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Doctoral Thesis:

Supporting teachers in the design and implementation of Group Formation Policies to carry out Group Learning Activities in massive and variable scale on-line learning contexts

Presented by María Luisa Sanz Martínez for the
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Directed by:
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PROGRAMA DE DOCTORADO EN INFORMÁTICA

TESIS DOCTORAL:

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Presentada por María Luisa Sanz Martínez para optar
al grado de
Doctor/a por la Universidad de Valladolid

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Abstract

MOOCs (Massive Open Online Courses), labeled as a new disruptive paradigm in the educational environment, are criticized by a large sector of the educational community due to their high dropout rates and low instructional quality. The inclusion of active pedagogies, such as collaborative learning, in this type of courses could improve their instructional quality, as well as increase student motivation and engagement. However, the massive scale and its variations during the course make it difficult to introduce such pedagogies and especially to form and maintain student work groups. Supporting teachers in group management tasks could facilitate the adoption of collaborative pedagogical designs. To address this goal and to be able to carry out the development of tools to support teachers, a broad and deep knowledge of the context and the problem to be addressed, as well as a holistic view of it, is desirable. For this reason, this thesis proposes, as a general objective, to support teachers interested in introducing group activities in this type of courses, both in the design of grouping policies appropriate for each situation, and in the implementation of such policies within the chosen educational platform. To that aim, a conceptual framework is created to categorize the relevant factors to be taken into account to form student groups or teams in the MOOC educational context, as well as the main characteristics of this context that can influence such teams. Based on this framework, design guides are developed with recommendations and guidelines that help teachers to design their own grouping policies, as well as supporting software tools that allow the implementation of such grouping policies in different educational platforms. Through three studies in real MOOCs and other research techniques such as literature review and expert opinions, grouping proposals based on learning analytics and student dynamics monitored during the course have been explored. In addition, a model has been generated for the creation of design guides, and an architecture for the development of software tools independent of the chosen educational platform, which serve to implement the designed groupings. Based on these models, proofs of concept have been created to test their viability and usefulness.

Resumen

Los MOOC (Massive Open Online Courses, Cursos Abiertos Masivos en Línea), etiquetados como nuevo paradigma disruptivo en el entorno educativo, son criticados por un amplio sector de la comunidad educativa debido a sus altas tasas de abandono y a su baja calidad instruccional. La inclusión de pedagogías activas, tales como el aprendizaje colaborativo, en este tipo de cursos podría mejorar su calidad instruccional, además de aumentar la motivación e implicación de los alumnos. Sin embargo, la escala masiva y sus variaciones durante el curso, dificulta la introducción de dichas pedagogías y en especial la formación y mantenimiento de grupos de trabajo de alumnos. El apoyo a los profesores en las tareas de gestión de estos grupos, podría facilitar la adopción de diseños pedagógicos colaborativos. Para abordar esta meta y poder llevar a cabo el desarrollo de herramientas de apoyo a los profesores, es conveniente un conocimiento amplio y profundo del contexto y del problema a acometer, así como una visión holística del mismo. Por este motivo, este tesis propone como objetivo general, el dar apoyo a los profesores interesados en introducir actividades realizadas en grupo en este tipo de cursos, tanto en el diseño de las políticas de agrupación adecuadas para cada situación, como en la implementación de dichas políticas dentro de la plataforma educativa elegida. Para ello, se crea un marco conceptual que permita categorizar los factores relevantes a tener en cuenta para formar grupos de alumnos o equipos, en el contexto educativo MOOC, así como las principales características de este contexto que pueden influir en dichas agrupaciones. Tomando como base dicho marco, se desarrollan guías de diseño con recomendaciones y directrices que ayudan a los profesores a diseñar sus propias políticas de agrupación, así como herramientas informáticas de apoyo, que permitan implementar dichas políticas de agrupación en las diferentes plataformas educativas. A través de tres estudios en MOOCs reales y otras técnicas de investigación, tales como revisión de literatura y opinión de expertos, se han explorado propuestas de agrupación basadas en las analíticas de aprendizaje y las dinámicas de los alumnos monitorizadas durante el curso. Además, se ha generado un modelo para la creación de guías de diseño, y una arquitectura para el desarrollo de herramientas informáticas, independientes de la plataforma educativa elegida, que sirvan para implementar las agrupaciones diseñadas. Tomando como base estos modelos, se han creado pruebas de concepto que han permitido comprobar su viabilidad y su utilidad.

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Chapter 1

Introduction

Summary: This introductory chapter describes the motivation and originality of our dissertation, its general research context, its main and partial objectives and the methodology followed to achieve such objectives. The dissertation tackles the challenge of dealing with small students' groups in MOOC scenarios. Specifically, we aim to provide support to those teachers interested in managing students' groups to carry out the Group Learning Activities (GLA) needed to put into practice active pedagogies such as Collaborative Learning (CL) or Project Based Learning (PBL), thus improving the pedagogical quality of MOOCs. Due to the fact that this dissertation was framed within the Technology Enhanced Learning (TEL) domain, we decided to select a methodology specialized in information system research, the Design Systems Research Methodology (DSRM), but supplementing it with the educational perspective provided by the Design Based Research (DBR) approach. Throughout our research process, we undertake a literature review, three studies in real MOOC scenarios and two rounds of gathering experts' opinions. The iterative nature of our research model, which started with exploratory cycles and evolved towards increasingly more evaluative iterations, allowed us to formulate and validate three contributions aimed at attaining the objectives of the dissertation.

1.1 Motivation

The emergence and popularity of MOOCs (Massive Open On-line Courses) have fostered many discussions in the educational technology community regarding, among others, their low instructional quality and their high dropout rates [38]. Most MOOCs currently follow a behaviorist pedagogical approach where the instructors add the educational content to the course stream and the students self-assess their learning with questionnaires [29], limiting the interaction between participants and instructors to discussion forums. Active learning and peer interaction can promote students' engagement [57], and collaboration can enrich learning through the achievement of social and cognitive competences [118]. Therefore, many authors are trying to include active pedagogies such as Collaborative Learning (CL) in MOOCs, identifying important research challenges related to the promotion of social interactions that generate knowledge [86] or to the development of new pedagogical approaches which take advantage of the benefits of large scale [132]. These authors have explored the benefits of using active pedagogies in this type of courses, claiming that these pedagogies have a positive influence in various facets such as student engagement [42] or performance [3]. Some studies have focused on the students' preferences [51], finding that learners demand more opportunities for discussion in groups. Nevertheless, the inclusion of effective collaboration in MOOCs is still a challenge [84], [46] due to the specific characteristics of the MOOC context. The massive scale and its variability, caused by latecomers and dropouts, the heterogeneity of the enrolled students, their different learning paces and their irregular engagement level [14] all hinder the adoption and effective use of CL strategies in MOOCs.

Several studies on CL have shown that group formation is a crucial factor when teachers design and put into practice collaborative learning activities in small groups [97], [103] because successful collaboration

depends, to a large extent, on the suitability of the peers included in the group [78], [63]. There exist three approaches that can be used to create groups in educational contexts [103]: (i) random selection of groups, (ii) self-selection of groups and (iii) teacher selected groups, also known as criteria-based grouping. Criteria-based group formation has been largely explored in small-scale educational environments [97], [105], [62], [63], employing different types of criteria (*e.g.*, student's profile, student's learning style). However, MOOCs have particular characteristics, such as their massive and variable scale or the variations of the engagement levels and learning paces of the students, which hamper a direct extrapolation of conclusions derived in small-scale studies.

Due to the interest for including CL in MOOCs, several authors have tackled the group formation problem in these contexts [135], [137], [159], [147] with different and fragmentary perspectives. These perspectives include a variety of criteria (*e.g.*, knowledge, personality, preferences, affinities, location, motivation), grouping approaches (e.g., criteria-based homogeneity or heterogeneity, random grouping) and technological aspects (*e.g.*, social network metrics, natural language processing, classification algorithms), which suggests there are a variety of factors that can be considered [123] for group creation in MOOC contexts.

Currently, only a few platforms offer facilities to create groups for collaborative activities (*e.g.*, Canvas, NovoEd, edX). The grouping facilities offered by these MOOC platforms include features for: (i) self-selection of teams by students, (ii) manual allocation of the members of each group by the teacher -which does not scale well with the number of students of these courses-, and (iii) splitting the students into random teams. Nevertheless, the criteria-based approach for grouping which, as discussed above, is the preferred method in small-scale contexts due to its pedagogic capabilities, is not covered by MOOC platforms at the moment.

Due to the particular difficulties of configuring groups in MOOC contexts, we decided to address this question by investigating the issues involved in the management of groups on a massive and variable scale. To that aim, we deemed it necessary to acquire a holistic view of the problem by studying the relevant aspects that can be taken into account for group management in MOOC contexts. Because of the aforementioned MOOC peculiarities (*e.g.*, irregular engagement level and different learning paces of the students), group management problems are expected to occur in MOOCs even if such groups were formed using sound criteria. Thus, a method for dynamic group management (initial formation and eventual restructuring) might contribute to the solution of the aforementioned problems. Our research goal is focused on providing support to teachers interested in introducing collaborative activities performed in groups in MOOCs. This support will focus on two stages of the course life-cycle: (i) the design phase, by giving advice to teachers on how to structure groups to carry out collaborative activities, and (ii) the enactment phase, by supporting the orchestration of group activities by means of tools which facilitate the creation, monitoring and even restructuring of the groups.

1.2 Dissertation Goals

Once the motivation and research context have been explained, we can state the main goal of this dissertation by solving the following research question:

- *How can teachers be supported in the design and implementation of Group Formation Policies to carry out GLA (Group Learning Activities) in massive and variable scale on-line learning contexts?*

From the pedagogical point of view and due to the wide range of active pedagogies that use groups of students and the high variety of existing types of groups, we have focused this dissertation on small groups intended for collaboration. Thus, we particularized our three studies in real MOOC scenarios to implement collaborative activities carried out in teams (a name frequently used to designate small groups of persons with a common objective).

In order to attain the aforementioned main goal, we propose to define and accomplish three partial and specific objectives summarized below, and depicted in Figure 1.1:

1. **OBJ_CLA: To identify and classify the aspects and dimensions to consider in the design and management of grouping policies in massive and variable scale courses.**

   In our approach, we look for a holistic perspective which would provide us with a global view of the variety of difficulties regarding the orchestration of group activities. Furthermore, we want to focus on the aspects related to the dynamics of the course activity, because they can reflect some specific contextual features which distinguish MOOCs from other contexts (*e.g.*, the irregular level of engagement of the students, their variable learning paces, or their high dropout rate). These dynamic data, based on the course activity performed by the students, may be interesting criteria to consider in the group management.

   This objective includes the creation of a conceptual and technological framework to describe the problem context and its scope. It includes tasks for the identification of the main aspects that must be taken into account when considering the management of groups in MOOCs, as well as the relationships between them in order to create a classification or taxonomy constituting a solid base to build the remaining objectives. The OBJ_CLA objective also includes the task of carrying out a review of the state of the art, although this task is carried out continuously throughout the dissertation.

2. **OBJ_DES: To support teachers in the DESIGN of grouping strategies in MOOCs to introduce GLA in these courses.**

   This objective aims to establish design principles and guidelines for teachers in order to facilitate the management of student groups needed to carry out GLA, such as those implementing collaborative learning in massive and variable scale courses. These guides will serve as support and reference for teachers who consider creating MOOCs that incorporate collaborative learning strategies. By illustrating various possibilities and aspects to consider, recommendations, tutorials and examples, it is intended to facilitate the creation of the course learning design conceived by the teacher. In this way, teachers who want to implement collaborative learning strategies in MOOCs will have support to face this problem. This will help MOOC teachers to put into practice innovative collaborative learning approaches for which they did not have support until now, the instructional quality of this type of course may improve and the community of students who take MOOC courses will benefit.

   This objective includes tasks related to the definition and refinement of guides that allow designers to take advantage of our framework to make decisions.

3. **OBJ_IMP: To provide technological support to IMPLEMENT the designed grouping strategy on the learning platform and to manage (creation, monitoring, restructuring) student groups in massive and variable scale contexts.**

   As a complement to the guidelines and design principles, it is expected that these tools will allow the implementation of MOOCs in which the teachers could manage student groups formed with sound pedagogical criteria, thus enabling the inclusion of collaborative group activities in their learning design. They will offer functionalities that permit the automatic or semi-automatic formation of the groups, allowing the teacher to apply different strategies, criteria and grouping restrictions. They will be able to monitor the activity carried out by students, both individually and within the group, so that they can locate dysfunctions (produced for example by the lack of participation of certain students) and propose mechanisms for the dynamic restructuring of the affected groups.

   This objective involves activities related to the design and implementation of group management support tools and it will be tackled by means of the following main subtasks:

   - The identification and refinement of requirements. The generation of successive versions of the requirements and use scenarios.
   - The design and implementation of modules aimed at processing dynamic aspects of support for group management. The generation of successive versions of the support modules for the dynamic aspects of group management.

- The design and implementation of modules to make the tools, as far as possible, independent of the learning platform. The generation of successive versions of the modules to support the independent definition of static aspects of group management.
- The definition of the integration architecture in MOOC platforms and the generation of successive versions of the integration architecture of the tool proposed in MOOC platforms.

Therefore, given the aforementioned partial objectives and following the methodology explained in Section 1.3, we expect to contribute to the solution of the group management problem in MOOCs by generating three artifacts: (i) a conceptual and technological framework, oriented towards setting the basis for the other two artifacts, and which could be helpful for other researchers who want to tackle this problem; (ii) a set of design guidelines, which can help teachers in the design phase of the courses; and (iii) a computational system, in order to support teachers in the management of the groups during the enactment phase of the course. It should be noticed that, as a consequence of our research process model, these three artifacts must be evaluated to become contributions of the dissertation.

It is also worth noting that, due to the nature of the methodological approach chosen in this dissertation (*i.e.*, a DSR methodology, commonly used in Information Systems research supplemented by a DBR to incorporate an educational perspective), both the main and the partial objectives emerged and evolved throughout the research process itself, although we present their latest versions in this chapter for the sake of clarity.

In summary, Figure 1.1 depicts a general overview of the context that motivated our research question, the general and partial objectives we wanted to accomplish, the expected contributions of our research work and the techniques we planned to carry out in order to explore the problem and to validate the contributions, while acquiring a deeper understanding of the problem.

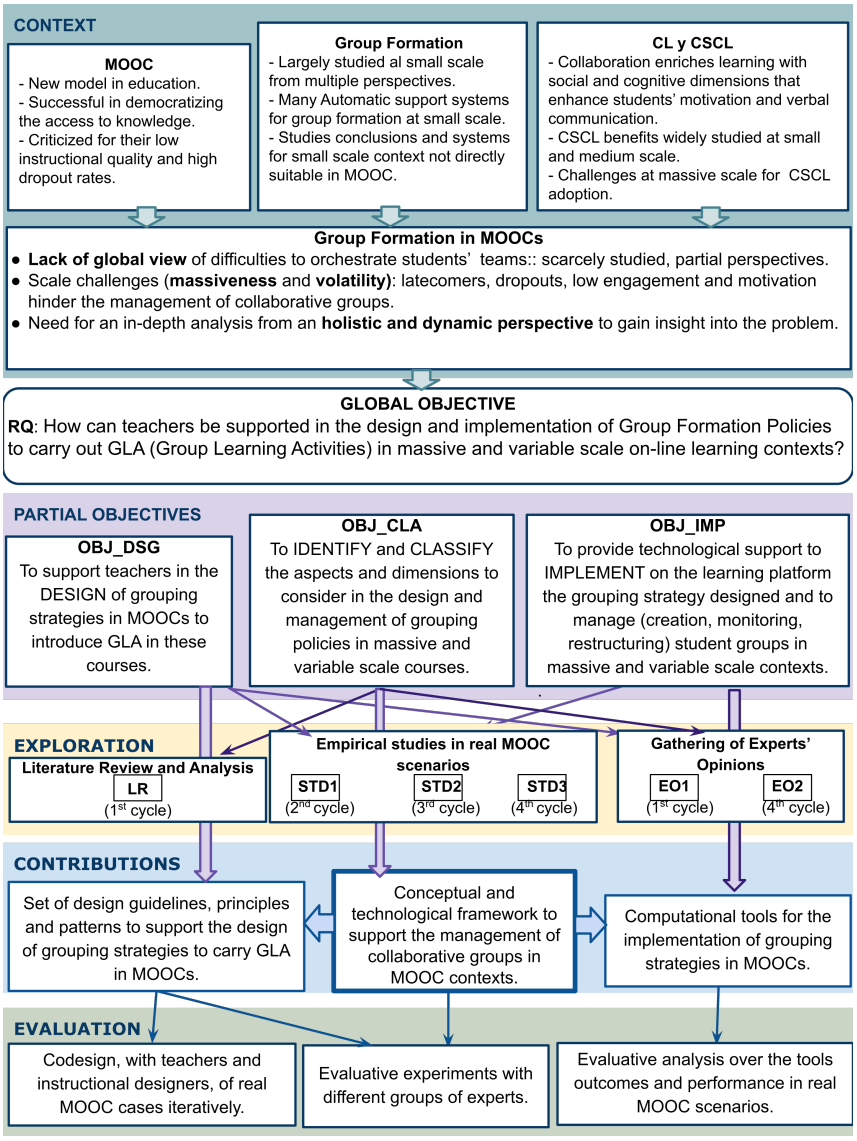


Figure 1.1: General overview of the context, goal, objectives, contributions and evaluation of the thesis.

1.3 Methodology

This section presents an overview of the methodological process used to carry out this thesis. Remember that the overall goal of the thesis is to provide help to MOOC teachers to design and implement group formation policies in order to facilitate the application of GLA such as those in collaborative learning strategies or other kind of active pedagogies. Such a global goal and the objectives derived from it are framed within the multidisciplinary field of TEL (Technology Enhanced Learning). It is also worth noting that the social nature of the problem to be tackled will, to a great extent, condition the methodological and philosophical approach to face it.

The selection of an adequate research methodology is essential to successfully accomplish the objectives of any research project. The selection of a research methodology is usually guided by the research discipline, including the research questions and objectives, and the psychological underpinnings of the

Table 1.1 Four Worldviews

Postpositivism	Constructivism
• Determination • Reductionism • Empirical observation and measurement • Theory verification	• Understanding • Multiple participant meanings • Social and historical construction • Theory generation
Transformative	**Pragmatism**
• Political • Power and justice oriented • Collaborative • Change-oriented	• Consequences of actions • Problem-centered • Pluralistic • Real-world practice oriented

Figure 1.2: The four world-views described by Creswell [28]

researcher [45].

According to Mertens [93], one of the first steps in planning and conducting a research study is to identify the researcher's philosophical world-view (to which other authors such as Kuhn in 1962 referred to as a paradigm [79]). This world-view is a consequence of his or her assumptions: (i) ontological (conception of reality), (ii) epistemological (nature of knowledge), (iii) axiological (ethical principles that will guide the research) and (iv) methodological (the systematic approach used to conduct the inquiry). Mertens [93] and Creswell [28] proposed four world-views widely discussed in the literature: post-positivist, constructivist, transformative world-view, and pragmatic world-view. Figure 1.2 shows the main characteristics of each of these world-views according to Creswell; while Figure 1.3 depicts the relation between the researcher's world-view and the designs and research methods he or she chooses.

The author of this report has been formed in engineering and this fact could have led to a post-positivist world-view, understanding the world as described by laws that control the phenomena which are objective and independent of the researcher who observes or measures such phenomena. However, her expertise of more than twenty years as a teacher also forced her to acquire a constructivist interpretation of the world more in line with the social sciences. As a result of this mixing, and with the premise that, in the end, the important question is the results, the author of this thesis realized that pragmatism was currently what best fits her way of seeing the world: focused on the problem, choosing the methods that best fit at each moment to solve a particular problem, while avoiding metaphysical concepts about whether reality exists by itself or whether it is a social product, but rather by combining both and considering reality as that which works at each moment [28], [93].

In terms of the research methods and designs, the mixed methods is a methodological approach focused on making things work, and using the most appropriate techniques to verify it instead of conditioning them to methodological assumptions (that is the reason why some authors consider it to be part of the pragmatic philosophy [65]). The mixed methods approach proposes the use of qualitative and quantitative techniques in the same study to allow a better understanding of the phenomenon analyzed, as well as more robust results, since the triangulation of the data obtained can be performed [65], [28]. According to Greene [50] and Cook, [26] a "better understanding" means a more comprehensive (deeper, wider) understanding, more defensible and stronger, more insightful and also with greater value consciousness and greater diversity of values. Thus, in order to attain such a better understanding, the following

Figure 1.1 A Framework for Research—The Interconnection of Worldviews, Design, and Research Methods

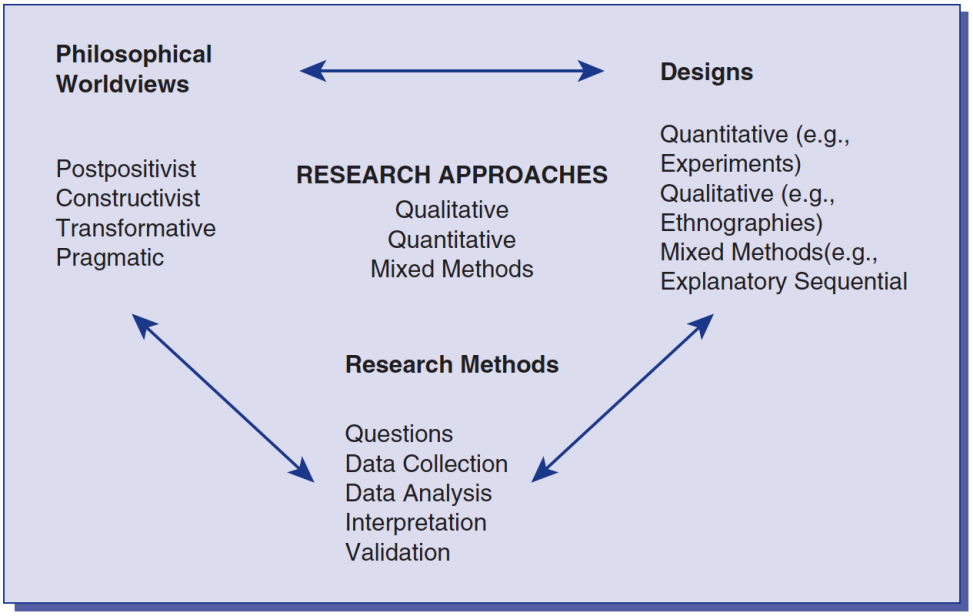


Figure 1.3: The interconnection of Word-view, Design and Research Methods according to Creswell [28]

Table 1.1 Labels Commonly Associated With Different Paradigms

Postpositivism	*Constructivist*	*Transformative*	*Pragmatic*
Experimental	Naturalistic	Critical theory	Mixed methods
Quasi-experimental	Phenomenological	Neo-Marxist	Mixed models
Correlational	Hermeneutic	Feminist theories	Participatory
Causal comparative	Symbolic interaction	Critical race theory	
Quantitative	Ethnographic	Freirean	
Randomized control trials	Qualitative	Participatory	
	Participatory action research	Emancipatory	
		Postcolonial/indigenous	
		Queer theory	
		Disability theories	
		Action research	

SOURCE: Adapted from Lather (1992) and Guba and Lincoln (1989, 2005).

Figure 1.4: Paradigms and methods commonly associated to each world-view, according to Mertens [93]

strategies can be used:

- Complementarity is the use of different methods to assess overlapping phenomena or multiple facets

of the same phenomenon, whereby the results from one method are used to enhance, augment, clarify the results of the other, toward a more comprehensive understanding.

- Development is the sequential use of different methods to assess the same phenomenon, where the results of the first method are used to inform the development of the second.
- Expansion is the use of different methods to assess different phenomena in order to expand the breadth and scope of a study, again toward a more comprehensive understanding.
- Triangulation is the use of different methods to generate findings that (hopefully) converge in their assessment of the same phenomenon, toward the increased validity and defensibility of inquiry inferences.
- Initiation seeks the discovery of paradox and contradiction, new perspectives or frameworks, the recasting of questions or results from one method with questions or results from the other method, both measuring the same construct (phenomenon).

Thus, we have taken on this research problem from a pragmatic philosophical world-view using the mixed methods inquiry approach and implementing the two strategies we deemed that best fitted our research problem: (i) complementarity, in order to gain a deeper understanding, and (ii) triangulation, which allowed us to strengthen our findings. This pragmatic and mixed methods approach impregnated the actions we have carried out within our methodological process.

