Online discussions
7.How much did you learn on your own, versus from your instructor of through interactions with other students	1	I learned a lot from the instructor as well as other students	~~Sense of community~~ Instructor Interactions Students Interactions
	2	During the course, not so much, maybe 1-2 hours/week in addition to course.	Learning time
		It happens that I have learn before the course about this subject	SDL
	3	Well, the materials provided were not voluminous yet so rich.	Course materials
		I appreciate the frequent input from the instructor from time to time	Instructor ~~presence~~ Interactions
	4	I made some researches on my own on the internet	SDL
	5	I took the course very serious	~~Goals~~ Value judgment
		and go through and read several times	Learning Strategies
	6	*No response*	---
	7	I learned a lot from stopping and going through the material the next day instead of trying to rip through the material	SDL Course materials
	8	*No response*	---
	9	I read all the material and refresh myself	Learning strategies
8. What strategies did you use to learn independently during the MOOC if any?	1	I did documentation research on internet to help me cross-thinking	SDL-research
	2	I organized myself to study every day	SDL-organization
	3	For one, I made sure I had the hard copy of the material and accessed any link provide	Course materials SDL-organization
	4	I read and hear all videos or materials and took the tests	Course materials
	5	I read the books pertaining to the course	Course materials
	6	After my weekly assignment I would read everything over and over again	Course materials

Question	ID	Transcript	Code
	7	I read some articles on cybersecurity on the internet	SDL-research
	8	Mostly prevention against cyber crime	Course materials
	9	None	---
9. Did you set up goals for your learning? How did you monitor your progress?	1	My goal was to take the exam after the course but unfortunately I did not pass the first time	Learning goals
	2	In general speaking, yes, I do have a goal while learning information security. That is to complete my practical and theoretical knowledge about the subject with other notions which I have not had the chance to cover before,	Learning goals
		keep me informed and instructed about, enlarge my view to a general coverage of the subject and learn new things.	SDL Course content
		In one course I don't have specifically any goal except those upper.	Value judgment
	3	No I tried to work when I had time-I work full time	Work issues
	4	Monitoring the progress inside a course can be done by evaluating a function of speed-easiness-good answers on quizzes, the degree of understanding the material, the degree of challenge as new questions are appearing.	SDL-monitor own progress
		But I think an evaluation of progress is hard to get outside of the real world, to measure progress one must face real threats/attacks	Connection with real-life
	5	I made sure or it was my goal to finish going through the materials at most in the first three days of every week	Learning goals
		and then engage in discussion whenever situations allowed	Online discussion
	6	Yes, I monitored my progress based on all of the things that I learned. Also,	SDL- monitor own progress
		I tested what I learned on the quizzes	Connection with real-life
	7	Established to study 1 hour per	SDL-organization
	8	Through the grades that I reached	SDL- monitor own progress

Question	ID	Transcript	Code
	9	Did not have the scope but followed the materials to make these tests	Organization
10.Did you experience any challenges? Please explain	1	Yes, I wanted to have as much knowledge as possible	Learning goal
	2	During some of the quizzes.	Course materials
	3	Work schedule was the biggest challenge	Work issues
	4	Yes, mainly on the more technical subjects.	Course content
	5	My challenges was at the exam (Introduction to cybersecurity), some of the questions during the exam I did not study in the MOOC course.	Course content Course design
	6	It was interesting trying to figure out how the courts would rule.	Value judgment Course content
	7	Yes, sort of. As I am not a native English speaker I've had to turn around sometimes some questions, where the text it was not clear for me	Language barrier
	8	Not really	---
	9	I had to study	Learning strategies
11.Do you want to add anything else?	1	I really enjoyed the course	~~Social presence~~ Value judgment
		and I learned a lot from the instructor and the students.	Instructor ~~presence~~ Interaction
	2	I would love to take another course.	Future goals Value judgment
	3	No, thank you.	---
	4	I wonder if I can get certified course via email	Future goal Value judgment
		For those of us who want to take the exam after the course should be given hits what to expect or if we can expand our reading beyond MOOC.	Course content Course design
	5	Thank you for the course, again,	Value judgment
		and also, don't hesitate to make other courses on this subject, some more specialized.	Recommendations
	6	I do not understand exactly what the question is asking	Language barrier

Question	ID	Transcript	Code
	7	*No response*	---
	8	*No response*	-----
	9	*No response*	-------

F.- Excelsior's IRB

EXCELSIOR COLLEGE

7 Columbia Circle
Albany, NY 12203-5159
Lisa K. Daniels, PhD
Institutional Review Board
Voice: (518) 608-8398
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TO: Teresa Ferrer
FROM: Lisa K. Daniels, PhD, IRB Chairperson
DATE: February 4, 2015
SUBJECT: Human Subjects Review of Proposal No. 2013-06
Entitled: *Self-Directed-Learning and MOOC's: Excelsior College case study*

After reviewing your resubmission to continue the above-referenced proposal, along with the proper documentation of the changes that will apply, the Excelsior College Institutional Review Board has approved this continuation.

As stated on your first review approval, it is incumbent upon you to secure the prior approval of the Institutional Review Board for any changes in your proposed procedures that will affect your use of human subjects. You must also report to the Board any problems that arise in connection with your use of human subjects in this activity.

Your continuation approval for this research extends for 1 year from the date of this memo. Formal re-approval is required if the research extends beyond February 4, 2016.

Please feel free to seek the advice of the Board at any time.

Sincerely,

Lisa K. Daniels, PhD
Chairperson, Institutional Review Board
Excelsior College