Having presented our vision and approach to research, it was then necessary to identify a research method to guide the steps to be followed. The methodology selected in the first instance was DSRM (Design Science Research Methodology) using the process model proposed by Peffers [107]. This process iterates over six phases, as shown in Figure 1.5: (i) problem identification and motivation, (ii) definition of a research goal (iii) design and development, (iv) demonstration, (v) evaluation and (vi) communication. This methodology is used in information systems research and is aimed at developing different types of artifacts in order to solve human problems.

Thus, the main reasons to select DSRM as our primary methodology were the following:

- It is aimed at information systems research using the principles of DS (Design Science) that attempts to create "things" that serve human purposes [107].
- DS is aimed at creating and evaluating artifacts that solve problems [56], such as constructs, models, methods, instantiations, social innovations; in short, any designed object that includes a solution to a research problem. This is consistent with our goal of generating a conceptual framework and subsequently other types of tools, such as support guides, design patterns, or computational tools.
- It includes a rigorous process for designing artifacts that solve problems and make scientific contributions, evaluating the designs, and communicating the results to appropriate audiences [56].
- Its evolutionary nature, in which the experience and knowledge gained in each iteration will help us refine the problem and find new research questions and proposals, allows us to advance the goal of finding different ways to help MOOC teachers create and manage student groups.

We use quantitative and qualitative methods in the design, demonstration and evaluation phases in order to gain a deeper understanding by means of complementarity. As explained above, this mixed-methods approach was a consequence of our underpinning pragmatic world-view, centered on the problem and oriented towards real world practice [28].

Conversely, as explained above, the work presented in this dissertation is framed within the multidisciplinary Technology Enhanced Learning (TEL) research area, involving both, educational and technological issues, and strongly connected with the CSCL paradigm. This multidisciplinary nature of TEL and CSCL implies a need for mutual understanding among the involved stakeholders, demanding active participation of all these stakeholders during the whole development cycle of the CSCL solutions [138]. Hence, since teachers are our target users, we decided to involve them from the very beginning in the

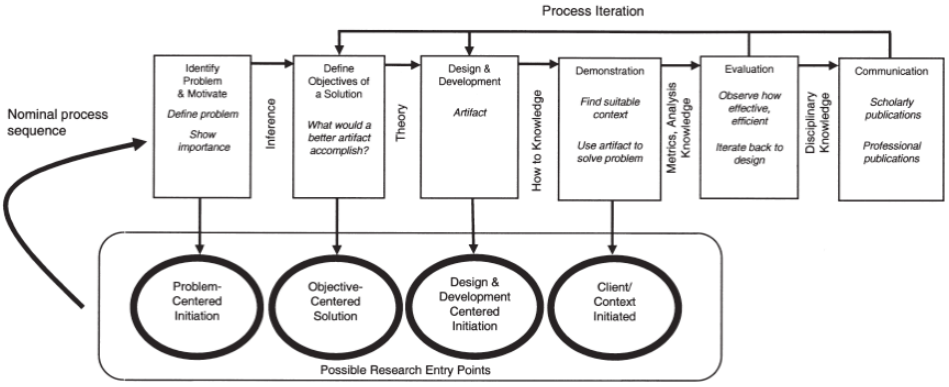


Figure 1.5: Short description of the six phases of the DSRM process model proposed by [107]

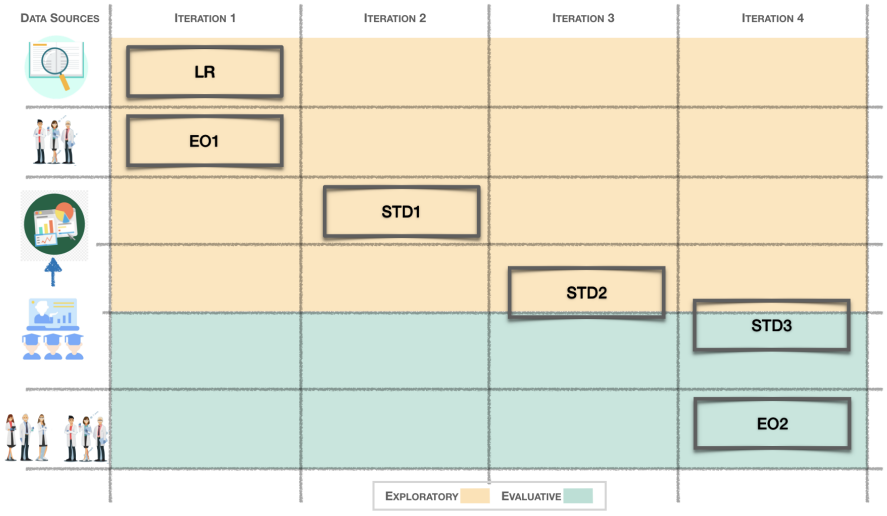


Figure 1.6: Overview of iterations and research techniques used in our dissertation

formulation of our proposals [52], [71], [98]. Therefore, the factors that impact the research questions were expected to emerge and evolve during the process, as a consequence of the knowledge gained by the researchers. These research context characteristics led us to supplement the aforementioned selected primary methodology (DSRM) by impregnating it with several principles of an educational research approach such as Design-Based Research (DBR) [10], thus enriching our process model with another research approach also based on designing to solve human problems. Design-Based Research is a systematic but flexible research approach aimed at improving educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories [10], thus fitting satisfactorily with our primary methodology and our research problem.

Thus, as shown in Figure 1.6, our research process began with a first exploratory stage, then moving towards increasingly evaluative phases, until finally reaching the last almost fully evaluative iteration. Each cycle covered different types of research methods and techniques, as well as experimental studies such as a literature review, various semistructured interviews and questionnaires to gather expert opinions

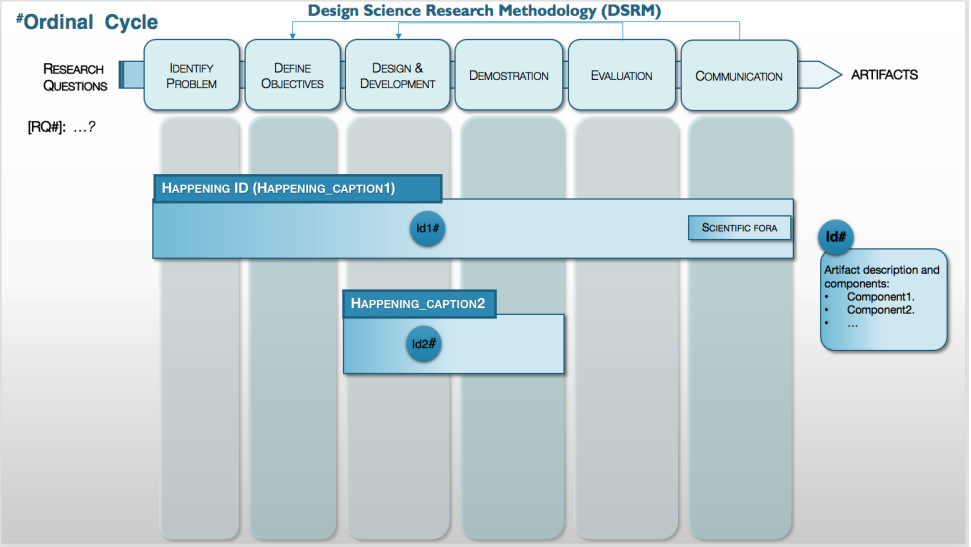


Figure 1.7: Mock-up of the graphic schema used to explain each iteration of the process

and several studies in authentic MOOC scenarios. Through this process, we collaborated with participant teachers with different backgrounds and expertise in MOOCs and CSCL. The first iteration was mainly exploratory and focused on understanding the problem context and on finding out the main factors which affect the group formation problem in on-line courses with a variable or massive scale. As a result of this iteration, we generated the first research artifact of our framework, which allowed us to identify and classify the key issues related to our research problem. We then carried out a second iteration with a twofold purpose: a) to test the relevance of different categories of the factors entailed in the framework, and b) to develop a tool prototype which would allow us to implement various experimental grouping strategies based on these factors. At the end of the second iteration, the taxonomy was improved and the framework was enriched by adding a tool prototype and a teachers' questionnaire to support teachers and instructional designers. During the third iteration, the evaluative tasks became more relevant in order to validate the artifacts of the framework. As a result of the cycle, we produced an architecture schema for the development of automatic tools to manage grouping policies and a guidelines model from which we created the first version of the teacher design guide. The final iteration was intended to be completely evaluative and mainly focused on validating the usefulness of two elements: the tool prototype and the design guide. To that aim, with the stakeholders, we evaluated the utility of our design guide and also validated the tool capabilities to deploy, on the learning platform, the grouping strategy designed, while also testing new functionalities of the prototype.

Figure 1.7 shows a mock-up of the graphic schema we use throughout the following chapters to explain the inputs, tasks and outputs of each cycle of our research process. As depicted in Figure 1.7, the six phases identified by Peffers [107] to drive the process appear in the upper part of the image. Below them, the concrete events or happenings carried out during the cycle are depicted, each one with their upper identifying caption. The width of each event frames it within the concrete process phases where it took place. On the left, the research questions used to lead the current iteration are presented as inputs for the process. The concrete cycle or iteration itself is identified by an ordinal number in the upper left corner. On the other side, the process outputs, which are materialized as research artifacts in DSR Methodology, are depicted on the right hand side of the image. These artifacts are identified by a letter together with a version number inside a circle. A short description of the artifact components is listed in a box below its identifier.

1.4 Structure of the Rest of the Document

The rest of this dissertation final report is structured in three differentiated parts:

- An introductory part, composed of this chapter and Chapter 2, in which we delve into the theoretical background of our dissertation as well as the current state of the problem by analyzing the work related to ours developed by other researchers.
- A second part, which explains the work developed throughout the four iterations of our research process, consisting of: Chapter 3, which describes the methods and results of the first cycle where the taxonomy of influential factors was produced; Chapter 4, which presents our first proposal of grouping strategy by means of an intervention in a real MOOC scenario; Chapter 5 where we document our second intervention in a real MOOC, while testing a second grouping strategy; and Chapter 6, which validates prior findings and the artifacts produced as a consequence of our research process by means of a third intervention in a real MOOC and an evaluative experiment with MOOC experts.
- Finally, a concluding third part sets out, in Chapter 7, the conclusions drawn from the dissertation and avenues for future work.

Finally, the appendices enclose supplementary material, including:

- Appendix A. Mapping tables used to analyze and process the information gathered in the Literature Review (LR) and in the first round of gathering expert opinions (EO1) across the first iteration of the research process.
- Appendix B. Semistructured interview model and transcription of the fieldwork corresponding to the interviews carried out to gather the Expert Opinions (EO1) of three teachers and instructional designers specialized in MOOCs and Collaborative Learning (first iteration of our research process).
- Appendix C. Profile questionnaires fulfilled by the three teachers of our first study (STD1), together with the Teachers' Questionnaire (TQ) used to design the MOOC and GLA characteristics and the grouping strategies for our first intervention (STD1). This appendix includes the TQ model and the fieldwork resulting from the consensus of the three teachers involved to fill such a TQ out (second iteration of our research process).
- Appendix D. Pilot satisfaction survey used in our first intervention (STD1) and the fieldwork corresponding to the judgment of five experts (second iteration of our research process).
- Appendix E. Guidelines Model and its proof of concept, the Design Guide (template) and the teachers of the second intervention (STD2) fieldwork (third iteration of our research process).
- Appendix F. Models and fieldwork corresponding to the second round of Expert Opinions (EO2): questionnaires and design guides fulfilled by the teachers (fourth iteration of our research process).

Chapter 2

Background and Related Work

Summary: Once the motivation and relevance of our research problem have been explained in the preceding chapter, this unit is intended to present the main concepts involved in the context area within which this research work is framed. Such concepts have been selected taking into account the overall goal of this dissertation. Due to the exploratory nature of this early stage of our research process, it was necessary to delve into the main areas involved in our research problem, thus analyzing their state of the art in order to test the relevance and originality of our research question. As will be explained in the next chapter, various data gathering techniques, such as a literature review, were used to deepen our understanding and broaden our scope into the main area where our thesis takes place: the Group Formation Problem (GFP) in MOOC contexts. To that aim, we explored related areas needed to acquire a broader vision of the problem. Thus, throughout this chapter, we report our synthesis about: (i) social learning, collaborative learning and computer supported collaborative learning, (ii) group formation, (iii) orchestration, MOOCs, and group formation in MOOC contexts.

2.1 Introduction

The first exploratory stage of our dissertation required deepening our knowledge of the main concepts related to our problem context, so as gain a better understanding of the research challenge to tackle. It is worth remembering that the final goal of this thesis is *to provide support to MOOC teachers for the creation and management of student groups intended to carry out group learning activities (such as those in collaborative learning)*. Therefore, it was necessary to understand the key theoretical concepts directly related to this overall goal, as well as discovering the research works that form part of the state of the art in the target field.

Thus, we decided to gather and analyze information concerning::

- Collaborative Learning (CL): This term is implicit within the very definition of the overall goal of our project and required of an analysis of its evolution, advantages and implementation in virtual environments.
- The Group Formation Problem (GFP) in traditional scenarios: The analysis of the techniques and criteria used in contexts other than MOOCs allowed us to understand the problem space and assess the ways of transferring or adapting these techniques and criteria to the new context.
- Orchestration: This concept refers to the way in which a teacher manages, in real time, multilevel activities in a context with different restrictions [35], [36]. Therefore, the management of collaborative groups is a major part of the orchestration tasks the teacher has to perform in order to carry out CL. Thus, our research work was aimed at facilitating certain orchestration tasks.
- Massive Open On-line Courses: Understanding the context, characteristics, peculiarities, difficulties and opportunities was essential to be able to face our research project.

- The Group Formation Problem (GFP) in the MOOC context: An analysis of the state of the art, examining the studies with objectives closely related to ours, was necessary to assess the approaches of other researchers and the originality of our proposal.

The rest of the chapter includes a section for each of these topics, as well as a discussion about the state of the art, ending with the conclusions obtained after the concept review carried out.

2.2 Social Learning, Collaborative Learning and Computer Supported Collaborative Learning

For a long time, learning was studied from cognitive psychology as an individual process, and research into the psychology of the teaching-learning process focused on aspects of cognition from an individualist perspective [143]. However, the constructivist theories from the last few decades have shown the relevance of learning as a social process.

As part of the constructivist epistemological approach, Piaget's theory of socio-cognitive conflict suggests that social interaction leads to higher levels of reasoning and learning because of the creation of cognitive conflicts. These conflicts create imbalances that make the learner question their beliefs and experiment with new ideas. According to Piaget, "the imbalance forces the subject to go beyond their current state and take new paths" [109]. Another theory illustrating the role of the social process as learning mechanisms is the social cultural theory of Vygotsky, who defends the idea that the social dimensions of conscience are more basic and important than the individual dimensions, which are secondary to or derived from the first. The author asserts that ideas have social origins and are built through communication with others, and that the individual cognitive system is a result of social communication in groups and can not be separated from social life [145]. Vygotsky pointed out that collaborative learning among learners or between teacher and learners is essential to support student progress, as it allows the distance between what students can learn by themselves and what they can learn cooperating with others of greater capacity and/or experience to be bridged [144].

The situated constructivist theories stand for a situated approach of learning. This approach introduce the concepts of context and situated cognition. Thus, the context (*i.e.*, setting and activity) in which knowledge is developed cannot be separated from learning [115], [80] and [91]. Thus, learning is fully situated or located within a given context [90]. Learning occurs while people participate in the sociocultural activities of their learning community, transforming and constructing their understanding and responsibilities as they participate. Lave and Wenger [80] argue that learning is a function of the activity, context and culture in which it occurs, where social interaction is a critical component of situated learning [103]. Authors such as Roschelle assert that convergence is key to building a shared knowledge through the collaboration. Collaboration is a process that can gradually lead to convergence of meaning, building concepts in a social and incremental way [116]. Conversational interactions allow students to build relational meanings incrementally. Collaboration enriches learning with social and cognitive dimensions that maintain student motivation and elicit verbal communication [118].

For years, collaborative learning theories focused on how individuals behave in groups. However, later, the group itself became a unit of analysis and the focus was on analyzing the properties of interactions [37]. The setting became an integral part of the cognitive activity instead of a bare set of circumstances where cognitive processes take place.

According to Dillenbourg, the broadest (but unsatisfactory) definition of collaborative learning would be a situation in which two or more people learn or try to learn something together [34]. For Dillenbourg, a precise definition of the meaning of collaborative learning would be highly negotiable. For instance, there could be people who consider it as the collaboration between three or four participants doing an activity together for 20 minutes; while others, however, could see it as forty professionals trying to solve a problem for a year. For this reason, Dillenbourg suggests three dimensions in which the nature of the collaboration can be specified:

- Scale of the situation (group size and time frame): Number of people involved and duration of the

collaboration. The optimal group size will depend on each specific situation (specific group, task, context...).

- Learning: Object and goal of the collaboration, for example, follow a course, solve a problem-solving activity, etc.
- Collaboration: Different forms of interaction that participants can use, for example, face to face, using a computer, synchronous, etc.

Different ways of collaboration differ in purpose, duration, complexity of the tasks and degree of formality [34]. Some examples of widely used forms of collaboration are, for instance: group discussions, where learners share views on certain issues; group projects, where students cooperate to solve specific problems; study groups, where troubled students look for help from those more gifted. The initial goal, from the empirical research perspective, would be to establish when and under what circumstances collaborative learning is more effective than individual learning [37].

Computer-Supported Collaborative Learning (CSCL) is a branch of the learning sciences that studies how people can learn together with the help of a computer [138]. According to Stahl et al., it is important to identify CSCL as a range of research possibilities on computers aiding learning instead of an established and accepted body of laboratory and classroom practices. The idea of combining technology and education in a way that truly enhances the learning process is a challenge that must be addressed by CSCL. The potential of telematic networks, especially the Internet, to connect people in innovative new ways has boosted research at CSCL. Thus, many technologies supporting different areas of collaborative learning, such as discussion forums, co-authoring tools etc., have been introduced.

Although many paths of research in CSCL have already been established, there are a variety of challenges, some of them derived from social problems arising from distance, which are important to consider [19]. Some of these challenges are:

- Socialization. The way of providing sufficient attention to the learner despite the lack of face-to-face interaction.
- Group management. Collaborative learning can be hindered when students do not know each other and to assign them to a specific group can be a complicated task for the teacher. It is important to place each learner in the "right" group (*i.e.*, suitable for the student and the concrete activity) for him/her so that both individuals and groups benefit from it.
- Suitability of the student. Students could have different demographic characteristics, interests, preferences, previous experience, or learning styles, which could differ from what is required in the collaborative activity. This effect can be seen as a personalization of learning at an individual and group level, so that communities of students with shared interests and goals could emerge.

2.3 Group Formation Problem (GFP) in Traditional Settings

In previous sections, the importance of learning as a social process was highlighted and different ways of collaboration, such as group discussions, group projects and study groups, were shown. Hence, the group formation constitutes a key aspect for putting collaborative learning into practice.

The Group Formation Problem (GFP) includes a variety of aspects to be taken into account, such as the group type, its composition, the approach selected to create the groups, etc. In the following sections the most relevant concepts related to the GFP are explained.

2.3.1 Group Types

Groups can vary in different dimensions, such as the size of the group, the duration of the group work, the objective of the group (which is usually related to the task to be carried out), the degree of formality and its cohesion [103].

According to Ounnas, the main types of groups are:

Teams: People who collaborate together on a well-defined task or tasks and who form a system, with boundaries, interdependencies and differentiated roles. Within this category we can find complementary teams, competitive teams and problem-solving teams.

Communities: Informal groups that develop a shared way of working together to undertake an activity. They are usually created through self-selection and are self-organizing. The main difference with teams is that communities focus on the value of individual members, while teams focus on the value of the results they produce. The heart of the team is formed by the interdependence of tasks leading to the defined goal, while the community focuses on knowledge sharing.

Within this category, Communities of Practice (CoP) are groups of people who come together informally because of a common interest or shared (practical) experience. CoPs collaborate and share ideas to find solutions and tend to be organic, spontaneous and informal in nature, making them autonomous and unsupervised.

Networks: The following subcategories can be found in this category:

- Intentional Networks or Networks of Practice (NoPs) which are collections of collaborators whose goal is to address a specific task. They are less formal and of shorter duration than teams and also have less group cohesion.
- Social networks are social structures of nodes (individuals or organizations) and their relationships within a given domain. They have been extensively studied in sociology, mathematics and computer science. They are usually represented by a graph.

In learning environments, the type of group to be formed is determined (by the instructor or the learner) so that it fits the needs of the collaborative activity to be developed.

2.3.2 Group Formation in Education

A simple definition of group formation in education might be "putting students together in different groups for educational purposes", but organizing collaborative learning effectively requires more than placing students together with other peers without any guidance or preparation [103].

According to Ounnas, poorly formed groups could lead to serious disadvantages, such as bullying, anti-intellectualism, conformity, and other problems, which could lead to detrimental effects on learning. Other authors, such as Isotani, Inaba, Ikeda and Mizoguchi, argue that group formation represents the backbone in creating scenarios that promote proper collaboration among students [63], and the way these groups are defined is an essential function in intelligent CSCL environments. For Konert, Burlak, and Steinmetz [78], whether collaboration is successful depends largely on the suitability of the peers included in each group. Therefore, group formation is an essential, significant activity, since it directly influences group performance and the individual benefit of belonging to a given group.

Different forms of collaboration will require different types of groups, and for groups to function properly, the approach chosen and the process followed for their formation must be carefully considered. The following sections describe different aspects of the group formation process and the types of approaches that exist.

2.3.3 Group Formation Process

According to Wessner and Pfister [152] and Ounnas [103] the process of group formation can be carried out in three steps:

1. Initiate the formation process: Firstly, the initiator starts the formation of the chosen type of group. Possible initiators can be the instructor, the learner, or a system representing the instructor or the learner. Here the initiator starts the formation of the chosen group type. The initiator can be the instructor, the learner, or a system representing the instructor or the learner.

2. Identify the members of the group: At this point the formation initiator chooses who should join which group. This is usually done based on learner profiles and the requirements for joining the groups.

3. Negotiating the formation: In this stage, the initiator has to ensure the formation satisfies members of the group(s), in addition to the criteria (constraints) of the initiator, and hence the collaboration.

For all types of groups, in stage (1) and (2) of group formation, the initiator has to consider two problems [103]:

- Modeling: In step (2), the requirements needed to identify the members of each group will serve as parameters for the formation. In this context, the initiator needs to identify what parameters need to be modeled for profiling the learners and processing the formation.

- Satisfying criteria: It is not an easy task to form groups that maximize the benefits of each learner within each group. When the formation aims to construct balanced groups in terms of the formation parameters, this approach may conflict with the best interests of individual students. These factors create the complexity of the group formation in terms of violating the criteria set for the group composition.

2.3.4 Group Formation Approaches

As described by Ounnas in her thesis [103], there are three different types of approaches that can be followed in group formation:

- Randomly selected group approach - The formation is initiated by the instructor who assigns students to groups randomly. It is usually used to form informal and temporary groups (mostly teams). It does not require negotiation, as there are no restrictions to be met and it is the easiest way to form groups.

- Self-selecting group approach - The formation is initiated by students who can choose which group they want to belong to and can negotiate with whom they want to work. Assigning participants requires potential peers who meet the requirements for joining a group to be identified. This approach is widely used in communities and networks where participants are brought together by a common interest. It can also be used in teams in which students choose their peers based on interests, preferences, similarities, friendship, and trust; they can also be based on finding peers with the technical capabilities, experience, knowledge, and skills to complete the task. These groups tend to be homogeneous.

- Instructor-selected group approach - Also known as criteria-based selection. Group formation is initiated by the instructor. This is a very popular approach in task-oriented grouping and intentional networks.

Within this approach we can distinguish different ways in which the criteria are applied to group formation. In this way, groups can have one of the following structures::

- Homogeneous - The members of the group are similar in terms of the grouping criterion.

- Heterogeneous - The members of the group are different in terms of the grouping the criterion.

- Rule-based - The criteria consist of applying certain rules, such as never putting only a girl alone in a group.

2.3.5 Group Formation in CSCL

The group formation problem in CSCL has been explored by different authors using different techniques and approaches. In some cases, for example, group formation is based on criteria related to the learner's profile and context [97]. There are also researchers who use students' learning styles to create heterogeneous groups [105], while others decide on the formation of homogeneous groups based on learners' strategies to solve certain tasks, including students with similar strategies in the same group [22].

Regarding its technical implementation in virtual platforms, the solutions proposed by researchers are also varied. In environments where the number of learners could be high and they could also be scattered in different locations, manual grouping by teachers becomes impossible and an algorithmic solution to support them is definitely necessary [78]. To perform Computer Supported Group Formation (CSGF), different techniques and algorithms are used. In some cases, nonlinear optimization techniques with cluster analysis are used, for example the Fuzzy-C-Means technique [105], but this is not useful when criteria mixing homogeneity and heterogeneity must be used. In this case, heuristics and optimization techniques are necessary [19]. Nonlinear optimization techniques are used in small e-learning scenarios and grouping criteria, as pointed out by Konert et al. [78] in their state of the art on algorithms in the group formation problem. In addition, there is another large group of algorithmic solutions for the realization of learner grouping based on semantic techniques and ontologies, such as those used by Inaba, Supnithi, Ikeda, Mizoguchi, and Tayoda [62], Ounnas, Davis, and Millard [104], and Isotani et al. [63]. These authors use ontologies to model learner characteristics and even grouping criteria, as well as sometimes to improve clustering techniques and sometimes to create grouping approaches that model pedagogical theories and thus drive grouping through these theories.

2.4 Orchestration

Many pedagogical scenarios integrate individual activities (e.g. reading), teamwork (e.g. problem solving) and other types of activities (e.g. lectures). Some of these activities are computer-based and some are not, some are face-to-face and some are on-line, while different types of technological tools installed on different types of devices (laptops, tablets...) are used to integrate them. These integrated scenarios require real-time management called orchestration [35].

Roschelle, Dimitriadis and Hope [117] argue that orchestration is a TEL approach, especially focused on helping the teacher, which puts special emphasis on the challenges of using technology in a classroom. The authors highlight that, although there is a lack of consensus in this field concerning which aspects to include in orchestration and how to carry out its design, it is an important, time-consuming activity that deserves special attention.

The creation, monitoring and restructuring of groups of learners can therefore be considered orchestration tasks which the teacher has to carry out when he/she wants to implement collaborative learning.

With the introduction of different types of personal devices in the classroom (such as laptops, tablets or smart-phones) the orchestration tasks of teachers have been acquiring a higher level of complexity [131]. Sharples proposes that, as opposed to the alternative of the teacher having access and control over all student devices, there is the possibility of sharing the orchestration tasks among teachers, students and computational agents.

In on-line, open, massively scalable and variable environments, this shared and distributed orchestration, with the computational agents assisting teachers and students in group management tasks, could be a solution to the problem.

2.5 MOOCs

This section reviews the history, characteristics, etc. of massive open on-line courses in order to improve our understanding of one of the problem areas addressed by this work. A more detailed characterization of the MOOC context as part of the conceptual framework of this dissertation is presented later, in Chapter 3 of this dissertation.

The MOOC context encompasses a series of aspects that distinguish it from other learning contexts and can be analyzed by relying on the abundant literature and reviews conducted by other authors [72], [82] and [157]. The massive nature determines specific peculiarities which deserve special attention, due to their influence in orchestrating and guiding the course. The large scale in terms of number of participants and its possible variations due to latecomers or dropouts can hamper the instructor's organization tasks. The open-ended nature may aggregate a component of heterogeneity to the participant population, which would add a further complication for the instructor when performing orchestration tasks. These issues are more significant if the course design includes collaborative learning, since the difficulties in coordinating the implementation of collaboration increase proportionally to the number of participants and the variations in such numbers that may occur during the course.

The first course to be called MOOC (Connectivism and Connective Knowledge - CCK08) was developed by George Siemens and Stephen Downes in 2008 at the University of Manitoba and was intended to put into practice the connectivist theories of its authors. Connectivist pedagogical approaches hold that knowledge is distributed through a network of connections and therefore learning consists of the ability to build and navigate this network [39]. Connectivists argue that learning is activated through the connection to these networks of specialized resources (whether people or other non-human resources). These connections, which make it possible to learn more and more, are even more important than the specific state of knowledge at a given moment [133].

CCK08 students were autonomous both in their choice of technology to interact with the course and in their ways of working. Several course sites were created (Moodle forums, Ustream, Elluminate and a wiki), but in addition, students configured their own learning spaces with blogs, wikis, Facebook, Google groups and Second Life, for example. The course syllabus appeared in five languages. The course attracted a diverse group of students (2200), mostly English-speaking, but there were participants who set up a different language for their group (such as Spanish). Despite being carefully planned, the course struggled because, in the first few weeks, the forums were flooded with a multitude of messages and many students felt overloaded and discouraged.

Some researchers, after an analysis of the activity and results of CCK08, have shown that while it fostered key aspects of connectivism such as autonomy, diversity and openness necessary for connectivity and interactivity, the large scale simultaneously hindered the coordination, support and moderation needed in an on-line course and the possibilities for students to create groups [84].

After CCK08, other MOOCs emerged that also tended to be decentralized, network-based, non-linear in structure and focused on conversation and interactions. These MOOCs were later categorized as cMOOCs (connectivist MOOCs) [134], [64].

The cMOOCs were relatively unknown until 2011, when a few leading universities in the United States started offering MOOCs through commercial platforms such as Coursera or Udacity. Unlike early MOOCs these were centralized, content-based and linear. They typically revolved around a series of short, modularized, video-based content followed by automated, multiple-choice quiz activities to assess learners' content knowledge. These MOOCs were referred to as xMOOCs [88].

From 2012, an increasing number of universities around the world began offering MOOCs and the debate about their instructional quality intensified. In early 2012, Stanford University offered a free course on Artificial Intelligence in which 58,000 people enrolled. One of its creators, Sebastian Thrun later founded Udacity, a commercial start-up to help other universities offer MOOCs. MIT founded the MITx platform that morphed into edX when Harvard and Berkeley joined. Another for-profit start-up, Coursera, offered a platform where course design was delegated to institutions that were simply provided with general guidelines. The year 2012 became, according to the New York Times, "the year of MOOCs" and today there are already million people who have participated in hundreds of MOOCs offered by universities and public and private institutions around the world, yet there is still little research on their effectiveness for learning [82].

The most criticized aspect of this type of courses is their high dropout rate. In the MIT 6.002x course "Circuits and Electronics", there were 155,000 registrants from 160 countries. Of those 155,000, 23,000 did the first set of problems, 9,000 passed half the course, and 7,157 passed the entire course [29]. Available data indicate similar dropout patterns in platforms such as Coursera, edX or even Moodle, registering

course completion rates between 5% and 15% ([29], [30], [43], [156]). This aspect together with their low instructional quality, both in the cMOOC and xMOOC modality [88], has led many authors to investigate how to design more effective and higher quality MOOCs ([2], [25], [38], [51] and [46]), proposing, in many cases, the inclusion of student collaboration [112], [111], [121] and [110]. The challenges to be faced start from the pedagogical design, since pedagogy directly influences the level of student involvement [42], but the pedagogical model is greatly limited by the technological platform, and in order to make designs that implement pedagogical models adapted to the MOOC characteristics (diversity, heterogeneity and massiveness) it is necessary for the technological framework and the pedagogical model to be aligned [43].

There are MOOC learning platforms, such as Canvas Network[1], FutureLearn[2], NovoEd[3] and more recently, OpenEdx[4], which have incorporated capabilities for the inclusion of pedagogical designs that go beyond the individualistic and instructional model. However, although these platforms only allow random or self-selecting groups (avoiding the preferred strategy for teachers due to its pedagogical capabilities: the criteria-based grouping), there are studies showing that, even in environments prepared for collaboration such as NovoEd, failure rates to perform team activities are very high [147],[46].

2.6 GFP in MOOCs

The level of difficulty of group formation increases, compared to traditional environments, in a massive and variable scale context by adding new variables to the problem. In these scenarios, it is very complex to manually design and orchestrate the configuration of groups with large and variable volumes of students. The heterogeneity and diversity of the student body and the volatile level of participation add new issues when the course is also open. Therefore, in order to implement a criteria-based or self-selection approach to grouping, CSGF (Computer Supported Group Formation) solutions are required.

Some researchers have already started to explore different possibilities to address the problem with the aim of improving social interactions and the level of learner involvement.

Sinha proposes the development of a methodology for dynamic team building in MOOCs, establishing a conceptual framework based on the theory of team organization, social network analysis and machine learning [135]. The author performs an analysis of the interactions between learners and the network of links produced by these social exchanges. He proposes basing the configuration of teams on the balance of different quantitative and qualitative metrics that can be extracted from the social networks that are formed.

Other authors approach the problem with a more algorithmic and mathematical view. In the case of Bahargam et al., the authors aim to make groups of students for the distribution of different content and activities in each group and so that the benefit of peer reviews can be maximized in each group [7]. The authors pose a problem with several parameters (total number of students, time interval, number of different activities required, and desired number of groups) that they solve with an polynomial algorithm of NP-hard complexity and which they test on synthetic and real data. Later on, Bahargam addresses again the group formation problem by measuring the faultlines in existing teams to apply his faultline optimization [8]. In this work, the author meets the challenge with a new measure that can be used for both faultline measurement and minimization. He then use the measure to solve the problem of automatically partitioning a large population into low-faultline teams. By introducing faultlines to the team-formation literature, the author introduces opportunities for algorithmic work on faultline optimization, as well as on work that combines and studies the connection of faultlines with other influential team characteristics.

Ullaman, Fjames, Camilo-Junior and Nogueira [141] proposed, for the formation of the groups, an adaptation of the Particle Swarm Optimization algorithm [70] on the basis of three criteria: level of knowledge, interests and leadership profiles. They formed groups with different levels of knowledge, similar interests and distributed leadership, providing a better interaction and construction of knowledge.

[1] https://www.canvas.net/
[2] https://www.futurelearn.com/
[3] https://novoed.com/
[4] https://edx.readthedocs.io/projects/edx-partner-course-staff/en/latest/course_features/teams/index.html

Their algorithm demonstrated that it can meet the criteria for grouping in a computation time, but it is only more efficient than the model of random groups.

In other cases, the approaches aim to implement project-based learning, since they estimate that the high dropout rates of these courses are, in part, due to the lack of motivation of the students and this is a consequence of the individualistic pedagogies used [137], [136]. To achieve their goal, they present a model of team formation using data that they classify into three categories: knowledge, personality, and preferences. By varying the levels of these data among team members, team outcomes and team productivity can be improved. The authors use interviews and surveys of university professors who practice project-based learning to explore and validate information regarding their process model. They collect information regarding the weight of the three categories of data on which the model relies, finding in their results that the relative order of importance among these three categories is: (1) knowledge, (2) preferences, and (3) personality.

The work of Zheng et al. analyzes the impact of the formation of small learning groups on MOOC dropout rates. In their experiment, they use two methods to create small learning groups: a randomized one and one that uses criteria chosen by the learner in a previous survey [159]. The algorithm used to create the criteria-based groupings is a k-means clustering, in which they mix homogeneity conditions (time zone and language) with heterogeneity conditions (gender, personality type, and learning objective). In addition, they use the MOOC within a face-to-face course using flipped classroom and compare the three approaches using two metrics: dropout rate and learning performance. Their results indicate that using small groups results in a slight decrease in dropout rates, but no improvement in learning performance; although these results should be taken with caution because the statistical sample is not very significant. Later on, on his dissertation [158], the author structured his research in two stages: (a) group composition using the discrete-PSO algorithm he proposed in the aforementioned paper, and (b) group re-composition by means of a data-driven approach that makes full use of group interaction data and accounts for group dynamics.

In her doctoral dissertation proposal and in further research studies, Wen explores deliberative procedures prior to group formation[147], [149]. In this deliberation phase, she aims to find transactional reasoning among learners and to analyze attitudes that may lead to team success, such as leadership. At the technical level, it uses natural language processing techniques and survival models. She conducts three case studies and a fourth case by conducting an intervention with group training in a MOOC. In two of her studies, she finds that, in platforms such as NovoEd, prepared for integrating collaborative activities, the formation of groups of students remains an unsolved problem. Despite the best efforts of teachers to support the formation of groups, many students fail to join a group and neither the method of random assignment to groups nor team selection by the learner provide good results, since many of the teams created do not get to have any activity. The author believes that, for a team to be successful, it needs to be formed in such a way that there are certain common interests and characteristics that indicate that the members can work well together.

According to the aforementioned research papers and dissertations on group formation in MOOCs, it seems that the challenge of group formation in MOOC contexts exists and requires in-depth analysis. The peculiarities of the context hinder the creation and damage the suitability and persistence of the structures created. The problem includes many factors to be considered which may mean, even if the teams formed have been created using sound criteria, that the final objective fails because these teams degrade over a short period of time. It would be convenient, therefore, to contemplate the possibility of designing strategies to monitor the dynamics of the groups and restructure them when necessary.

Thus, this dissertation aims to achieve a holistic view of the possibilities and aspects to be considered, paying special attention to the monitoring of the dynamics of the course and the performance of the teams. In this way, we intend to contribute to the solution of the problem by opening up different paths towards the design of guides, methods, or tools to support teachers. These tools could help teachers to perform the necessary orchestration tasks to be able to manage collaborative groups of students with a certain level of involvement in this type of courses.

2.7 Related Work Summary

Although the previous sections 2.3.5 and 2.6 are, themselves, an analysis of works related to ours, in the current section, we go through and summarize the main aspects of the works most similar to ours by comparing them to our proposal and thus guarantee its originality.

The strategies employed for group formation strongly influence the learning experiences of the students during collaboration, and consequently, group performance and the individual learning gains [63]. Poorly formed groups can negatively influence the peer interactions, which may lead to detrimental effects such as isolation, conformity, anti-intellectualism, intimidation, and leveling-down of the learning quality [103]. Therefore, group formation is a very critical stage in CL.

In the CSCL field, several tools and systems have been proposed to support automatic group formation in face to face and blended learning scenarios using different techniques and algorithms [85]. However, MOOCs have particular characteristics, which preclude a direct extrapolation of lessons learned from these studies to massive and open learning contexts. In MOOCs, the flexibility in the enrollment dates, the high dropout rate, and the presence of students with no activity in the course all cause major variations in the target population throughout the course. Moreover, the diversity among MOOC participants results in a high variability in students' engagement levels and learning behaviour, thus hindering the process of group formation.

Currently, only a few MOOC platforms (e.g. Canvas, NovoEd, edX) offer features to set up collaborative groups; while in the courses delivered in platforms (e.g. Coursera, Udacity, FutureLearn) with no group formation support, students have even formed external networks to meet and create study groups using services such as MeetUp[5]. Among the three main group formation approaches *i.e.*, random, self-selected and teachers' criteria-based groups [103], the aforementioned MOOC platforms allow the automatic formation of random groups. This is a simple yet convenient way of ensuring that every student is assigned to a group; however, it does not guarantee that groups will work productively. Some platforms (e.g. Canvas Network) also allow teachers to manually assign students to groups. However, this solution is not always feasible in a course with a massive number of students. The Teams feature of Open edX platforms allows students to browse through existing teams (created by the teacher) and select the team that they want to join (mostly by interest in the topic). However, it has been reported that, when this method is used, many students do not manage to join a team [148]. Nevertheless, the criteria-based grouping approach, which is the preferred method for small-scale contexts due to its pedagogical affordances, is not currently supported by automatic means through the existing MOOC platforms.

There have been few research studies addressing the issue of group formation in MOOCs [148]. However, many authors continue to defend the need to include GLA in MOOCs [139], [113] in order to improve the instructional quality of such courses and diminish their high drop out rates, while also supporting the adoption of intelligent and virtual teams in MOOCs [20].

Among the authors who faced this problem, Zheng used random and survey-based algorithms to compose the groups, later proposing a method for recomposing the groups that are incomplete in size (due to dropout) when a new task begins [158]. Spoelstra, Van Rosmalen, and Sloep analyzed team formation in project based learning, using data gathered from surveys about the background knowledge, preferences, and personality of the students as grouping criteria [137] and [136]. Sinha proposed a theoretical approach for dynamic group formation focusing on the use of Social Network Analysis and Machine Learning techniques to find relations among students in order to configure the groups [135]. Wen tested the effectiveness of giving the students the opportunity to interact meaningfully with the community before they are assigned to teams, in order to extract evidence of which students would work well together [148] and [149]. Bahargam [7], [8] and Ullman [141] addressed the problem from a more mathematical point of view, solving algorithmically a problem of optimization. However, the parameters they used for such optimizations were numeric variables (such as total number of students, time interval, number of different activities required, and desired number of groups) or static factors taken mostly from the students' profiles, and they did not take into account any of the student dynamics to form the groups.

[5]https://www.meetup.com/es/topics/coursera-org/; https://www.meetup.com/es-ES/topics/udacity/; https://about.futurelearn.com/meetups

Although some of the aforementioned research studies have considered social interactions among students to create the groups [135], [149] and others have taken into account the possible re-composition of damaged groups [158], none of these studies have considered the students' engagement dynamics in MOOCs and their distinctive behavioral patterns (e.g. no-shows [59],[3]) as main factors to inform the group formation process. Thus, for implementing successful collaborative activities in open and massive contexts, there is a need for automatic group formation approaches that consider a variety of indicators of the learners' engagement in the course [128], [127] and [125].

2.8 Chapter Conclusions

Collaborative learning enables the acquisition of skills and capabilities that cannot be acquired through individual learning. The creation of groups and the definition of the group composition is an essential function to put into practice effective collaboration.

MOOCs represent a disruptive model in education that has become very popular and is being used by universities and other institutions to promote their educational offerings. It would be desirable that this model could also benefit from the advantages of social and collaborative learning, especially since the environment and the large scale can multiply the opportunities for social interactions among learners. Many researchers are working to put it into practice, but so far no significant results have been observed. The characteristics of the MOOC environment keep on tilting the balance towards individualism and the instructional nature. The technological platforms restrict, to some extent, the pedagogical models that can be implemented.

An important step to enable the implementation of collaborative learning would be to provide support to MOOC teachers in the formation of groups since, with a massive and variable scale, the teacher needs technological tools to be able to carry out this activity. The creation of groups with sound criteria will be key to their future performance, and their monitoring and dynamic restructuring will be essential for the groups to guarantee a successful collaboration. By tackling the problem from partial visions, critical aspects that can influence and damage the groups created are not taken into account. This process implies a challenge that needs to be addressed, and a holistic view of the issue can contribute to finding solutions to the problem.

Chapter 3

Identifying and Classifying: Towards a Taxonomy of Influential Factors. Literature Review (LR) and Expert Opinions (EO1).

Summary: In this chapter, we summarize the work carried out across the first cycle of our research process. The design of this research process was a consequence of the concepts and assumptions described at the beginning of this report, in Chapter 1, Section 1.3, Methodology. In preceding chapters, we also motivated the need of acquiring a broad view, as holistic as possible, of the problem context in order to find out the main influential aspects or factors involved in our research problem. We deemed the identification of these factors as a necessary requisite to, subsequently, determine which of them could impact significantly in the formation and management of virtual student teams. As a consequence, we planned the first stage of our research process to be fully exploratory and we designed the first cycle of our research process by carrying out a literature review and a set of semistructured interviews to collect the expert opinion of several teachers skilled in Collaborative Learning and MOOCs. In the current chapter, we document the research process carried out, as well as the results of analyzing the collected information, our findings, and the research artifacts produced as a consequence. Throughout the sections of this chapter, the methods used to gather information are explained and their results are analyzed. Furthermore, the mapping tables obtained as a consequence of the processing of the Literature Review (LR) and the Experts' Opinions (EO1) are available in Appendix A, whereas the interview model and the annotated transcriptions of the semistructured interviews carried out to gather the opinion of three experts are available in Appendix B.

3.1 Introduction

The most relevant issues and outcomes presented in this chapter have already been published in different scientific fora. Thus, the work developed during this stage produced two short papers, [129, 123], presented in two international conferences. A short description of each publication that arose from this dissertation is included at the end of this report, in Chapter 7, in the Conclusions section.

As explained in the first chapter of this report, the final goal of our dissertation was to provide teachers with support in the design and implementation of group formation policies in MOOC scenarios. This support could be materialized through various tools intended to help teachers or instructional designers

in two stages: firstly, by providing guidance to design and configure the teams of students needed to collaborate in the Group Learning Activities (GLA); and secondly, by deploying these instructional designs on the chosen educational platforms. However, as explained in Chapter 2, Background and Related Work, after assessing the research works related to ours, we found that all the authors we analyzed tackle the Group Formation Problem (GFP) in MOOCs through partial perspectives and without considering the peculiar features of the MOOC context that could affect or even damage the stability of the formed teams.

Therefore, to achieve this main goal, we deemed it necessary to acquire a broad view, as holistic as possible, of the problem context in order to figure out what could be the main influential aspects or factors involved, and also to decide in which of them we could intervene. We guessed that the aspects to take into account for the development of these supporting tools could be numerous and could be assigned or mapped to different categories and levels of abstraction. For instance, some of these aspects refer to the grouping criteria the teacher could apply while designing the course, whereas others correspond to computational techniques needed to implement the group formation in the learning platform. Thus, in order to gain a wide and deep understanding of our research problem, we designed the first iteration of our process model to be wholly exploratory.

In the following sections of this chapter, we describe: the overall goals of this cycle, the research design and development of the two data gathering methods selected, the analysis process carried out to obtain the results, and the main findings and conclusions obtained throughout the process.

3.2 Cycle Goals

The analysis of aspects that could have an impact when forming collaborative groups of students in MOOCs would be intended to accomplish the following goals:

- To acquire a global view of the problem.
- To consolidate our research question by validating its originality and relevance.
- To identify and classify the aspects or factors that can be taken into account in the search for possible solutions.

Hence, the first stage of our research process was mainly focused on the identification and organization of the variety of factors which could be taken into account for the design of the envisioned tools to facilitate group formation in MOOCs. To that aim, we carried out a first wholly exploratory iteration based on our first Research Question (RQ):

RQ1: *What aspects and dimensions are involved in the Group Formation Problem in MOOCs?*

Across this cycle, two techniques for the gathering of information were selected: a literature review, and a semistructured interview to collect expert opinions, as shown in Figure 3.1.

Figure 3.1 shows the phases where both techniques were carried out. Thus, the literature review was applied to cover the six phases of our process model, starting with the *Identification of the Problem* and ending with two *Communications* in scientific fora; whereas the interviews to gather the opinions of experts were intended to *Define Objectives* and to *Design and Develop* a solution. The artifact produced as an output of this cycle is depicted on the right side of the figure. This preliminary version of the framework was identified as F1 (*i.e.*, Framework version 1) and its components are listed in the box below.

The following sections describe how we accomplished the two data gathering techniques chosen for this cycle .

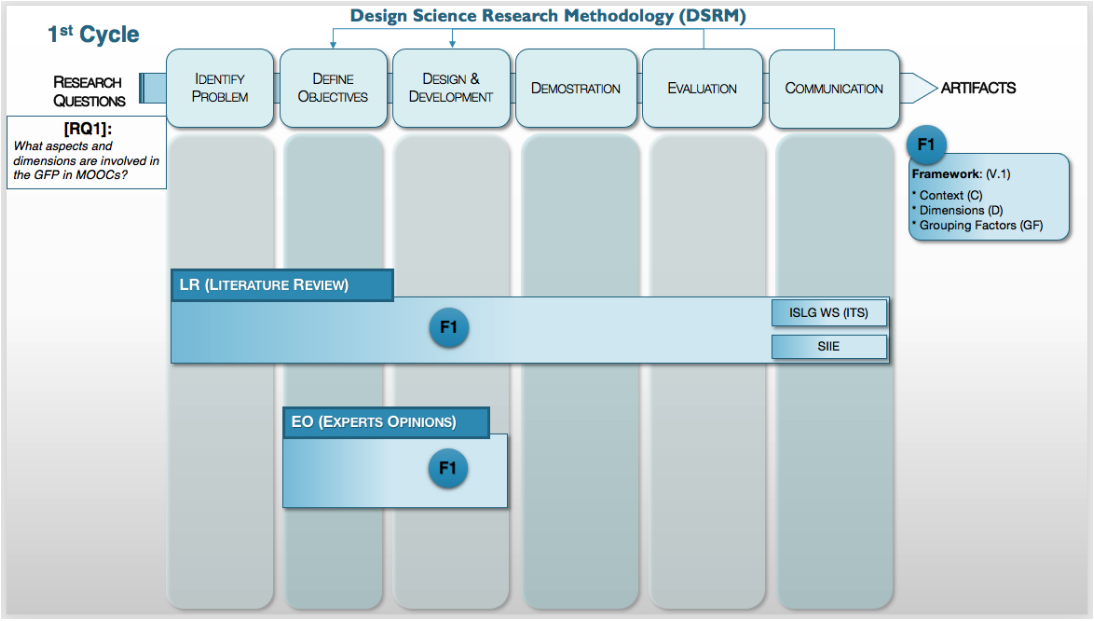


Figure 3.1: Exploratory tasks carried out through the first iteration of our process model.

3.3 Literature Review and Analysis

As shown in Figure 3.1, the first data gathering technique we selected was a literature review and analysis to understand the particular features of the problem context. To do so, we followed a process inspired by the Kitchenham guidelines [74].

Thus, we accomplished a literature review intended to: (i) strengthen the originality and relevance of our research question; (ii) identify the particular features of the MOOC context that can affect the formation and management of collaborative groups of students and (iii) Identify and classify the factors than can be relevant to implement collaborative grouping in this type of courses.

The review was carried out in three stages: a first for planning, a second for carrying out the review itself, and a final stage in which an analysis of the data obtained and a report synthesizing the results of the review was accomplished.

3.3.1 Planning the Review

At this stage, the specific objectives of the literature review were defined, focusing on covering the general Research Question (RQ) of this cycle (see Figure 3.1). The sources to be used, as well as the search criteria to select the primary studies to be revised, were also determined at this point.

To that aim, the conceptual organization of the data was adapted from the anticipatory data reduction procedure, used typically for evaluation in qualitative data analysis. Thus, by applying an anticipatory data reduction process inspired by Miles and Huberman (1994) [94] and following the method used by Muñoz-Cristobal et al. (2015) [99], we obtained the main categories, topics and issues to be explored by means of this literature review.

Figure 3.2 depicts the anticipatory data reduction diagram showing the specific Research Question (RQ1.LR: *What factors appearing in literature should be considered for the design of supporting tools which help teachers to create and manage student teams in massive and variable scale courses?*) to answer with this technique, and the two main Issues (I1 and I2) to be dealt with at this stage. A variety of topics (T) to explore arose from each of these issues, concerning which we stated several Informative

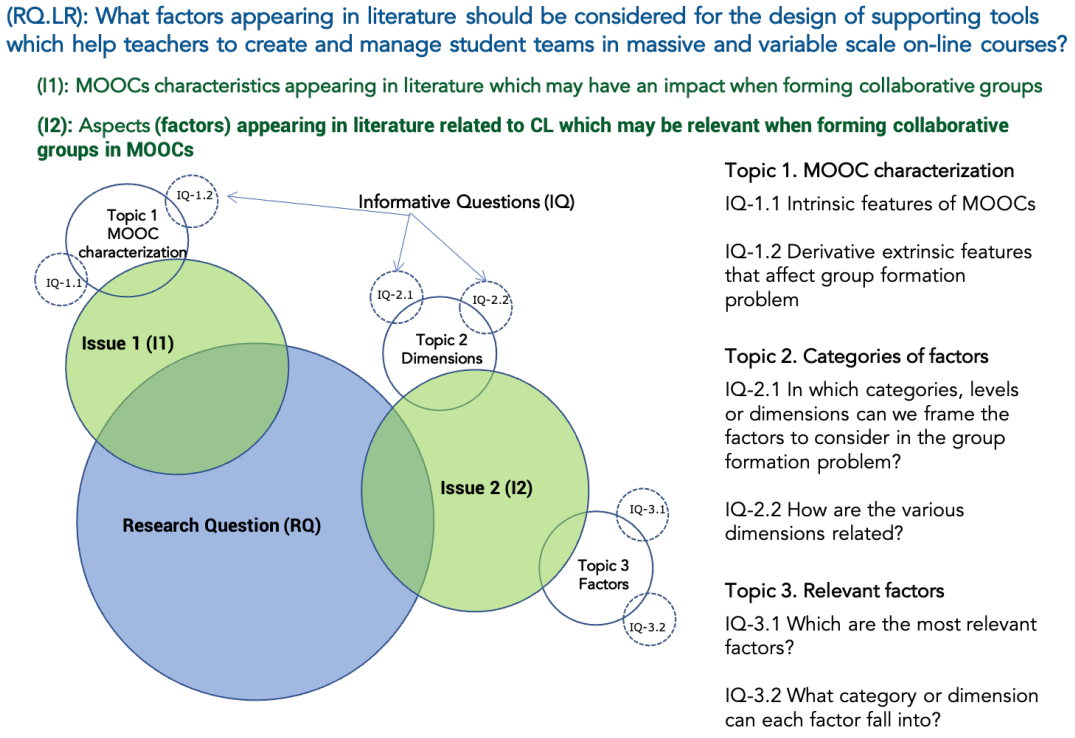


Figure 3.2: Anticipated data reduction process schema used to set the literature review objectives

Questions (IQ) to be answered through our judgmental revision of the literature. Therefore, each of the topics was in turn informed by several informative questions that aim to probe for information.

As shown in Figure 3.2, two issues arose from the research question and were established as objectives in the revision planning:

a) MOOC characteristics appearing in the literature which may have an impact when forming collaborative groups and

b) Aspects (factors) appearing in literature related to CL which may be relevant when forming collaborative groups in MOOCs. The topics to be dealt with and the informative questions regarding these topics are also shown in Figure 3.2.

Moreover, the selection of the literature sources was carried out pragmatically by considering the repositories available to the author and with the aim of covering a significant but approachable volume of information. Thus, the chosen sources where we obtained the primary studies were:

- Google Scholar [1]
- Scopus.
- Web of Knowledge.
- References contained in previously selected articles.
- References recommended by other researchers.

[1] https://scholar.google.es

In order to attain the aforementioned objectives, we determined that our literature review should cover the following three global concepts and the intersections among them:

- Pedagogical aspects such as active pedagogies, social learning, collaborative learning, orchestration tasks, etc.
- Grouping concepts such as group formation, CL group characteristics
- MOOC features including MOOCs instructional quality, MOOC types, , .

With the goal of obtaining the aforementioned three categories or lists of papers, a variety of searches were carried out in the first three sources using keywords or combinations of them which appear explicitly or implicitly in our research question, for instance: "CL", "CSCL", "Orchestration", "Group formation", "CSCL groups", "Teams", "MOOC features", "MOOC groups" and "MOOC teams".

We applied a homogeneous method to select the primary studies that reduced, as far as possible, the arbitrariness and bias. The criteria applied to do so were:

First criterion - Direct relationship with the target problem (assessed by a critical analysis of the paper abstract).

Second criterion - Trust in the source (*i.e.*, reputation, in the research field target of this dissertation, of the author of the research study, or of the researcher who recommended the reference).

3.3.2 Conducting the Review

The literature review was carried out by a single person (the author of this report) applying the process and criteria previously described.

Thus, after executing each of the searches specified in the previous subsection, the researcher applied a screening process on the list of papers resulting from the search filters. To carry out such a screening process, the researcher implemented the following algorithm:

1. Sorted the results of each search in descending order according to their impact (*i.e.*, citations).
2. For each sorted list
   (a) Processed the first paper of the list that were still unprocessed.
   (b) Carried out a critical analysis of the selected paper abstract aimed at determining whether the paper had a direct relationship with the target problem or not. The papers not directly related were discarded.
   (c) Selected the papers whose authors had a high reputation in the target research area. To do so, the researcher checked the published career of the author, together with the recommendations of her dissertation supervisors and research group mates in order to score the author's reputation.
3. Repeated the process until the number of papers selected in each of the three aforementioned concept lists was considered as acceptable (in a range between 20 and 30 papers).

Furthermore, new papers were added due to recommendations, references included in papers highly valuated in the selection process, need of updating or solving doubts about certain concepts and a final review, at the end of the dissertation, to keep the literature review up to date, as much as possible, in order to guarantee the validity of the state of the art provided in this report.

A total of 106 primary studies were selected and subsequently analyzed and synthesized.

The results of this analysis, the emerging findings and our conclusions after this process are documented in the following subsection.

3.3.3 Analyzing and Reporting the Review

The analysis carried out to process and synthesize the literature review was documented by means of a set of mapping tables. As mentioned above, the fieldwork generated during the research process carried out across the first iteration was collected in Appendix A, including these mapping tables. The tables included in Appendix A are labeled as TableLR1, TableLR2, etc. to identify the origin of the table (with the acronym LR for Literature Review) and an ordinal number to sort the presentation of results.

To better understand the utility and content of these tables, we have included a sample of them in Subsection 3.3.3.2 (Table 3.1), as well as the following short description about the content of the LR mapping tables included in Appendix A:

- TableLR1 depicts the MOOC extrinsic characteristics, linking each one to the intrinsic characteristic from which it is derived.
- TableLR2 shows, in its rows, each of the dimensions or levels of abstraction in which the factors can be categorized. Each row specifies, in its second column, the concrete literature references where the dimension was clearly identified.
- TableLR3 lists the factors related to the learning design, each one linked to the references in which it is mentioned.
- TableLR4 depicts the aspects we called static factors of the student, collected generally at the beginning of the course. The literature references in which these factors were mentioned are also included in the table.
- TableLR5 includes those aspects we named as dynamic, related to the activity and behavior of the students during the course. The references in which these factors appear are also included in the table.
- TableLR6 documents the factors we considered as related to the technical implementation. Each row specifies, in its second column, the concrete literature references where the technical factor was mentioned.

A summary of the main findings obtained after the literature analysis is presented below.

3.3.3.1 MOOC Context Characterization

The first result from the literature review was the characterization of the MOOC context. Starting from the MOOC acronym itself and then analyzing what is considered as a MOOC in the revised literature, we concluded that the Massiveness, Openness and On-Line modality are the intrinsic characteristics of this type of Courses, because they all take part in the definition and nature of MOOCs. Thus, a deep analysis of the meaning and repercussions of each of these intrinsic characteristics was carried out in order to figure out new derived features we labeled as extrinsic.

For instance, the analysis carried out on the intrinsic feature OPENNESS gave rise to the following conclusions:

a) The learning contents are usually free to access for students, who can share them.

b) Most of these courses do not require formative prerequisites to access.

c) The course access remains open after the start of the course.

d) The enrollment in the course is usually free or has a very low cost.

These facts lead to five new extrinsic characteristics, derived from openness, that are usually observed in the students of this kind of courses:

- High heterogeneity,

- Students can enroll in the course when it has already started,
- Low motivation,
- Low engagement and participation, and
- Very high drop out rates.

The literature analysis helped us to discover a set of extrinsic characteristics linked to each intrinsic characteristic, as in the aforementioned case of *openness*. To document this analysis, we created a set of mapping tables where each extrinsic characteristic detected in the literature was linked to the intrinsic characteristic from which it was derived, as well as to the concrete literature references where such a characteristic appears significantly. Most of the aforementioned characteristics appear explicitly or implicitly in 59 specific references, out of the total of 100 selected when the review was planned, as explained in the Planning the Review subsection. The mapping table generated to synthesize the MOOC Context Characterization is included in Appendix A and labeled as TableLR1.

3.3.3.2 Factor Dimensions

The literature analysis allowed us to detect a variety of dimensions or levels of abstraction where the influential factors could be framed. The aspects to consider belong to a variety of fields and have a different nature and scope. To better clarify the place of our proposal, it was useful to identify the dimension or levels of abstraction where each influential factor could be pinpointed. Carrying out this classification helped us to better understand the realm of our research problem and the scope of our proposal. Across the primary studies analyzed, we found four levels of abstraction where the factors just identified could be categorized.

The analysis process carried out to do so was documented by means of a mapping table. Table 3.1 has been included in this report as a sample of the mapping tables we developed to document the processing and synthesis of the collected data. As mentioned above, all the mapping tables generated in this process are included in Appendix A. The tables included in this Appendix are labeled as TableLR1, TableLR2, etc, to identify the origin of the table with LR for Literature Review and an ordinal number to sort the presentation of the results.

The conventions followed for all these tables are the same as those depicted in Table 3.1. Thus, each table depicts, in its rows, one of the four identified dimensions linked to a sample of references which helped us to figure this dimension out. The sample table shown in Table 3.1 is not intended to be comprehensive because that would mean registering every single reference where the dimension appears explicitly or implicitly. However, many of these references also appear in the subsequent mapping tables we developed to register the concrete factors assigned to each dimension. Thus, to avoid redundancy, we only registered in this table the primary references where the dimension was identified.

3.3.3.3 Identification and Classification of Influential Factors

First of all, it is worth clarifying what we mean in this research work by the term factor. With the term factor we intend to represent a set of features or aspects, all of the same kind and similarly handled when managing groups of students. That is why some factors are very concrete and specific, while others are more generic or composed of several individual characteristics. For instance, the factor Homogeneity/Heterogeneity is atomic and indivisible, composed of a single characteristic not susceptible to more divisions, but which has an entity of its own and can not be merged with other factors. On the other hand, the factor we called Teacher Constraints agglutinates the variety of conditions a teacher can impose to create groups, for instance “in each of the groups there must never be a single female member” or “in each group there must be at least two people with a high participation level”. As shown in the example, this factor can encapsulate an infinite number of possible elements, but all of them are of the same type and will receive a similar treatment when forming groups.

Dimension	Selection of References
Learning Design	[25], [51], [18], [42], [43], [36]
Static Data from the Student	[97], [136], [159], [103], [11]
Course Dynamics	[95], [59], [3], [1], [21], [119], [120], [120], [5]
Technological Implementation	[43], [16], [159], [135], [7], [8], [147], [22], [63], [62], [104], [78], [85]

Table 3.1: Sample of LR mapping Table (Table LR2)

3.4 Expert Opinions

In order to test and further refine the initial classification of grouping factors, we carried out a second research technique with exploratory objectives by interviewing CL experts with experience in designing massive and on-line courses. Therefore, following the planned research design depicted in Figure 3.1, the literature review was supplemented and triangulated with the opinion of several experts in the research field we are tackling. According to our research designs and following the principles of qualitative research in education [48], [32], we decided to obtain the opinion of three experts by asking them open questions. To do so, a virtual semi-structured interview was designed [6].

In the following subsections, we describe the three stages in which the gathering of expert opinions was accomplished. To do so, a semistructured interview was designed and carried out with three teachers belonging to different universities (*i.e.*, Universidad Carlos III, Madrid, Spain; Universidad Pompeu Fabra, Barcelona, Spain and Universidad Católica de Chile).

A detailed description of the interview design, as well as the fieldwork developed to process the interviews, are available in Appendix B.

3.4.1 Designing the Interview

Due to the main goal of this dissertation, providing MOOC teachers with support in the management of student groups, the objectives of this interview were aimed at knowing, first-hand, their needs, concerns and problems regarding the use of CL and CSCL in this type of course. The information collected by the interviews was used to complement and triangulate that gathered in the literature review. However, it is important to note that the nature of these unstructured interviews was more exploratory than evaluative. For this reason, we did not include direct questions to the experts about the factors just identified. Instead, we preferred to raise open questions about the problem in order to check whether the experts (i) mentioned some of the factors we had identified (*i.e.*, triangulation) in their answers; (ii) talked about new factors not taken into account until the moment (*i.e.*, complementarity). The final goal of the analysis of the information gathered by means of the techniques explained in this section was to characterize the context and to classify the aspects that can be relevant in the creation and management of student groups.

To set the issues, topics and informative questions raised from the specific Research Question conducting this technique (RQ1.2) which helped us to design the interview contents, we used the same method as in our prior data gathering technique, that is, the anticipatory data reduction inspired by the qualitative analysis of Miles and Huberman [94], following the method of Muñoz-Cristobal [99]. As already mentioned above, we adapted the anticipatory data reduction method to be used for the design of exploration, by organizing the data involved in the process in a similar way to how it was formerly

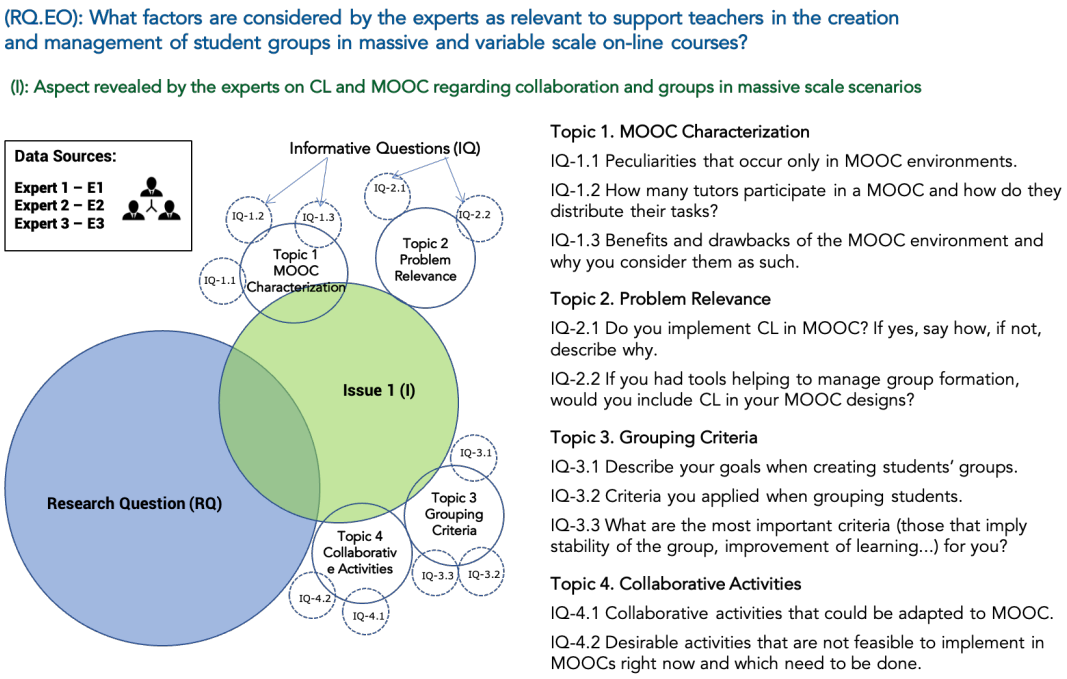


Figure 3.3: Anticipatory data reduction process schema used to set the open questions of the semistructured interviews.

used for evaluation. Thus, following the process depicted in Figure 3.3, we obtained the open questions to be asked during the unstructured interviews.

Four topics raised from the main issue identified and we use them to set the subjects to be tackled in the interviews:

1. Identifying what aspects characterize the MOOC context, making it different from other educational scenarios.

2. Obtaining hints about the problem relevance. Finding out whether the MOOC teachers or instructional designers miss the possibility of carrying out Collaborative Learning (CL) and Group Learning Activities (GLA) on such courses. Checking if they would appreciate to have tools and support to facilitate this objective, or if, on the contrary, they do not even raise this concern and assume that MOOCs are not designed for this type of pedagogical design.

3. Ascertaining the objectives of teachers and instructional designers when forming students' groups (e.g., maximizing interactions, improving student participation and engagement, reducing dropout...). Checking which factors they would take into account to create the groups (e.g., level of education, expertise, culture, learning styles, homogeneous/heterogeneous groups...). Finding out what would be, in their opinion, the most important criteria to form groups.

4. Figuring out which type of collaborative activities would be suitable to be carried out on a MOOC and also which type of activities they would like to develop in such context (e.g., productive or unproductive, preferred duration, collaborative learning patterns...). Checking what would they need to put their collaborative designs into practice.

For each of the topics, two or three informative questions were set. These informative questions became analysis categories, as shown in Table 3.2.

The questionnaire model used to carry out the interviews, as well as, the fieldwork corresponding to the transcription of the three interviews carried out are included in Appendix B.

TopicID	Topic	CategoryID	Category
T1	MOOC Characterization	IQ-1.1	Peculiarities that occur only in MOOC contexts
T1	MOOC Characterization	IQ-1.2	Tutors participating in a MOOC and distribution of tasks
T1	MOOC Characterization	IQ-1.3	Benefits and drawbacks of MOOC contexts and and reasons to consider them as such
T2	Problem Relevance	IQ-2.1	Do you implement CL in MOOCs? If yes, say how; if no, describe why
T2	Problem Relevance	IQ-2.2	If you had tools to help create groups would you include CL in your MOOC designs?
T3	Grouping Criteria	IQ-3.1	Describe your goals when creating groups
T3	Grouping Criteria	IQ-3.2	Criteria you apply when grouping students
T3	Grouping Criteria	IQ-3.3	What criteria are most important to you (those involving group stability, learning improvement, etc.)?
T4	Collaborative Activities	IQ-4.1	Collaborative activities that could be adapted to MOOCs
T4	Collaborative Activities	IQ-4.2	Activities that you would like to use in a MOOC but are not feasible now and requirements for their implementation in MOOCs
T5	Emergent	E	Aspects that arise during the interview and were not planned in advance

Table 3.2: Topics and categories of analysis. List of topics and categories of analysis corresponding to the informative questions of the semi-structured interview.

3.4.2 Development of the Interviews

The selection of experts was carried out considering firstly their research and teaching experience on CSCL; and secondly, their active participation in multiple MOOCs, either in the role of coordinator, designer, or facilitator, etc. The experts were chosen from different universities, other than that of the author of this thesis, where they had a relevant position in the educational strategy with MOOCs. Some of these universities were also required to be outside Spain.

We tried to choose experts with a similar perspective regarding the learning design and the role that technology can play in education. Thus, the interviews would form a consistent set regarding their concrete point of view. On the other hand, the possible bias derived from this decision would diminish its importance because this technique is complementary to the literature review where this constraint was not imposed.

Thus, three experts were selected belonging to the University Carlos III, Madrid, Spain, the University Pompeu Fabra, Barcelona, Spain and the Pontifical University Catholic of Chile, all of them with related perspectives regarding CSCL. Feasibility was a key criterion when carrying out this selection since two of the experts chosen were members of the coordinate project RESET [33], in which this dissertation is framed.

An annotated transcription of all the semistructured interviews can be found in Appendix B and the synthesis of all the factors identified by the experts are mapped in the tables included in Appendix A.

The first interview was conducted on April 8th, 2016 and lasted for 26 minutes. The expert profile was the following: postdoctoral researcher and teacher at the Carlos III University with nine years of expertise in Collaborative Learning. He was also member of the 'Educational technology and teaching innovation unit' of his University, providing support to the teachers who want to develop a MOOC. He supervised the MOOC project from its approval at the university, continuing while it is designed and until it is deployed on the platform. From 2013 he took part in 13 MOOCs, three of them with an active role in the course (*i.e.*, design and tutoring) and in the remaining 10, as a coordinator.

Some of the most relevant evidence from his interview are summarized below:

1. The expert highlighted the need of supporting tools to help teacher managing the student groups. Thus, short collaborative activities could be carried out and the students would be able to proactively enroll in the group they want. The expert explained how the short collaborative activities should be, from his point of view. [Position on the transcribed interview: Page 4, paragraph 5, line 1].

2. He worked with cohorts in massive platforms although not intended for collaboration, but to segregate students for exams or exercises. The group was assigned automatically when the student enroll. Splitting students in cohorts can be useful for segregating contents or for A/B testing.

The second interview was conducted on June 26th, 2016 and lasted for 32 minutes. The expert profile was the following: teacher and researcher at the Information Technologies Department of the Pompeu Fabra University. Her main research lines over more than 13 years have been focused on the use of technology to support Collaborative Learning. She took part in three MOOCs, two of them as coordinator and manager and in the third by providing her learning design tool ILDE [54]

Below, we present some of the most relevant evidence from her interview:

1. The expert believes CL is not carried out in MOOCs due to the lack of knowledge about its pedagogical goodness and also because the difficulties to implement it. [Position on the transcribed interview: Page 3, paragraph 5, line 2]

2. She believes that certain collaborative learning patterns, such as jigsaw, are difficult to scale, while others like pyramid could scale more easily. [Page 4, paragraph 4, line 1] and [Position on the transcribed interview: Page 4, paragraph 6, line 1].

The third interview was conducted on July 26th, 2016 and lasted for 33 minutes. The expert profile was the following: teacher of the department Computation Sciences at the Pontifical Catholic University of Chile. She currently leads the "Education in Engineering" intended to explore how to innovate in education and engineering. She has been working for nine years in Collaborative Learning, from the beginning of her doctoral thesis. She has worked on 15 MOOCs from 2013. In one of them she acted as designer and tutor while in the following 14 she acted as project manager. She also teaches workshops about learning design to the teachers involved in MOOCs of her university.

Here, we list some of the more relevant evidence of her interview:

1. The expert highlights self-regulation and collaboration as key aspects in the MOOC context. [Position on the transcribed interview: Page 3, paragraph 1, line 1].
2. She compares MOOCs to large virtual libraries where each one "takes" what interests them. [Position on the transcribed interview: Page 4, paragraph 1, line 1].
3. Her view about collaborative activities that could be implemented in a MOOC include: long term asynchronous activities, strongly guided and timed activities, discussion or problem-solving activities in groups of about 10 people (taking into account that probably half will not participate). [Position on the transcribed interview: Page 7, paragraph 3, line 1].
4. The expert believes that the monitoring of activities to provide this information to students in order they can self-regulate is essential to transfer the collaborative learning patterns to MOOC context. [Position on the transcribed interview: Page 8, paragraph 1, line 1].

3.4.3 Processing the Interview Results

We synthesized the evidence we found in the semistructured interviews, while keeping in mind the exploratory nature of this stage, intended to corroborate and expand the data gathered through the literature review. For this reason, to document the processing of the collected data, we used similar mapping tables to those in the analysis of the literature review.

These mapping tables are included in Appendix A and labeled as TableEO1, TableEO2, etc. to identify the origin of the table (with the acronym EO for Expert Opinion) and an ordinal number to sort the presentation of results.The set of mapping tables generated to document the processing of the data collected by means of the interviews with the experts shows information about:

a) The factors previously identified by means of the literature review.

b) The informative questions or analysis categories in which the experts framed the concrete factor.

c) The location of the evidence (*i.e.*, page, paragraph and line) in the interview transcription that can be found in Appendix B.

To better understand the utility and content of these tables, we have included a sample of them in this report through the image shown in Table 3.3, as well as the following short description about the content of the EO mapping tables included in Appendix A:

- TableEO1 depicts the MOOC characteristics previously identified in the literature.
- TableEO2 shows the aspects related to the learning design.
- TableEO3 contains the factors related to the static data of the students, collected generally at the beginning of the course.
- TableEO4 includes those aspects we named dynamic related to the activity and behavior of the students during the course.

The rows of each table link the factor previously identified by means of the literature review with the concrete points of the interviews where the expert mentioned this factor. As shown in the EO mapping tables, some of the factors previously identified were not explicitly mentioned by any of the experts. We did not generate any mapping table for the technical implementation factors, due to the nature of the experts and the interviews, mainly focused on pedagogical aspects. Thus, we did not include in the interview any question related to the basic technology needed to implement the envisioned supporting tools we want to develop in future stages of this dissertation.

Students' Static Data	**E1**	**E2**	**E3**
Identifying personal data	IQ-4.2 [pag 7, par 3, lin 1], IQ-1.1 [pag 2, par 9, lin 11], IQ-1.1 [pag 3, par 1, lin 1]		IQ-3.2 [pag 6, par 3, lin 6]
Predefined role			
Previous knowledge	IQ-1.1 [pag 2, par 9, lin 10]	IQ-3.1 [pag 3, par 11, lin 6]	
Learning style	IQ-3.1 [pag 6, par 1, lin 2]		IQ-3.2 [pag 6, par 3, lin 6]
Preferences	IQ-4.2 [pag 7, par 3, lin 2]	IQ-3.1 [pag 3, par 11, lin 9]	
Personality			

Table 3.3: Static factors from the students. List of the student's static factors linked to the experts who identify them indicating the informative question in which they do so and a reference to the evidence found in the semi-structured interview.

3.5 Results and Findings

As a result of this iteration, we produced the first preliminary version of our framework, F1. As shown in Figure 3.1, F1 was composed of three graphical elements intended to synthesize the information collected by depicting, from various views, the main characteristics of the massive, open and on-line courses. These artifacts describe graphically the MOOC context, its dimensions and the grouping factors we detected.

In the following subsections, the elements that make up F1 are shown and described.

3.5.1 MOOC Context (C)

The context was documented by means of a graphical artifact with a circular shape, depicting the intrinsic characteristics of the MOOC context in the center and irradiating their derived characteristics to the outside as shown in Figure 3.4. Afterwards, we transformed the C artifact into other graphical schema in order to improve its legibility, as shown in Figure 3.5. Thus, improving its comprehensibility we could use it as a research instrument with teachers in subsequent cycles. Furthermore, a better readability helped us to include it in our scientific communications.

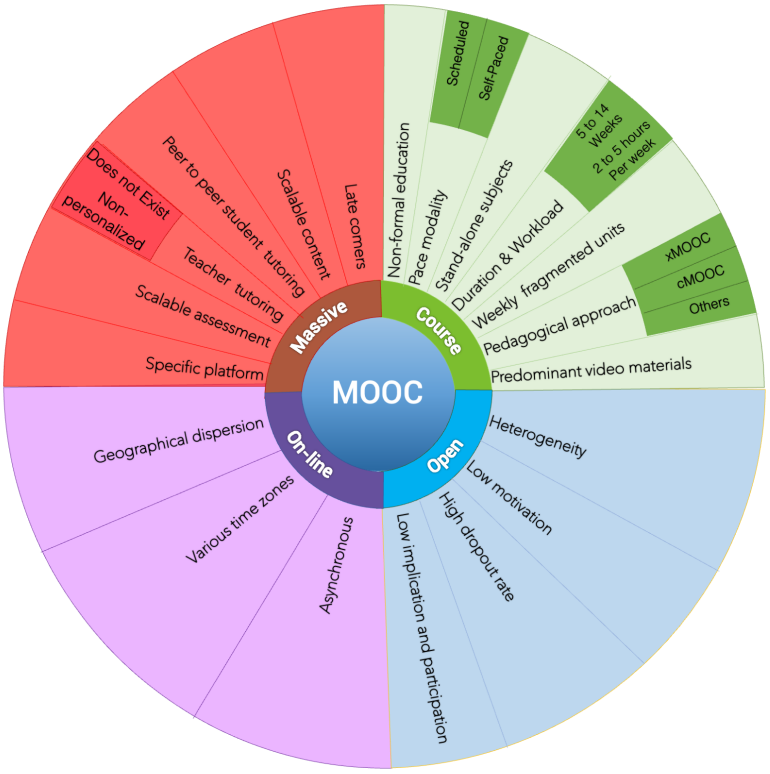


Figure 3.4: Extrinsic and Intrinsic Characteristics of the MOOC context

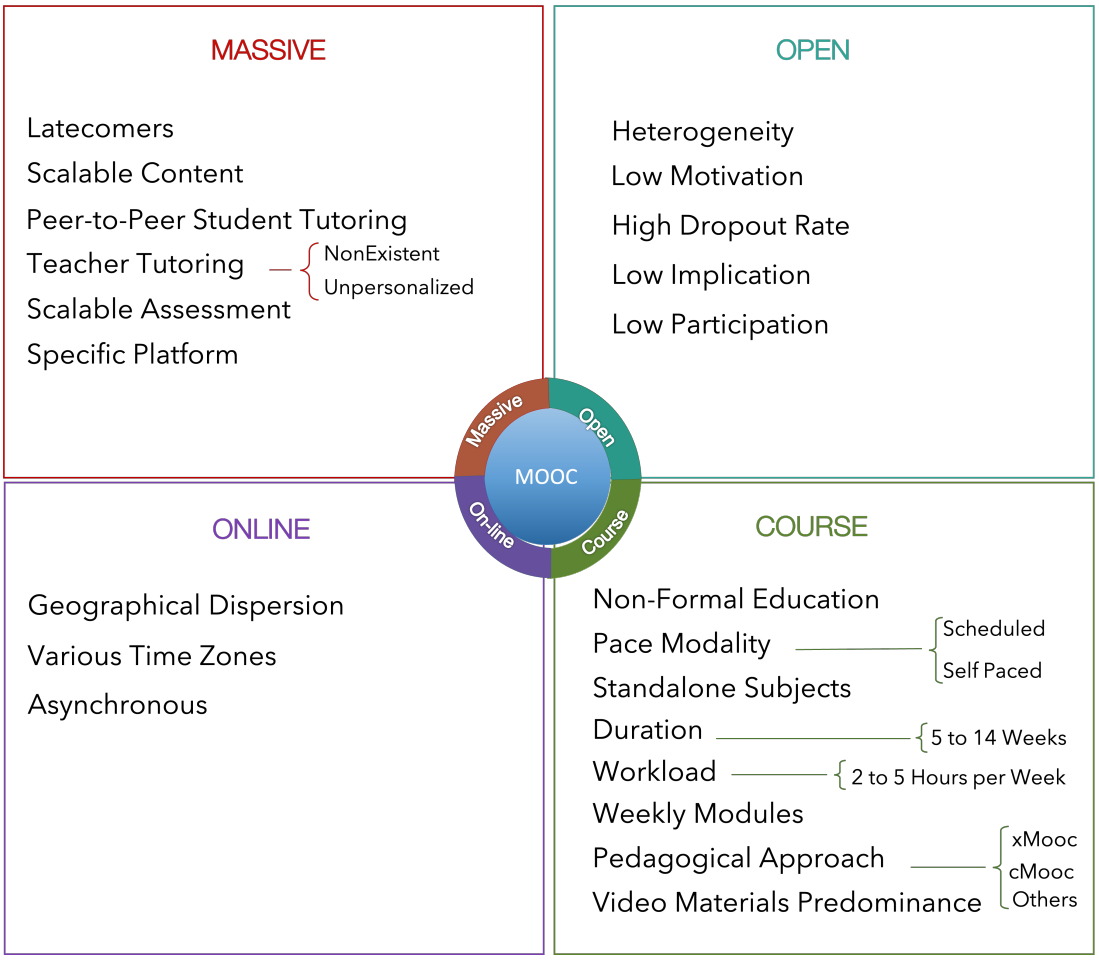


Figure 3.5: Extrinsic and Intrinsic Characteristics of the MOOC context

3.5.2 Dimensions (D)

Using a well-know metaphor of the Information Systems practitioners regarding the levels where the programming languages are included (*i.e.*, high-level and low-level programming languages), we identified several levels of abstraction from the higher, the general or abstract, to the lower, the concrete or physical. Thus, Learning Design factors would constitute the higher level of abstraction, sited pretty close to the mind of the final users, the learning designers of the course. On the other side, the Technological Factors would frame into the lower level, because of their proximity with the computer. We deemed, also, the Dynamic Factors on a higher level of the Static ones, because of their nature, more complex and abstract, and related not only with the student but with the course itself. For instance, we accounted the engagement of a students as a characteristic of a higher level of abstraction and complexity than their personal data or profile, which we reckoned more concrete and closer to the physical properties of the student.

Figure 3.6, depicts the categories where each factor can be assigned. These categories are:

- Learning design factors which are typically selected by the teacher when designing the course.
- Course activity factors that are dynamic and usually emerge during the course.
- Student static-data factors which are captured at the beginning of the course. (*i.e.*, in the enrollment profile or in a student survey) and their value is not updated or monitored during the course enactment.
- Technological (design and implementation) factors that have to be considered when the rest of factors are embedded in an automatic or semi-automatic software tool.

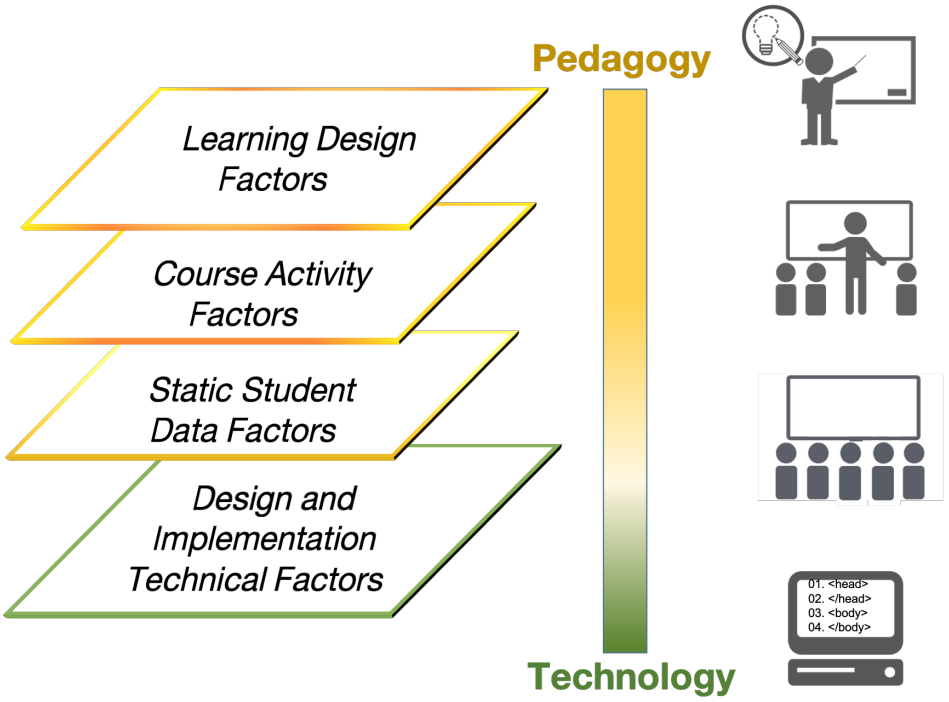


Figure 3.6: Dimensions or Levels of Abstraction where the Factors can be Framed

3.5.3 Grouping Factors (GF)

Once the dimensions or levels of abstraction were delimited, the factors identified by means of the literature review and the experts opinion were framed each into its category. Afterwards, we generated, in an iterative process, a classification schema including two different perspectives: (a) a hierarchical decomposition; and (b) a various levels of abstraction (from pedagogy to technology) perspective.

Figure 3.7 depicts a first hierarchical perspective showing two main branches: the technological (related to the technical design and implementation) to be considered when incorporating the rest of the factors in a computational tool; and the pedagogical, related to the aspects the teacher can take into account for grouping students to carry out collaborative activities. These pedagogical factors can be further classified into different categories, depending on the phase of the course life cycle. Learning Design factors are typically accounted when the teacher designs the course, although they could be reconsidered during the course enactment. The student data captured at the beginning of the course and whose values are not monitored nor updated during the course are reckoned as Static Factors. Finally, the factors related to the Course Activity are the data that emerge by monitoring the students' progress during the course.

The proposed classification poses the relevance of the pedagogical factors, since they occupy 18 out of 21 categories. Moreover, those factors related to the dynamic activity of the course could be critical to characterize and differentiate MOOC scenarios. This type of factors may affect the dynamics of the groups playing an important role in their formation or restructuring. Therefore, we deemed these dynamic factors as the first type to focus on, in order to reach our thesis goals.

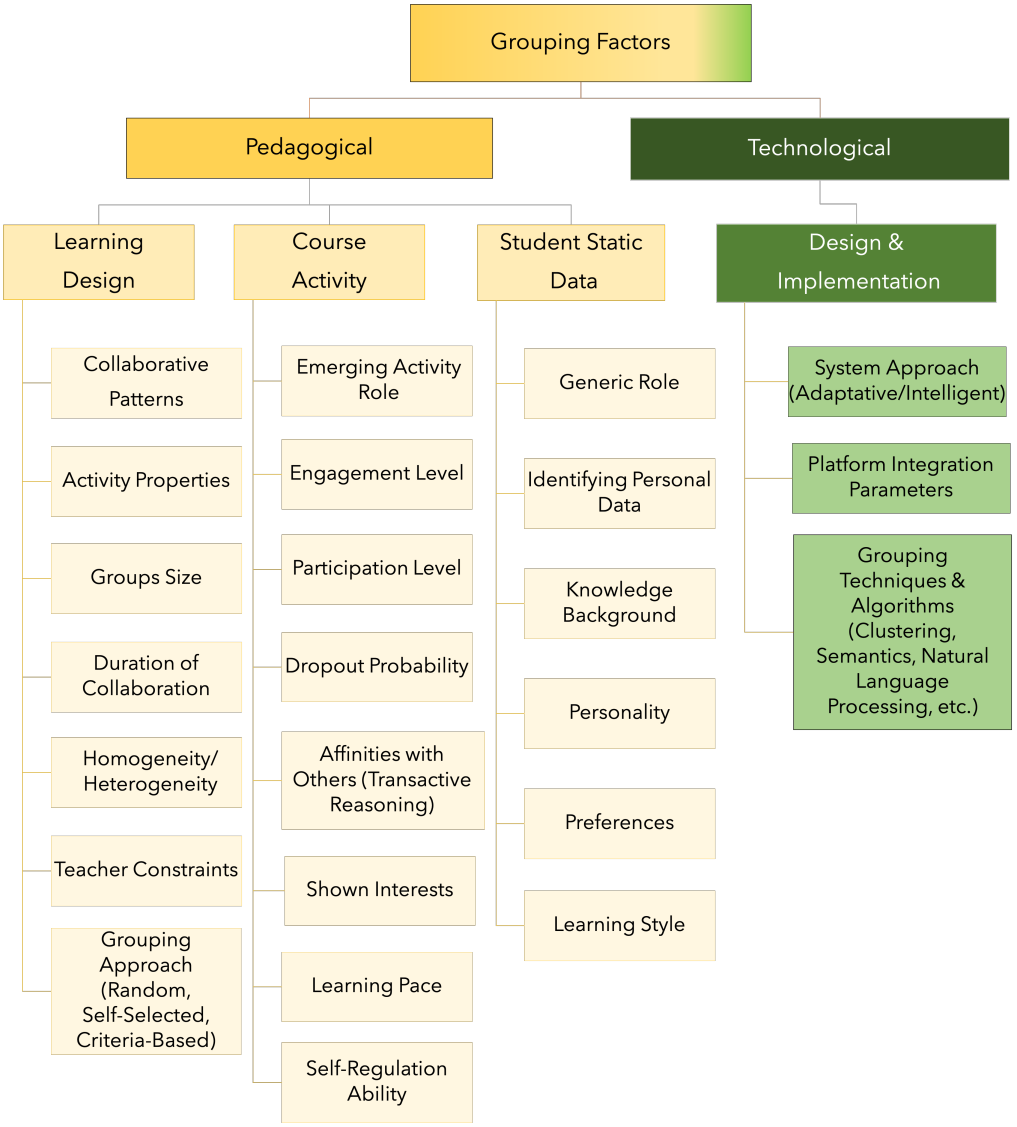


Figure 3.7: Hierarchy of influential grouping factors

3.6 Chapter Conclusions

The first iteration of our process model produced an artifact which constituted the first version of our framework, F1. The research methods used allowed us to delve into the complex problem of creating and maintaining groups in MOOC environments. As explained throughout this chapter, there are many factors that can influence the formation and management of student teams. We deem that these factors should also be considered to create tools to support teachers in carrying out this task.

The finally proposed classification, depicted in Figure 3.7 shows that pedagogical factors can play a highly significant part in MOOC group formation (18 out of 21 categories of factors). Moreover, those factors related to the dynamic activity of the course present critical issues in MOOCs, because they affect

the dynamic restructuring of the teams. For this reason, we believe this type of factors could be the most relevant in order to advance towards our main goal: the development of supporting tools that can be used by teachers in the formation and dynamic restructuring of teams in MOOCs.

However, F1, the artifact produced at this first stage did not seem useful for use by the teachers to give them some kind of advice or support. Therefore, one of the objectives of the next cycle is to transform these graphical elements that make up our first artifact into research instruments to use them across the following cycles.

Chapter 4

Automatic Group Formation Based on Student Homogeneous Activity Criteria. First Study (STD1).

*Summary: In the previous chapter, we described the work carried out throughout the first cycle of our research process, as well as the preliminary findings and outputs produced as a consequence, such as the first version of our framework (F1). In this chapter, we summarize the work carried out across the second cycle of the research process, presenting our first hypothesis. This first hypothesis is related to the relevance of dynamic factors and the impact of using them as criteria to form homogeneous groups. We also document in this chapter the results of a study (STD1) intended to test such a hypothesis in a real MOOC. To that aim, two experiments were carried out in the MOOC in two different weeks. The elements that make up the F1 were transformed at the beginning of this iteration to be used during the cycle as research instruments. The goal of the new research instruments was to help us in two purposes: a) to provide guidance to teachers in the design of collaborative activities carried out in teams in the MOOC; and b) to deploy the teacher designs on the chosen learning platform. To that aim, we created a Teacher Questionnaire and a Tool Prototype using F1 as input. At the end of the second cycle, a new version of the framework (F2) was produced and its graphical elements (*i.e.*, Context (C), Dimensions (D) and Grouping Factors (GF)) were enriched and improved. The second version of F2 also included the Teacher Questionnaire (TQ) we used to co-design the collaborative activities of the MOOC. Moreover, a new artifact labeled T1 was generated which consisted of the first version of a tool prototype that allowed us to deploy and implement the planned grouping strategies in the Canvas Network platform. Furthermore, the profile questionnaire of the three teachers involved in STD1 and the TQ model, together with the fieldwork resulting from the consensus of the three teachers involved to fill such a TQ out, are available in Appendix C; whereas the Pilot Satisfaction Survey and the fieldwork resulting of the judgment of this pilot by five experts are available in Appendix D*

4.1 Introduction

The most relevant issues and results presented in this chapter have already been published in different scientific fora. The work developed during this stage produced two papers presented in international conferences, [128] and [127], and a journal article [125]. These three scientific communications are shortly described in Chapter 7, in the Conclusions section.

In our prior cycle, we found out that most of the factors identified fell into the pedagogical category. Moreover, we deemed that those factors related to the dynamic activity of the course could present critical

issues in MOOCs, affecting the formation and dynamic restructuring of teams. We focused firstly on the dynamic factors of the framework (which can be obtained from the platform analytics), since we consider that they reflect specific contextual features which distinguish MOOCs from other educational scenarios. Many of these MOOC features are directly related to students' attitudes, such as their irregular level of engagement, their variable learning paces, or their high dropout rate. In order to test this intuition, we scheduled an intervention in a real MOOC to analyze a grouping strategy based on one of these dynamic factors.

Throughout the following sections of this chapter, we present: (i) the overall goals of the current cycle, (ii) how we produced the Teacher Questionnaire (TQ) and its structure, (iii) the co-designing of the MOOC in which the intervention took place, (iv) the research designs of the collaborative activity and the experiments carried out in the course, and (v) the results, findings and conclusions of this intervention and of the whole iteration.

4.2 Cycle Goals

Taking into account the outcomes of the first iteration of our research process, we posed our first hypothesis related to the impact of Dynamic Factors in the formation and management of student teams. Our proposal focused on creating groups where all the members demonstrate a similar level of activity. To do so, we estimated one of the best known of these dynamic factors, **the student engagement**, using it as criterion to create homogeneous teams. Therefore, we designed the research process of this cycle in order to test such hypothesis. To that aim, through the second iteration of the process, we carried out a study, in an authentic MOOC scenario, where two similar experiments were implemented in different weeks of the course. This intervention allowed us to gain insight into the impact of using dynamic criteria for grouping students (which would be useful to give advice to teachers) as well as, to test and refine our framework. Furthermore, we also needed a tool prototype to deploy the grouping strategies into the learning platform.

Hence, the second iteration of our process model was conducted by two Research Questions (RQ), as shown in Figure 4.1, which set the objectives of the cycle:

RQ2: *What is the relevance of dynamic factors, such as engagement, to form and manage student groups.*

RQ3: *Is a homogeneous basis shared among members of a group necessary to enable effective collaboration?*

As depicted in Figure 4.1, the study was framed within five of the six phases of our process model, from the definition of objectives, to the communication of results in scientific fora. The study was identified as STD1 and internally labeled as TraduEco, and its nature was mainly exploratory, trying to answer both RQ stated.

To that aim, we decided to use F1 (*i.e.*, the first artifact produced as an output of the prior iteration) as an instrument for this second cycle. However, the graphical elements compounding this first artifact do not seem suitable to be used directly with the teachers as research instruments. Therefore, we needed to firstly transform these graphical artifacts into two instruments:

a) A Teacher Questionnaire (TQ) intended to be used in the design phase of the course.

b) A Tool Prototype (T) aimed at deploying in the platform the grouping strategies designed.

As a result of this iteration, a new version of the framework (F2) was produced where the Context (C), Dimensions (D) and Grouping Factors (GF) elements were refined and improved. F2 also included a new element, a Teacher Questionnaire (TQ), produced by transforming the graphical schemas of F1 into a set of annotated and guided questions. Furthermore, a new artifact labeled as T1 was generated constituting the first version of a tool prototype which allowed us to deploy and implement the planned grouping strategies into the Canvas Network platform.

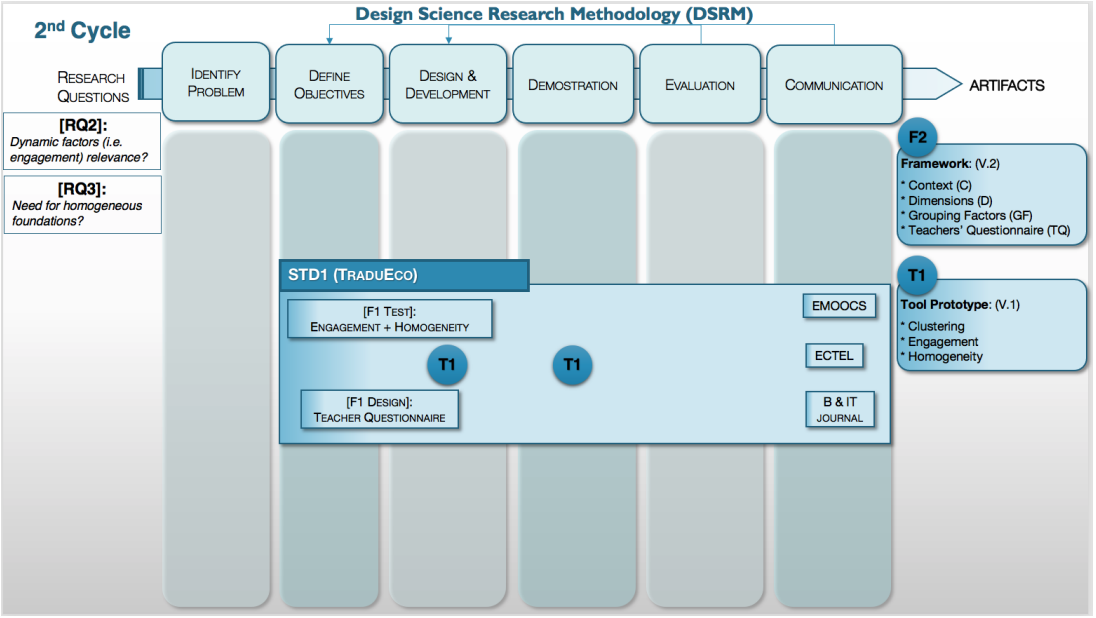


Figure 4.1: Exploratory and evaluative tasks carried out through the second iteration of the process model.

4.3 Drawing Up the Teachers' Questionnaire (TQ)

The three artifacts compounding the first version of our framework (F1) were graphical schemas which helped us to organize and synthesize the information gathered across the prior cycle, in order to better understand the problem context. However, this graphical representations did not seem helpful by themselves to support teachers making decisions about grouping strategies in a MOOC. Therefore, we decided to transform these graphical artifacts into a new textual artifact which collected, some way, the information depicted on those graphical schemas. Thus, we designed a questionnaire where we included questions related to the factors and classifications previously identified. The purpose of the Teacher Questionnaire (TQ) was to be used as a research instrument henceforth, in the second and following cycles of our process model. To do so, we planned to hold meetings and workshops with teachers interested in creating MOOCs that include collaborative group activities. Thus, through the guidance provided by the questionnaire across its advices, questions and even the user own responses, the teacher could envision the future MOOC he/she wanted to carry out.

The first version of the Teacher Questionnaire (TQ) was composed of four well-defined and thematic blocks and a total of 28 questions. At the end of the questionnaire, we included a fifth section composed of four more questions intended to evaluate the questionnaire itself and its utility. Each block started with a summary explanation about its sense and content. Likewise, each question included advise in its own exposition.

Next we describe the questionnaire structure and content:

- **First Block**: Context and Characteristics of the envisioned MOOC. This section contained 13 questions related to the concepts depicted in the graphical artifact of F1, we called Context (C) depicted on Figure 3.5.

- **Second Block**: Learning Design. This block was intended to give advice about the learning design factors corresponding to the branch labeled as "Learning Design" on the hierarchical classification depicted on the Grouping Factors (GF) graphical element of the Framework (see Figure 3.7).

Through seven closed-ended questions, we tried to foster the discussion with the teacher by including a summary guidance previously to pose the question itself, and by urging the teacher to make decisions while analyzing the possible consequences of each choice.

- **Third Block**: Static Data of the Students. The questions of this block refer to the branch labeled as "Static Student Data" on the hierarchical classification depicted on Figure 3.7. The questions of the block were related to those data the student can provide, usually at the beginning of the course, and that will not change during the course. We included on this block seven closed-ended questions aimed at fostering the discussion with the teacher, similarly with the prior block.

- **Fourth Block**: Dynamic Data of the Course. The questions of this block, a total of seven, were related to the "Course Activity" branch of the Figure 3.7. The questions of this block were aimed at assessing the relevance the teacher gives to each dynamic factor identified when forming groups. This relevance would be assigned taking into account the impact this factor can have in the formation of the teams. Through a variety of examples, we tried to provide guidance about the meaning, relevance and possible advantages or drawbacks of each dynamic factor in case it would be used as grouping criteria. The block included two multi-response questions: one to assess "raw" dynamic factors (atomic, directly measurable, such as the total time of the student connected to the course, or the number of pages viewed), and the other to assess the dynamic factors elaborated from the raw ones, such as the engagement, the learning pace or the dropout probability. As in prior blocks, each question was designed to foster the discussion and to urge teacher to make decisions.

- **Final Evaluative Block**: The four final questions of the TQ allowed the users to assess the utility of the questionnaire. The three first were closed-ended questions, while the fourth was an open-ended question where the teachers could express freely their feelings about the questionnaire. The fourth question also acted as a validation element regarding the three previous questions, helping to detect inconsistencies over the teacher opinions.

The questionnaire was planned to be used in two stages. Firstly, by the teacher autonomously with the goal of taking a first contact with the concepts and questions in order to make more productive the second stage. Secondly, we used the TQ in a meeting, a co-design session with the teachers, where each of the concepts and questions included on it were discussed as deeply as the teacher required.

4.4 Co-Designing the MOOC with the Teachers

The intervention documented in this chapter took place in a real massive, open and on-line course. The original course had been initially designed by two teachers and one undergraduate student of the Faculty of Translation at University of Valladolid (UVa) who previously had never worked with MOOCs. The topic of the course was an introduction to translation from Spanish to English over economic and financial texts. So, we gave the course the internal acronym of TraduEco because of its topic in Spanish language. The course was originally conceived as an instructor-led MOOC of seven weeks. We formed a co-design team composed of instructors and researchers, and this team redesigned the course to incorporate CL activities in order to identify the emerging challenges [102].

Prior to the co-design meeting, the three teachers involved received a profile questionnaire they should fill out to gather information about their knowledge and expertise on CL, together with the TQ. All the teachers received the questionnaires at least a week prior to the first meeting with the researcher, in order to have time to read and understand the concepts and questions included on them. The session of co-design of the MOOC lasted for eight hours and was recorded in order to be processed later on. During this session, each of the questions included on the TQ was revised and commented, while taking decisions about the course structure, contents and activities. The teachers filled one agreed copy of the TQ out later on by themselves, after several on-line meetings with the author of this thesis. The models and fieldwork corresponding to this stage are included in Appendix C.

We also used other research techniques (e.g., interviews, observation and meetings with other researchers and CL teachers) intended to gather information about the designing of the collaborative activities to be included in the course. We also maintained a regular interaction with the teachers of the TraduEco MOOC focused on the co-design of the compulsory collaborative activity, which was the basis of the grouping experiments.

The collaborative activity constituting the basis of our experiments is described in the next subsection.

4.4.1 Group Learning Activities (GLA) Description

Once the course was redesigned in order to explore the challenges to achieve collaborative learning, several collaborative activities were co-designed with the teachers and included in the course in order to test the feasibility of different type of collaborative tasks. Thus, a community glossary and several peer reviewed translation tasks were integrated as optional activities. However, the main collaborative activity included in the MOOC learning design, basis for our experimental study, was a compulsory task presented in the fourth and in the sixth weeks of the course.

The mandatory collaborative activity used for the grouping experiment consisted in a terminology extraction from some given texts in teams of six. Each team should create a group artifact including 20 economic or financial English terms and their corresponding Spanish translation referencing the source. The teams should use some of the group-oriented Canvas platform tools (*i.e.*, discussion forums and announcements) for organizing their work, sharing opinions, discussing and reaching agreements in order to select the required terms and choose a spokesman who would be in charge of the task submission. Finally, the activity would be considered as completed, when all members of a team perform an individual revision of the artifact produced by another team. This way, the non-active members of a team would not pass the activity, even if the task was submitted by a member of their group, since the non-active members did not carry out the individual review. The task was assessed as passed/not passed for all the students that completed it and there were no individual or group grades.

4.5 Description of the First Study

This section describes the main decisions taken for the design of the intervention in the just co-designed real MOOC. Throughout the following subsections we describe the study context, our first proposal of grouping strategy, the objectives of the intervention and the methods and data sources used, as well as, the experimental design carried out to accomplish the goals of this study and the analysis methods used to carry them out.

4.5.1 Context

This study was carried out in an introductory-level MOOC that teaches how to translate economy and finance related texts from Spanish to English. This course had been initially envisioned by instructors of the Faculty of Translation at University of Valladolid, Spain. We formed a co-design team composed of these instructors and researchers to review the learning design of the course and improve its instructional quality in several ways including active learning pedagogies [102]. The team decided to design a collaborative activity that was deployed as two identical compulsory assignments on the fourth and the sixth week of the course.

The course was deployed in the Canvas Network platform between February the 6th and April the 2nd, 2017, *i.e.*, a total of eight weeks: seven weeks (one per module) plus an additional week that allowed students to complete any pending activity (e.g., submitting the last assignments, completing peer reviews and answering the final satisfaction survey). The enrollment was closed at the end of the second week. The total number of students enrolled was 1031 (which dropped to 875 until the end of the course) and 132 students achieved the certificate (15.09% of the students remained enrolled till the end of the course).

4.5.2 Proposed Grouping Approach

The proposed approach aims at creating potentially successful groups, in which interactions are more likely to occur, by establishing a basic level of homogeneity regarding students' engagement with the course. This basic homogeneity is implicit in non-open, and in formal educational contexts, where less variance in students' behavior is expected. We deemed that setting this homogeneity is essential to obtain a more reliable student sample by minimizing the harm introduced by absent students (*i.e.*, no-show) [3].

To implement the homogeneous engagement grouping approach, learning analytics were employed to track MOOC learners' activities and to obtain indicators of student activity on the course. Some authors such as Ferguson and Kizilcec explored student engagement and created profiles for learners that reflected their engagement in the course with content, with assessment, and with discussion. Hence, inspired by the research works of Ferguson [41], [42] and Kizilcec [77] we chose three variables to cover three aspects that take part in the student engagement level and would allow us to measure it:

- Number of pages of the course content visited by the student (coded as num_page_view), to measure the content engagement.
- Number of submitted assignments (coded as num_subm_assi), to estimate the assessment engagement.
- Number of posted messages in forums (coded as num_post_mess), to gauge the discussion engagement.

The choice of variables or indicators used to estimate engagement should necessarily be strongly related to the pedagogical design of the course [69]. Thus, due to de fact that all the weekly units of the course subject of our first study (STD1) required the submission of a task, and the only space available in such units for sharing questions, doubts and student impressions were the weekly forums, the indicators chosen to estimate the assessment and discussion engagement properly fit the learning design of the course. On the other hand, and due to the fact that the content of the course was hosted in the set of web pages which conform it, the estimation of the content engagement using the number of pages of the course visited by the students also complied the pedagogical design of the course.

These indicators are used to inform the grouping method to establish some degree of homogeneity among the members of a group. An important issue is to detect the students with no-engagement at all, because they are not really in the course and consequently they do not leave any traces. In other words, it is necessary to identify those students who are enrolled in the course but show no activity (*i.e.*, no-show). This type of students, which hardly exists in formal educational contexts, represents in MOOCs a considerable percentage of the total number of enrolled students, resulting in a handicap to form effective collaborative groups. In the proposed approach, we can identify no-show students as those who have viewed zero pages and therefore they have a zero value in the variable num_page_view.

Next section describes how we applied this approach to the study reported in this chapter, thus showing one possible implementation of this grouping strategy.

4.5.3 Experimental Design

This subsection describes the main decisions taken for the design of the experiment. The first decision was the way in which the strategy described in Section 4.5.2, consisting in applying a criterion of homogeneity over the engagement of the students which form a team, would be implemented. Our first sensing was to create two cohorts, one of them using our approach and the other one as a control group using a random grouping. The random grouping seemed to be a good strategy to be used in the control group, because it is already implemented in the Educational Platform selected (*i.e.*, Canvas Network), and it is a simple and well known technique which takes all the students in the course into account and barely needs the teacher intervention. However, it seems to be obvious that a random grouping that merged all the students enrolled in the course including even those students who never connected the course platform, will produce worse outcomes than any other grouping strategy in which the no-shows students had been

segregated. Therefore, we deemed necessary to improve our control group by segregating the no-shows students in order to find significant benefits of our proposed grouping strategy. Thus, we decided to use a control group "slightly improved".

Hence, instead of the classical division between the experimental and the control group, two distinct strategies were developed to test the impact of homogeneity in the success of the resulting teams (see I1 in Section 4.5.4). The first one, called **Random Strategy (RN-S)**, consisted in randomly selecting the six members of each team. However, to avoid the foreseen negative effects of including no-shows in the groups, the students that had shown no activity at all in the course were taken apart in a previous step. This lead to two slightly homogeneous (in terms of engagement) clusters: students with no activity at all (*i.e.*, num_page_view $= 0$), and students with some activity (*i.e.*, num_page_view > 0]). Within these two clusters the RN-S strategy was applied to create random groups. Thus, with this strategy, a very coarse level of homogeneity within teams was established.

The second grouping strategy, called **Homogeneous Strategy (HM-S)**, aimed to achieve a higher level of homogeneity within the teams by forming groups based on the similarity in students' levels of engagement in the course. Three variables (described in Section 4.5.2) were computed based on the data collected from the course analytics (see data sources Ana1 and Ana3 of Table 4.1 and Figure 4.3) to measure student engagement: num_page_view, num_subm_assi and num_post_mess.

The algorithm selected for implementing the homogeneous grouping was k-means clustering as it has shown to be effective with large datasets [148]. Since the k-means algorithm does not necessarily result in clusters (*i.e.*, groups) with the same size, we slightly modified it to ensure that the resulting clusters had the same size (same size k-means variation [1]). Prior to the clustering process, the three engagement indicators were standardized in order to ensure that they had the same weight in the calculations of the grouping algorithm, as recommended in [96].

Both strategies were applied to the group formation process in two collaborative assignments (see Section 4.4.1 for a description of the collaborative activity) planned for two different weeks of the course (see I2 in section 4.5.4), *i.e.*, at the week four (4W) and six (6W) respectively. It is noteworthy to mention that in both assignments, a window of 21 days was used to trace data about the students' activity in the platform. For the first collaborative activity, this length was the distance between the course start and the beginning of the activity. The same window length (*i.e.*, 21) was also applied when obtaining the trace data in the second assignment.

Before applying the grouping strategies, we divided the global cohort of students into two subsets (one for RN-S and another for HM-S). We ensured that the resulting subsets did not statistically differ from each other in terms of the variables selected as grouping criteria (*i.e.*, [num_page_view], [num_subm_assi] and [num_post_mess]). This was an essential step to avoid any bias that could have resulted from unbalanced distribution of students in terms of their engagement levels across two grouping strategies. Because the three variables followed a non-Gaussian distribution, the Wilcoxon test [12] was used to test the statistical differences. The cohort formed by all the students of the course was first shuffled and then split in two equally-sized subsets. This process was repeated until the Wilcoxon test returned a satisfactory p-value for the three variables used as grouping criteria, which allowed us to reject the hypotheses that the subsets were different.

In summary, the steps followed to carry out the experiment were:

(1) Finding out the statistical distribution of the selected variables: num_page_view, num_subm_assi and num_post_mess).

(2) Standardizing the data, prior to the clustering, in order to assign the same weight to the three selected variables as recommended in [96]. Initially the variable num_page_view had a larger range than the other two.

(3) Splitting the whole cohort of students into two subsets (in which each grouping approach would be

[1] https://elki-project.github.io/tutorial/same-size k means

applied). Checking that they are not statistically different from each other regarding the variables used as grouping criteria.

(4) Using one of the aforementioned subsets to create the six-member teams according to RN-S using the data source Ana1 in 4W and the data source Ana3 in 6W.

   (a) Identifying the no-show students and segregating them from the rest, thus producing two clusters (*i.e.*, no-show students and the rest).

   (b) Creating six-member random teams in both clusters.

(5) Using the other aforementioned subset to create the six-member teams according to HM-S applying as clustering criteria the variables num_page_view, num_subm_assi and num_post_mess gathered from the data source Ana1 in 4W and the data source Ana3 in 6W.

4.5.4 Methods and Data Sources

This section describes the methods and research question used to conduct the study, as well as the data sources used to carry out and to evaluate the experiments.

In order to study the degree to which the homogeneous engagement grouping approach leads to successful collaborative groups, we designed two strategies that implemented the approach with different levels of homogeneity. We also tested both strategies at different weeks of the course to assess the influence of the timing of the group formation on the effectiveness of the approach.

The success of the resulting groups was measured in terms of:

(i) participation level in the collaborative activity (*i.e.*, number of messages posted and number of active participants),

(ii) submission status of the collaborative activity (*i.e.*, submitted or not),

(iii) satisfaction of students regarding the collaboration carried out in their group.

We performed an anticipatory data reduction process [94] and identified two main issues that should be explored through different topics and informative questions shown in Figure 4.2. The first issue (I1) was related to the impact of implementing this approach using different degrees of homogeneity on the resulting student groups themselves and on their members, while the second issue (I2) was related to the influence of the timing of the group formation (*i.e.*, earlier or later in the course) on the effectiveness of the implemented grouping approaches.

We used a mixed-methods approach in order to better capture the effects of the grouping strategies examined in the study. The goal of mixing was complementarity [50] by using several data sources to collect information about group performance, students' participation in group activities and their satisfaction with group experience. Mixed methods allowed us to triangulate and complement results [50]. This approach was a consequence of our underpinning pragmatic world-view, focused on the problem to be solved and on real world practice [28].

Thus, we monitored team performance during the activity retrieving data about:

(i) messages exchanged in each group space,

(ii) active participants in each team, and

(iii) teams that complete the task submission.

Therefore, we gathered both quantitative and qualitative data from multiple sources, shown in the table depicted in Table 4.1. During the enactment of the collaborative activities, data from the platform analytics was collected in order to check the teams' performance and the students' participation. This information allowed us to find out the teams that were active, and the students of each team that

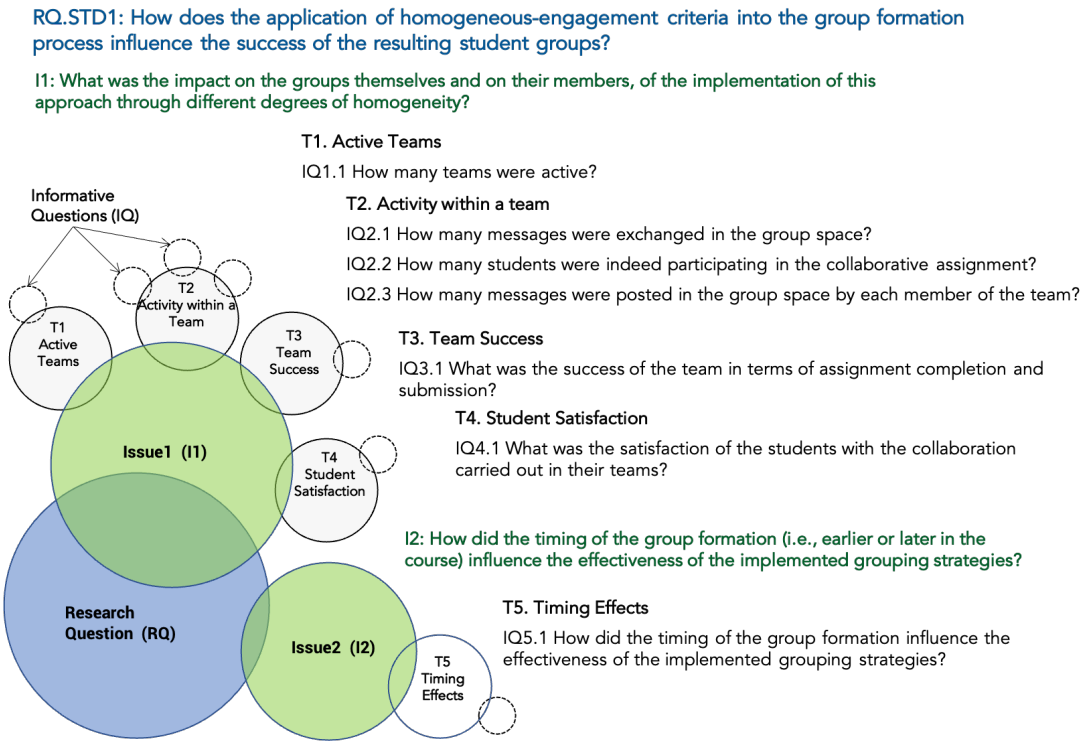


Figure 4.2: Anticipated data reduction process schema used to set the objectives of the intervention

were indeed participating in the activity. We also measured the teams' effectiveness regarding the task completion. We use the term ***active team*** to refer to those groups that exchanged messages in the group space. The term ***active student*** is used to refer to the students who participated in the collaborative activity by posting messages and announcements in the group space. Similarly, the term ***team size*** refers to the number of active students within an active team. We used the term ***small size*** when the team had one or two active students, ***medium size*** for those teams with three or four active students and ***large size*** for teams that registered interactions among five or six active students.

On the other hand, to measure the satisfaction of the students with the collaboration carried out in their group, we gathered the communications sent from students to teachers during the enactment of the collaborative assignments. Furthermore, at the end of the course, we gathered quantitative and qualitative data about students' satisfaction regarding the collaboration carried out within their teams. We asked about and collected data from both experiments by means of open and close ended questions in a final satisfaction survey. The method used to draw up the satisfaction survey was the construction of a pilot version of the questionnaire that satisfaction survey in order to be subsequently validated by means of an experts judgment [40], [114]. The five experts selected must validate each question of the pilot questionnaire by assessing its relevance and clarity with a Likert scale of five points:

1. Irrelevant / Confusing
2. Little relevance / Little clarity
3. Medium relevance / Medium clarity
4. Relevant / Clear
5. Very relevant / Very clear

Source	Description
Surveys SurX	Course surveys composed of open-ended and closed questions in a 4-point Likert scale (1 = strongly disagree, 2 = disagree, 3= agree, 4= strongly agree, + don't know/no answer) were administered: • Sur1 - At the beginning of the course (optional) to get ethnographic data and preferences of the students. • Sur2 - At the end of the course (mandatory) to obtain students' satisfaction with the course.
Platform use Analytics AnaX	GET functions of the Canvas LMS REST API were used to collect indicators about: • Ana1, Ana3 - Students' engagement variables (*i.e.*, num_page_view, num_subm_assi and num_post_mess) used to inform the group formation process. • Ana2, Ana4 - Activity carried out during the group assignments (active teams, activity carried out within a team, effectiveness of the teams), used to evaluate the impact of the strategies approaches implemented.
Communication from students to teachers Com	Emails and personal messages sent in the Canvas platform from the students to the teachers during the collaborative assignments (4^{th} and 6^{th} weeks).

Table 4.1: Data sources used (codes indicated between brackets) to create the groups and to measure the effects of the grouping strategies employed.

The pilot satisfaction survey as well as the judgments of five experts are collected in Appendix D.

The diagram depicted in Figure 4.3 shows the time-line of data collection and other main events (*i.e.*, end of enrollment, creation of the collaborative groups) as related to the course schedule.

We analyzed the aforementioned data to find out the differences between the experimental group (criteria-based) and the slightly-modified control group (random) regarding the following concepts:

- active teams,
- active participants per team,
- interactions within a team,
- task completion rate,
- student complaints, and
- student satisfaction level.

This analysis may provide initial evidence about the impact of using criteria based group formation in order to achieve effective CL in MOOC contexts.

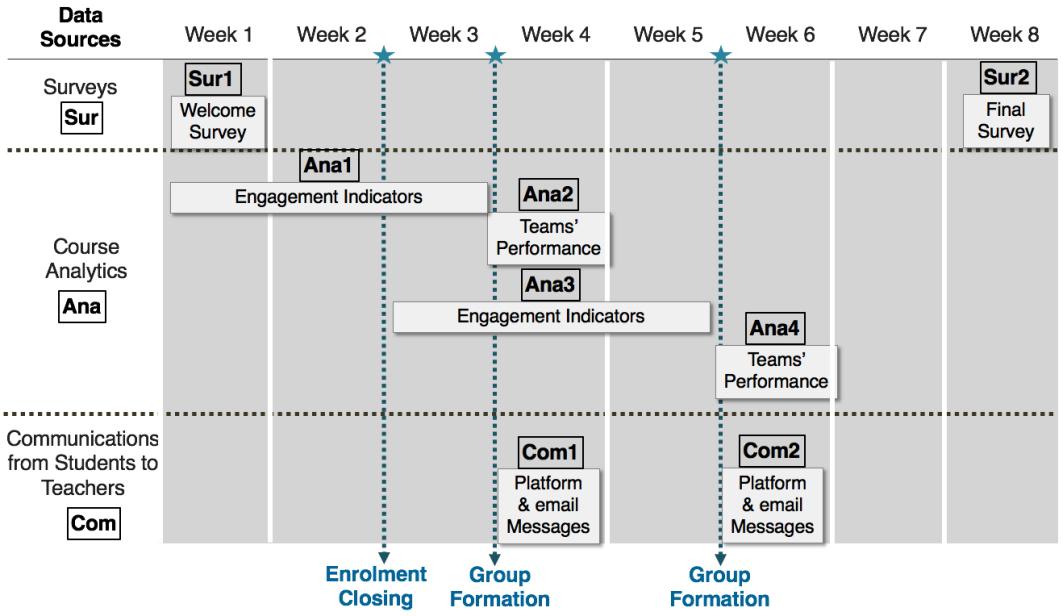


Figure 4.3: Timeline of main events as related to the course schedule.

4.6 Results and Findings

We now present the outcomes of each of the experiments carried out in our first study.

4.6.1 Data Analysis

The first execution of the experiment, carried out in 4W, produced 162 teams (81 per each grouping strategy), while the second one, performed in 6W, produced 150 teams (75 per each grouping strategy). This decrease in the number of teams was due to dropouts.

Activity data of each group (e.g., number of messages exchanged in the group space) were collected from the data sources Ana2 and Ana4 (according to Figure 4.3) in order to respond to the informative questions (IQ) depicted in Figure 4.2.

Table 4.2 provides a summary of the data collected from the Canvas Network platform. These data were used to respond to the Informative Questions (IQ) related to three of the topics of the first Issue (i1) in the anticipatory data reduction diagram, that is IQ1.1, IQ2.1, IQ2.2, IQ2.3 and IQ3.1.

Due to the non-Gaussian distribution of the data and the dependence between the measurements in each category, we carried out Wilcoxon tests in order to find out the statistical significance of the differences between the reported data. We coded the categories of significant differences and stated the appropriate codes in the first column of Table 4.2 between brackets. The codes assigned were:

[1] - Significant difference between RN-S and the HM-S in 4W.

[2] - Significant difference between RN-S and the HM-S in 6W.

[3] - Significant difference between 4W and 6W in RN-S.

[4] - Significant difference between 4W and 6W in HM-S.

According to Table 4.2 the number of active teams (IQ1.1) and the number of teams that submitted the assignment (IQ3.1) were higher in RN-S than those in HM-S. However, the total number of active

	4W		*6W*	
	RN-S	**HM-S**	**RN-S**	**HM-S**
Total number of teams	81	81	75	75
Number of active teams [1,2]	47 (52.02%)	25 (30.86%)	32 (42.67%)	16 (21.33%)
Number of teams that submitted the assignment	46 (56.79%)	26 (32.1%)	30 (40%)	16 (21.33%)
Number of teams that were active but did not submit the assignment	4 (4.94%)	1 (1.23%)	2 (2.67%)	0 (0%)
Number of teams that were inactive but submitted the assignment	3 (3.70%)	2 (2.47%)	0 (0%)	0 (0%)
Number of messages exchanged [1,2,3]	300	372	338	349
Number of active students	76	78	76	71
Number of messages per active student	3.95 (mean) 2.69 (sd)	4.77 (mean) 3.67 (sd)	4.45 (mean) 3.42 (sd)	4.92 (mean) 3.95 (sd)
Median of number of messages per active team	3	10	8.5	15
Number of messages per active team [1,2,3]	6.38 (mean) 5.87 (sd)	14.88 (mean) 14.94 (sd)	10.56 (mean) 9.23 (sd)	21.8 (mean) 16.93 (sd)

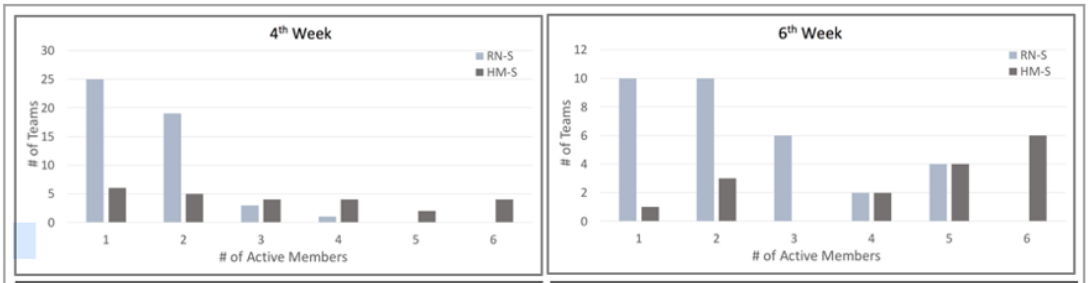
Table 4.2: Data gathered from the Canvas LMS API at the end of each collaborative assignment.

students was nearly the same in both strategies (76 with RN-S vs. 78 with HM-S in 4W, and 76 with RN-S vs. 71 with HM-S in 6W), which suggests that both cohorts of students were similar in their engagement levels, as intended in the group creation process. Nevertheless, the Wilcoxon test indicated that the distribution of these active students across the teams created with RN-S differed significantly from the distribution of those created with HM-S. The higher number of active teams achieved with RN-S can be attributed to the fact that active students were randomly spread across different groups. This strategy led to many groups with low activity. On the contrary, the homogeneity achieved using HM-S resulted in a concentration of these active students in fewer teams. Additionally, the total number of messages exchanged per active team in HM-S was more than twice that of in RN-S. Furthermore, the number of messages per active student was also higher in HM-S. These results suggest that HM-S teams showed a more intense activity. Furthermore, the number of teams that had some activity, but did not complete the task (and therefore, could not obtain the course certificate) was higher in the RN-S (IQ3.1).

Figure 4.4 depicts the distribution of active students across the active teams in both weeks. This distribution of the two grouping approaches was significantly different, as shown by the Wilcoxon test. The analysis of this distribution allowed us to delve into IQ2.2.

As observed in Figure 4.4, RN-S resulted in many small size teams with only one or two active members (44 in 4W and 20 in 6W), whereas HM-S minimized this type of teams (11 in 4W and 4 in 6W). On the other hand, the number of large size teams was higher in HM-S as compared with RN-S (16 vs. 4), and only HM-S resulted in teams with six active members in both weeks. There was a significant positive correlation between the average number of messages per active user and the size of the team (0.79 in 4W and 0.66 in 6W). That is, students who were members of a team with many active students were likely to post more messages in their group space.

To address IQ4.1, we examined the student responses to the final survey (identified as data source Sur2) regarding their satisfaction with the collaborative assignments. The students' responses to the closed-ended questions are summarized in the table depicted in Table 4.3. In this table, the responses of "agree" and "strongly agree" are merged into a single category "agree", and similarly, the responses of



# of active members in the team	1	2	3	4	5	6	ΣActive
# of Teams in the RN-S	25	19	3	1	0	0	76
# of Teams in the HM-S	6	5	4	4	2	4	78

# of active members in the team	1	2	3	4	5	6	ΣActive
# of Teams in the RN-S	10	10	6	2	4	0	76
# of Teams in the HM-S	1	3	0	2	4	6	71

Figure 4.4: Number of teams with a concrete number of active members in each week

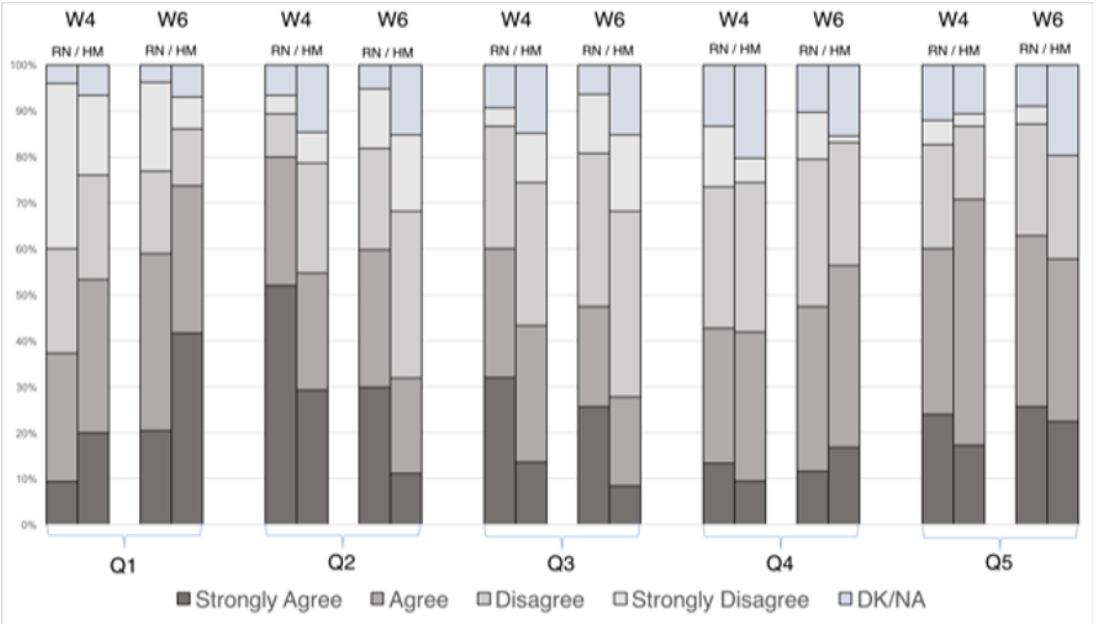


Figure 4.5: Distribution of the closed-ended responses in the satisfaction survey

"disagree" and "strongly disagree" have been merged into a single category of "disagree". The "Don't Know/No Answer" responses are not included in this table. To indicate the significant differences with the Wilcoxon tests, we used the same categories and codes used in the Table 4.2. These codes are shown in the first column of Table 4.2 between brackets. The distribution of student responses is depicted as bar charts in Figure 4.5, in pairs of RN-S and HM-S, as well as 4W and 6W.

According to the results in Table 4.3, the students who worked in teams built with HM-S were more satisfied with their collaborative work experiences, showing a higher percentage of positive responses for Q1 (55% in 4W and 70% in 6W). On the contrary, those who worked in teams built with RN-S were more frustrated with the presence of inactive students in their teams, although this frustration decreased in 6W (from 78.9% to 59,8%) as shown in Q2. Furthermore, these inactive students negatively affected the satisfaction of their teammates during 4W in teams built with RN-S, as they stated in their responses to Q3 (57.7%). These observations can be triangulated with the data obtained from the communication logs

	4W				*6W*			
	RN-S		**HM-S**		**RN-S**		**HM-S**	
	Ag.	**Dis.**	**Ag.**	**Dis.**	**Ag.**	**Dis.**	**Ag.**	**Dis.**
Q1: Satisfaction with the collaboration in my team [1,2,3,4]	35.3%	59.1%	55%	36.6%	61.1%	34.8%	70%	20%
Q2: Inactive students in my team hindered collaboration [1,3,4]	78.9%	12.7%	52.1%	32.4%	59.8%	33.3%	31.4%	51.4%
Q3: Inactive students in my team affected negatively my satisfaction [1,2,3,4]	57.7%	31%	39.5%	43.7%	45.8%	47.2%	28.6%	55.7%
Q4: Collaboration in this activity enhanced my motivation [2,3]	42.3%	42.3%	40.9%	38%	45.8%	43%	54.3%	28.5%
Q5: Collaboration in this activity enhanced my participation	60.5%	26.7%	67.6%	19.7%	62.5%	27.8%	54.3%	22.9%

Table 4.3: Summary of the aggregated responses to the closed-ended questions of the satisfaction survey..

(data sources Com1 and Com2) between teachers and students. These communications revealed the negative effect of inactive students in the team, which was less prominent in homogeneous teams (e.g., "I sent a message to the group forum in order to distribute the work and I have not received any answer. I have been waiting but finally I have decided to complete this activity by myself", "I am very interested in completing this assignment, but in my team, there is not a lot of activity and only one girl has sent her proposal of terms for the glossary. Can I add my own terms and send you our common glossary"?).

On the other hand, for both strategies, the collaborative activity was perceived to have a positive effect on the participation of students, based on their responses to Q5 in both weeks. However, the responses given to Q4 showed that the collaborative activity had a neutral effect on the students' motivation.

The data source Sur2 (final satisfaction survey) also included open-ended questions to ask students which aspects of the collaborative activity they liked or disliked. We processed this information together with the email messages that students sent to the instructors and the (private) messages sent within the Canvas Network platform. Thus, we complemented the data obtained by means of the closed questions to get a deeper understanding of the students' perceptions regarding the collaborative assignments. Table 4.4 shows a characteristic set of comments expressed by the students.

The majority of complaints came from the students who were the only active member (*i.e.*, the only member who posted messages in the group space) in their team. In many cases, the students in teams with one or two active members expressed frustration due to the lack of participation of their teammates, as well as perceptions of losing the opportunity of an enriching activity (e.g., the comments corresponding to students coded as std_1, std_2, std_3, std_8 and std_9 in Table 4.4.

On the other hand, the most positive comments came from the students that belonged to teams with five or six active members. These students expressed their satisfaction with the opportunity to meet their mates, helping each other and learning from different points of view (e.g., std_5, std_6 and std_7, in Table 4.4). Teams with three or four active members provided both positive and negative comments. On the positive side, the students of these teams showed their satisfaction in similar terms to the students of large size teams (e.g., std_4 in Table 4.4), but on the negative side, they expressed some frustration regarding the absence of some teammates (e.g., std_10 in Table 4.4).

In order to measure the change in the satisfaction of the students from 4W to 6W, we divided the respondents into four categories regarding the type of strategy according to which their team was formed in each week, and we compared the responses to Q1 (*i.e.*, Satisfaction with the collaboration in my team) of these four categories. We coded the responses by assigning the following values to the available options:

(i) strongly disagree was assigned the value 1,

(ii) disagree was assigned the value 2,

(iii) agree was assigned the value 3 and,

(iv) strongly agree was assigned the value 4.

Table 4.5 shows three central tendency statistics (*i.e.*, median, mode and interquartile range) about the responses provided by each category of students. The distribution of student responses is depicted as bar charts in Figure 4.6.

In Table 4.5, the number of students in each category, as well as the median, mode and interquartile range of the responses, are provided. Wilcoxon tests were used to check the statistical significance of the changes in the satisfaction of the students from 4W to 6W. The results of the Wilcoxon tests are provided in the last column of the table (bold text is used to indicate significant differences, *i.e.*, $p < 0.05$).

According to the results, there was a significant increase in the satisfaction of students who first worked in a team created with RN-S in 4W and who later worked in a team created with HM-S in 6W (from median=2 and mode=1, to median=3.5 and mode=4). This result was complemented and triangulated with data coming from the Survey Sur2. For example, in Table 4.4, std_11, std_12, std_14, std_15 and std_16 expressed an improvement of their satisfaction during 6W due to their membership in a larger size team. Similarly, students who worked in a team created using RN-S in both 4W and 6W reported an increasing level of satisfaction with their experiences in the group work. On the other hand, students who worked first (*i.e.*, in 4W) in a team that was created with HM-S did not experience a significantly higher level of satisfaction in 6W. In global terms, the satisfaction of all students (independently of the

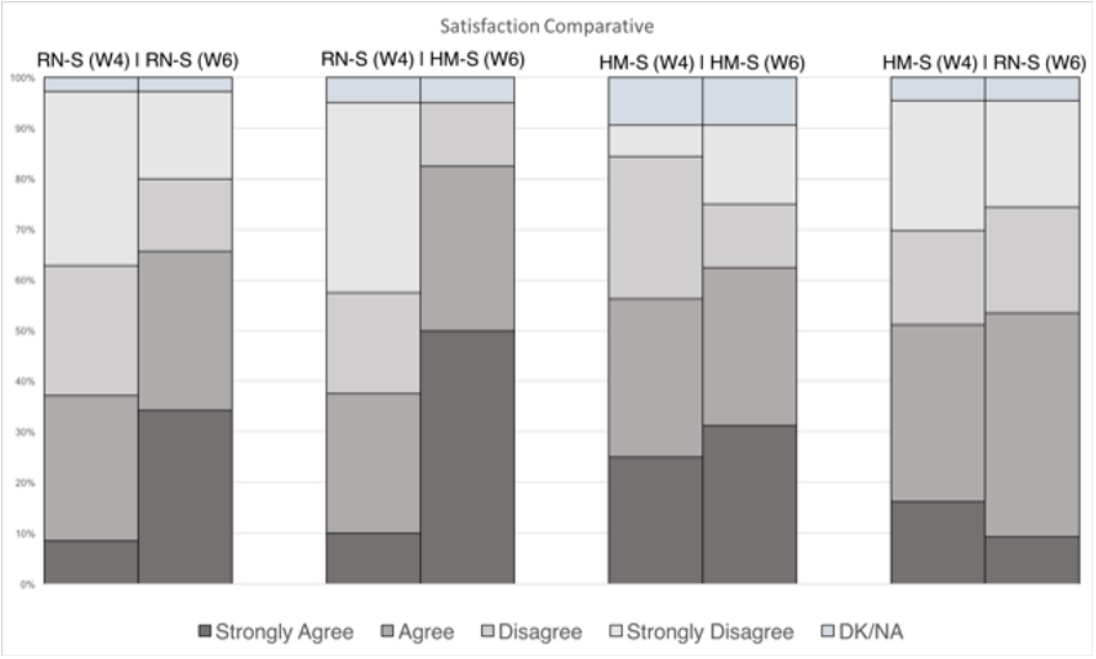


Figure 4.6: Distribution of the Q1 responses for the four categories of students

categories) increased significantly from 4W (median=2) to 6W (median=3).

Student Code	Week	Team type	# Active students	Response
std_1	4	RN	2	My colleagues were absent. At least they could have introduced themselves and said that they would not participate instead of keeping us waiting to see if they appeared
std_2	4	RN	1	No teammates showed up, although I sent them messages in the forum asking for their availability. I should say that it was a especially unpleasant experience.
std_3	4	HM	6	I disliked the lack of participation of many partners They don't answer and it was a handicap to reach agreements about the terms, the spokesman, etc.
std_4	4	RN	3	We were able to coordinate the work and we observed the way of working of others. We learnt from each other.
std_5	4	HM	6	We have been able to learn from each other and to correct the mistakes committed by our colleagues, a process that leads to a higher level of learning.
std_6	4	HM	6	What I liked most was the possibility of having real contact with the classmates. I loved reading many of the translations and the points of view provided by colleagues! There were frankly good translations.
std_7	4	HM	4	Although we are partners from all over the world, we managed to finish the activity and maintain a good communication.
std_8	6	RN	2	Nobody in the group showed signs of life until the last day. On Sunday afternoon, a girl answered and contributed her terms. She and I done all the assignment. We had no news of the rest of the team.
std_9	6	RN	1	I didn't receive any response from my teammates, so I had to do the assignment individually.
std_10	6	HM	4	There were some mates that waited till the end of the activity to make something – we didn't know till the last minute if they were still active in the course or if they planned to do something.
std_11	6	HM	4	This time we were more teammates resulting in an easier work. Very happy.
std_12	6	HM	6	The group assignment of the 6^{th} week was more efficient for our team, although not all the members were able to contribute on time. In my case, I had no time to contribute during the week and I was only able to add my tasks at the weekend.
std_13	6	HM	6	We submit the assignment in the limit because two teammates did not answer until the end. The teammates were fabulous.
std_14	6	HM	6	This time I were in a more active team and this makes the experience more pleasant.
std_15	6	HM	5	In this occasion, I was luckier and almost all my teammates participated. There were some mistakes caused by teammates that appeared in the last moment and tried to participate in the activity.
std_16	6	HM	5	After the assignment of the fourth week where nobody in my team participated, it has been very pleasant to find some partners willing to work and participate to complete the assignment of the sixth week.

Table 4.4: Sample of comments expressed by the students in open-ended questions of the final satisfaction survey.

		Satisfaction in 4W			Satisfaction in 6W			**Satisfaction Difference**
	#Students	**Median**	**Mode**	**IQR**	**Median**	**Mode**	**IQR**	**Median**
RN (4W), RN (6W)	33	2	1	2	3	4	1	1
RN (4W), HM (6W)	43	2	1	2	3.5	4	1.5	1.5
HM (4W), HM (6W)	35	3	3	1.25	3	4	0	0
HM (4W), RN (6W)	42	3	3	2	3	3	0	0
All respondents	153	2	3	2	3	3	1	1

Table 4.5: Descriptive statistics of satisfaction for the four possible combinations of experimental groups in which a student could be in the experiments of the fourth and the sixth weeks.

4.6.2 Study Findings

In this subsection, we present the findings derived from the data analysis in terms of the issues of the RQ and their corresponding topics.

- The first issue (I1) involved testing the influence of the homogeneous engagement grouping approach with two different strategies at varying levels of homogeneity (*i.e.*, RN-S and HM-S).

  To do so, the two grouping strategies were analyzed in relation to the following topics:

T1: Active teams. - The strategy that required a lower degree of homogeneity within teams, *i.e.*, RN-S, produced a high number of teams with a small size (with only one or two active students), whereas the strategy with strong requirements of homogeneity, *i.e.*, HM-S, produced a lower number of teams, but they had medium (three or four active students) and large (five or six active students) sizes.

T2: Activity within a team. - As mentioned above, the activity carried out in teams formed using HM-S was more intense than that in RN-S. This finding is based on several indicators, such as the number of active students per team, the number of messages exchanged in the group space per team, and the number of messages exchanged per student, which were higher both in 4W and 6W in teams formed with HM-S.

T3: Team Success. - The number of teams that did not manage to complete and submit the collaborative assignments was higher in RN-S in both experiments (6 in RN-S vs. 2 in HM-S). It is noteworthy that all these dropped teams had a single active member.

T4: Student Satisfaction. The satisfaction with their collaborative group work was higher in both experiments (4W and 6W) for those students who worked in a team formed using HM-S. On the other hand, the students in teams formed using RN-S expressed a higher number of complaints about the presence of inactive students in their teams. Regarding the students who worked in groups created with different strategies (HM-S and RN-S) in 4W and 6W, the highest increase in satisfaction was observed among those who were in a team created with RN-S in the first experiment and in a team created with HM-S in the second one.

All these results indicate that the number of active students in a team was a key element explaining the level of interaction among team members (the number of messages exchanged) and the satisfaction of the students with the collaborative activity. The presence of various inactive students in a team may negatively affect students' satisfaction. With HM-S, which employs a greater degree of homogeneity in terms of students' level of engagement, we were able to minimize the number of teams with a single active student and obtain many large size teams. Therefore, we may conclude that stronger degrees of engagement homogeneity have a positive impact on group performance, group interactions and student satisfaction in MOOC contexts.

- The second issue (I2) was related to the influence of the timing of the CL activity and the group formation on the effectiveness of the implemented grouping approaches.

  To that aim, the following topic was analyzed:

T5: Timing Effects. - The results showed that the timing of the group formation had a strong influence on the effectiveness of the strategies: the collaborative groups functioned more successfully (higher number of messages exchanged, higher numbers of active members, and higher satisfaction with group work) in the second experiment carried out in 6W. This improvement was higher in the RN-S approach due to the increase in the accuracy of the segregation process (*i.e.*, having more teams created from no-show students) that caused a higher concentration of active students per team.

In both experiments, we gathered data from the platform analytics that were accumulated during the 21 days just before the collaborative activity and used these data to feed the grouping strategies (e.g.,

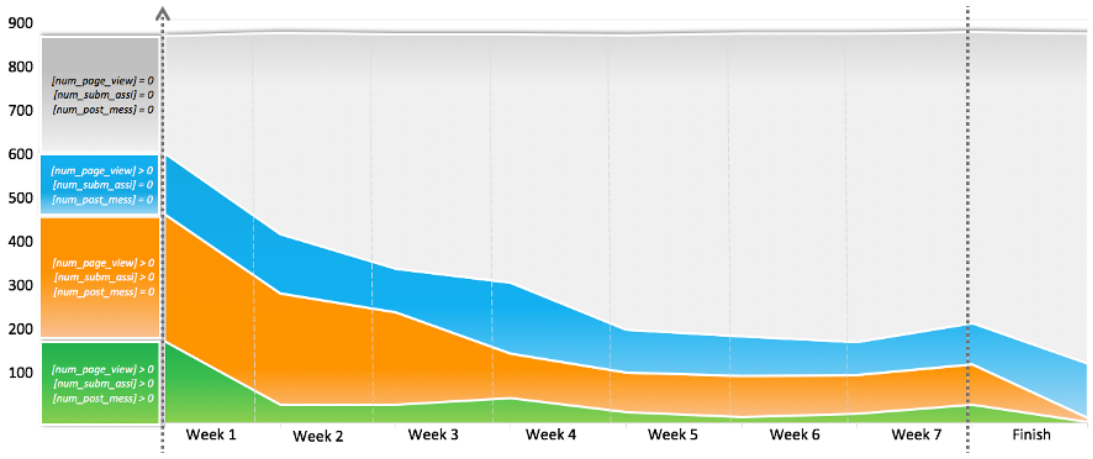


Figure 4.7: Patterns of engagement identified in the Translation MOOC

the variable num_page_view was used to segregate students). In the first experiment (4W), this interval corresponded to the beginning of the course, while the enrollment was still open till the 14th day of the course. During this period, it was likely that student participation in the course would not be stable (see Figure 4.7). On the other hand, the second experiment in 6W used data accumulated during the middle of the course; therefore, these data were from students with more consistent behavior, which helped us to better distinguish the no-show students from the rest. This was an expected result because in MOOCs, at the beginning of the course, there exist many students browsing the course content and learning resources with no clear goals. Some of these students, although they have been active during the first weeks, may drop out. However, around the middle of the course, the behavior of the students tends to stabilize and the ratios of each behavioral pattern remain more or less constant till the end of the course [59].

Considering the aforementioned analysis of the two main issues related to the RQ, we may state that HM-S was shown to be more effective in terms of team size, team performance, team interactions and student satisfaction. This strategy, which implemented a higher degree of homogeneity, was more effective when applied in the second half of the course.

4.6.3 Study Discussion

The study has revealed that setting homogeneity based on students' engagement led to an improvement in the performance and satisfaction of the groups. Furthermore, the number of group members that show activity and interact in the group space (*i.e.*, what we called team size) seems to be a key aspect regarding the density of messages exchanged among the team members and the opinion of the students about the collaborative activity. Moreover, the presence of various inactive students in a team negatively affects the students' satisfaction, in a significant manner.

The aforementioned findings of this study suggest that it is necessary to overcome the difficulties introduced by the variability of the open context [38] in order to create groups with the potential to interact and carry out CL in a MOOC context. To do so, the grouping strategy should aim to reduce the number of inactive students within a team by identifying and segregating no-show students [59], [3]. In this regard, requiring homogeneity based on students' engagement was found to be effective. Here, it must be said that this homogeneity in students' engagement does not impose any restriction regarding the degree of heterogeneity in the background of the students participating in a group. Therefore, with the homogeneous engagement grouping approach, it is still possible to take advantage of the diversity offered by MOOCs to enrich the group interactions.

However, most previous research on group formation in MOOCs [135], [136], [148], [159] does not acknowledge the fact that a high variability in MOOC learners' engagement is a critical issue to address

in the creation of successful collaborative groups. Sinha's [135] proposal aims to automatically group students with peers who have prior social connections. The model proposed by Spoelstra et al. [136] applies criteria based on knowledge, preferences and personality. These proposals do not provide a solution for the students with no social connections or for those that do not answer the surveys (as in the case of the no-show students), respectively. Furthermore, they did not present any experimental studies in order to evaluate the success of the teams created with the proposed approaches. Zheng's [158] method addresses the problem of re-composing the groups due to dropouts. However, this method did not consider the dynamics of the course for the group formation, nor did it take into account other main issues in MOOC contexts, such as the varying level of students' engagement and its impact on the satisfaction of the students with the collaborative experience. Wen [148] tested her approach using a crowd-sourcing service (Amazon Mechanical Turk) and acknowledged that "Crowd-sourced experiments may not represent how MOOC students will adopt or enjoy the designs". Therefore, this study does not contribute to the solution of the issue about the varying students' engagement level that indeed exists in MOOCs.

Finally, Wichmann and colleagues [154] compared the performance of heterogeneous and homogeneous groups based on the engagement of students with forums. Their results showed that, overall, heterogeneous groups were either similarly or a bit more productive than homogeneous groups. They also found that homogeneous groups classified as high-engagement level were as or more productive than heterogeneous groups, and that students classified as low-engagement level were more productive in homogeneous groups, suggesting that grouping less active students together makes social loafing more difficult and students participate more. However, it must be noted that this work did not take into account the engagement with either content or assessment. Furthermore, it did not deal with the problems that no-show students introduce in groups. Moreover, the subjects of their study were students of two universities that would obtain credit for participating in the MOOC, so the patterns of engagement of these learners differed significantly from conventional MOOCs.

In summary, our approach is novel in considering the variability of engagement MOOC learners, and this study is the first to provide initial evidence of the impact of different grouping approaches in group performance in a real MOOC context.

4.7 Chapter Conclusions

In this chapter we described the first hypotheses we proposed and tested: a grouping approach that applies homogeneous-engagement criteria to create successful teams in MOOCs. Informed by this approach, two grouping strategies were developed and used in a collaborative activity deployed in a real MOOC context at different points of the course time-line. The results showed that HM-S, the strategy with a higher degree of homogeneity, grouping students with similar levels of engagement, achieved the best results in terms of group performance, group interactions and student satisfaction. Therefore, higher degrees of homogeneity for students' engagement produced more successful teams, regarding the terms analyzed in this study. The success of the teams further improved when the collaborative activity was in a later phase of the course, because the grouping criteria used logs from the middle of the course, when the student engagement was more stable. These results contribute to the MOOC literature by highlighting the importance of establishing a homogeneous engagement base in group formation and the influence of the timing of the collaborative activity.

This study has several limitations. First, the data used for establishing the homogeneous engagement base was limited because we only considered three variables regarding the engagement, and all of them have been used with the same weight in the clustering process. Therefore, other students' digital traces from the platform analytics (e.g., video logs, private messages to teachers) should be further explored to form a more rigorous approach for setting the homogeneous engagement.

Moreover, we used quantitative data (e.g., number of messages shared in the group space) when assessing the activity level of groups. Along with the quantitative indicators, future research should also look into the quality of the messages exchanged among team members through qualitative data analysis methods. Furthermore, the proposed homogeneous-engagement approach was tested in a specific type of

collaborative activity in this study. To further support its relevance and effectiveness, this approach should be tested, in future research, in other types of collaborative activities that use different Collaborative Learning Flow Patterns (e.g., pyramid, jigsaw).

In this study, the homogeneous-engagement has been the only grouping criteria applied to form the groups. However, it could also be the first step in the whole group formation process, prior to applying other possible grouping criteria. Future work plans include the application of two levels of criteria. The first level would set the homogeneous-engagement ground needed to build successful teams. Once this homogeneity has been established, we will be able to apply a second level of criteria to implement the pedagogical objectives of the collaborative activity, taking advantage of the massive scale and enriching heterogeneity of MOOCs. Future research should also explore other possible solutions to avoid small team sizes (of one or two active members) such as re-organizing teams when isolated students are detected.

However, the choice of factors to be used as grouping criteria, as well as the variables selected to estimate these factors require a thorough decision process that should be clearly argued and, if possible, built on evidence.

This intervention allowed us to gain insight into the impact of using dynamic criteria for grouping students (which will be useful for giving advice to teachers) as well as to test and refine our framework and the first tool prototype.

We plan to continue iterating to explore the problem and to validate the prior artifacts generated. To do so, we are now designing the third cycle of our research process by planning a new intervention where we would use both dynamic and static data as criteria, considering both homogeneity and heterogeneity, as well as various learning design factors.

Chapter 5

Multilevel and Heterogeneous Profile Criteria. Second Study (STD2).

Summary: After presenting our first hypothesis of a grouping proposal suitable for MOOCs in the preceding chapter, here we document a second study in a real MOOC where new hypotheses and grouping strategies were tested. The grouping policy of this second study was wholly designed by teachers and instructional designers with a wide expertise in Collaborative Learning (CL) and Group Learning Activities (GLA). Furthermore, our Guidelines Model, its proof of concept, the Design Guide, as well as the fieldwork resulting from its use by the teachers and instructional designers of this MOOC are available in Appendix E.

5.1 Introduction

The most relevant issues and results presented in this chapter have already been published in a scientific journal article [124] which is briefly described in Chapter 7.

In the preceding chapter, we documented how our first hypothesis was tested by means of two experiments carried out in a real MOOC. Once the results of our first proposal enlightened the benefits of a grouping strategy based on setting a homogeneous grounding regarding the students' activity, we planned new experiments in order to test new hypothesis and grouping policies.

To that aim, we decided to conduct a new study in a MOOC scenario and give control to the teachers in charge of creating the contents and teaching the course, so that they could explore their own grouping strategies. Thus, we designed our second study in a real MOOC, where we would provide support to the teachers and instructional designers, while checking their grouping preferences. To do so, the teachers were urged to check other types of factors and grouping criteria, such as those included in the category *student static-data factors* (see Section 3.5.2 on page 43) that we identified in previous chapters. To that aim, we developed new functionalities for our tool prototype, including the possibility of deploying grouping strategies able to apply the criteria selected by the teachers at various levels of priority. The tool also allowed the selection of both, static and dynamic factors, to be used as grouping criteria so as to offer teachers a wide range of possibilities. In this way, the teachers could check the grouping strategies they used to implement in their face to face (f2f) classes.

Therefore, the third iteration of our research process, documented in this chapter, was intended to test a second hypothesis of grouping strategy wholly designed by the teachers that created the MOOC contents and taught the course. To do so, the artifacts produced as a consequence of the second cycle were enriched and their elements improved, as explained in Section 5.3.

The rest of the chapter describes the goals of the third iteration, the updates and improvements of our framework, and the description of the second study (including its context, objectives, experimental design, etc.). Then, the results and finding of this study are presented, finishing with the chapter conclusions.

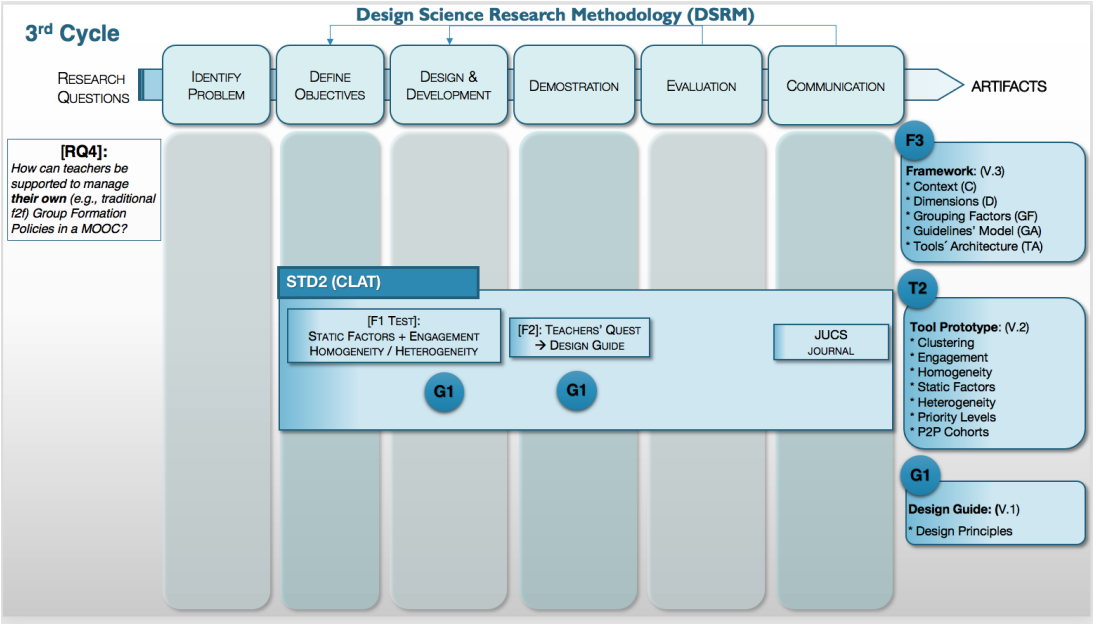


Figure 5.1: Exploratory and evaluative tasks carried out through the third iteration of our process model.

5.2 Cycle Goals

Taking into account the outcomes of the prior iteration of our research process, we decided to conduct a second study in a real MOOC. In order to harness their expertise, we deemed this new MOOC should be wholly designed by teachers and researchers very experienced in CL, although we would support and give them advice based on our previous findings. To that aim, we planned several co-design sessions in which we advised the teachers by means of our newly created Design Guide, while sharing the outcomes of prior cycles with them. However, the teachers chose a grouping strategy quite similar to that they had implemented in their formal classes for years, although they also tested new possibilities such us the incorporation of various levels of priority, where the grouping criteria had to be applied. Although the grouping policy proposed by the teachers consisted of three levels of priority with several criteria at each level, to sum up, we could say that their proposal focused mainly on the creation of heterogeneous groups in terms of some characteristics of the students' profiles, a well known strategy in face-to-face scenarios. Thus, we were able to explore the impact and suitability of using some of the Static Factors identified in our framework as grouping criteria in the formation and management of student teams.

Therefore, across the third cycle of our research process, we carried out a second study in a real MOOC. This iteration was conducted by two research questions, as depicted in Figure 5.1, which set the objectives of the cycle. Thus, across the third cycle we aimed to find out:

RQ4: *How can teachers be supported to manage **their own** (e.g., traditional f2f) Group Formation Policies in a MOOC?*

The nature of this second study was half exploratory, half evaluative, in an attempt to discover new guidelines to form teams of students where collaboration could take place, while validating previous findings and artifacts.

5.3 Framework Updates

As in previous cycles, to tackle the challenges of the new iteration, it was necessary to improve and enrich the elements of the framework. Thus, new elements were produced, whereas others were improved or enriched.

The first main element produced at this cycle was the Guidelines Model (GM). This conceptual element belonging to the third version of the artifact, which we called Framework (F3), was created by referring to the Teachers' Questionnaire in a bottom-up process, from the concrete or particular to the abstract or general. To conform properly with the GM, it was also necessary to take the remaining elements of the F3 artifact (*i.e.*, Context, Dimensions and Grouping Factors) as references. Furthermore, when the GM was completed, we produced a proof of concept of this model in a top-down process (*i.e.*, from the general to the particular), thus creating a Design Guide that we could include in a new artifact identified as G. Hence, the DG was created from the pattern GM and it was particularized to our environmental conditioners, such as the Canvas Learning Platform, where our first study (STD1) took place and where we planned to deploy our second study (STD2).

On the other hand, another main element produced at this stage was the Tools Architecture (TA). However, the Tool Prototype (TP) developed in the preceding iteration (see the element T1− >TP in Figure 4.1) did not help us to create the architecture model because, at that stage, it was only composed of a set of ad-hoc routines. The TA conceptual element of the F3 artifact was developed using a well-known software design pattern identified as ADAPTER [47]. Thus, we created from scratch a model schema devised to be independent of the learning platform on which it was to be applied by means of two adapter modules. The encapsulation of the well defined and desirable features of the envisioned tools enabled the portability of this solution by simply changing the internal code of its adapter modules. In this way and taking the TA as a reference, we improved our Tool Prototype by structuring and modulating the code to fit our TA, while also enriching it with new functionalities. As a consequence, we obtained the second version of our TP, which served as a proof of concept of the newly envisioned architecture. As shown in Figure 5.2, the TA element constituted a high-level design of the envisioned group-management supporting tools structure. It uses the pedagogical Grouping Factors (*i.e.*, Learning Design, Dynamic Data and Static Data) as data inputs for the system. The model schema is composed of several modules, including the aforementioned adapters aimed at importing/exporting data from/to the MOOC platform.

Each module of the TA encapsulates the main features of the envisioned supporting tools as follows:

(a) The two adapters, the Gathering data adapter and the Dynamic deployment adapter, which include the functionalities needed to gather information from the learning platform and to put the grouping policy designed into the platform.

(b) An Interface module aimed at capturing the learning designs the teacher wants to put into practice to deploy his/her grouping strategy.

(c) The Dynamics processing module to gauge and estimate dynamic factors (such as the engagement, the emerging role or the dropout probability of each student) by using the raw dynamic data (such as the number of pages or videos viewed or the connecting time of the students, for instance) collected from the platform.

(d) The Grouping module, to configure the group structures based on the collected data and the specifications given by the teachers.

(e) A Controller module intended to manage and coordinate the system operability.

Due to the fact that new artifacts and elements of those artifacts are produced at each cycle of the process, at this point, we deemed it necessary to identify the framework and its elements with a name, a personal brand, in order to simplify and clarify the references to such artifacts and elements that we would use in our scientific communications. The name assigned was MyGang, as an acronym for the words Mooc analYtics for Group Assignment and moNitorinG. Through MyGang we aimed to organize the available information regarding the issue of managing collaborative groups in MOOCs. It has been

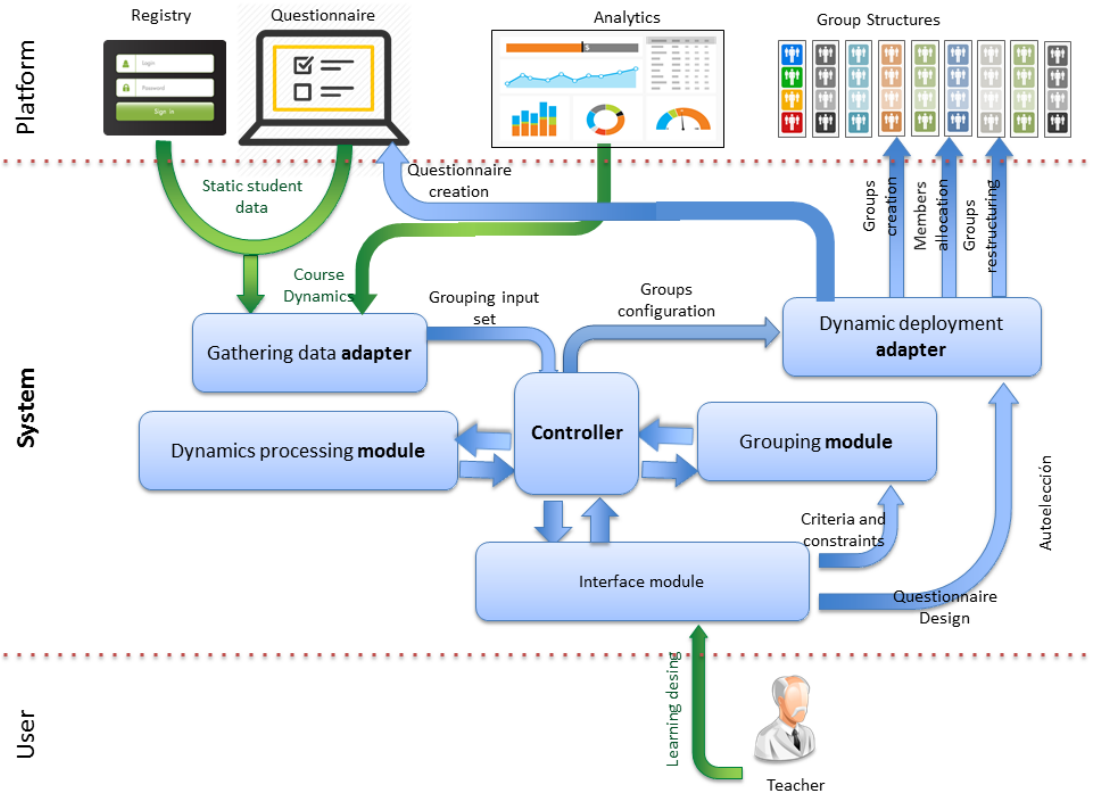


Figure 5.2: Architecture model schema for the envisioned supporting tools.

developed based on the literature review and expert opinions, and it has been enriched and evaluated through iterative interventions. The framework is currently composed of three artifacts and one of these artifacts, concretely the F artifact, is in turn made up of several identifiable elements.

Thus, the MyGang Framework structure and components at the current stage could be summarized as follows:

1. **MyGang.F** constituted an artifact composed of five elements aimed at organizing the available information regarding the issue of managing collaborative groups in MOOCs. The components of MyGang.F at this stage were the following:

   - Context (MyGang.F− >C): Extrinsic characteristics that affect the management of groups were identified per each intrinsic feature of the MOOCs.
   - Grouping Dimensions (MyGang.F− >D).
   - Grouping Factors (MyGang.F− >GF): Both pedagogical and technological factors to consider in the management of collaborative groups in MOOCs were derived.
   - Guidelines Model (MyGang.f− >GM).
   - Tools Architecture (MyGang.F− >TA): Architecture model schema for the envisioned supporting tools.

2. The artifact we identified as **MyGang.T**, containing the Tool Prototype, was simply enriched by adding several functionalities for:

- applying criteria with different levels of priority,
- the use of static and dynamic grouping factors,
- the requirement of homogeneity or heterogeneity over each individual grouping criterion,
- and the formation of student cohorts aimed at carrying out student peer reviews within their cohorts. In our case, and due to the fact that the course presented its contents in two languages (*i.e.*, English and Spanish) and students who knew only one of these languages were accepted in the course, it was imperative to guarantee the peer reviewing of their assignments to be conducted by a student who could understand the language in which the assignment was written.

3. **MyGang.G**, which includes the proof of concept of the Guidelines Model (MyGang.F− >GM), and in which the teachers' Design Guide evaluated across this cycle.

Having explained the newly updated framework, in the following sections, we present our second intervention in a real MOOC, as well as the results and findings of the experiments carried out.

5.4 Description of the Second Study

5.4.1 Context

The study was carried out in a five-week MOOC named "Innovative Collaborative Learning with ICT" offered by the University of Valladolid, Spain; although we identified it internally with the acronym CLAT (Collaborative Learning And Technology). The course was delivered in both English and Spanish. The course targeted innovative pre-service and in-service teachers interested in incorporating collaboration with technology into their own teaching practices. The two instructors of the course were very experienced in CL and ICT, but this was the first MOOC in which they had participated. We formed a co-design team made up of these instructors and the researcher in order to design a GLA to be deployed in the second week of the course.

The course was deployed in the Canvas Network platform between June 12th and July 24th, 2017, *i.e.*, a total of six weeks: five weeks (one for each of the five modules) plus an additional week to allow students to complete the peer review of the final project and fill out the final satisfaction survey. The enrollment was closed at the end of the first week to allow us to properly configure the groups for the collaborative assignment of the second week. A free certificate was given to the students who completed the mandatory assignments (one per week) in addition to the two surveys.

The participation in the course and the completion rates were low compared with other courses of short duration. This could be attributed to the period in which the course was deployed (June and July), when the target students (*i.e.*, in-service teachers) had a high workload. The patterns of student engagement in the course were proportionally similar to those reported in the literature. The total number of enrollments was 759, but only 671 of them remained enrolled at the end of the course. 174 students filled out the initial mandatory survey (needed to configure the groups) and 52 filled out the final satisfaction survey, however only 29 of them (3.8% of those enrolled) achieved the requisites to obtain the certificate.

5.4.2 Experiment Objectives

As explained in the first chapter of this report, the main goal of our research project was to support teachers in the design and implementation of Group Formation Policies to carry out GLA (Group Learning Activities) in MOOCs. To that aim, we carried out this second study in a real MOOC with the aim of continuing to explore the problem and testing the usefulness of two instruments, a Design Guide and a technological Tool Prototype, intended to support teachers in two stages (design and implementation, respectively).

Therefore, taking into account our overall research question (*How can teachers be supported in the design and implementation of Group Formation Policies in MOOCs?*), we raised the specific objectives

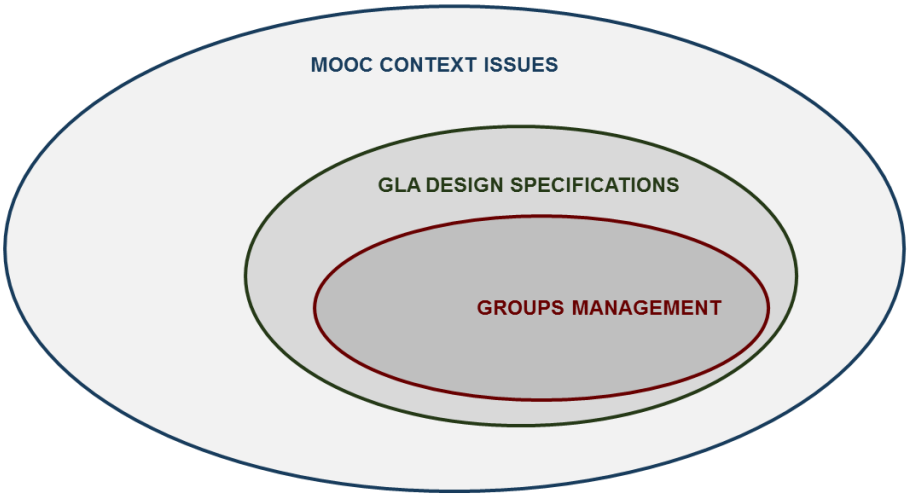


Figure 5.3: Three levels of aspects to be considered in the design of group formation policies.

and research question of this intervention. To do so, we performed an anticipatory data reduction process [94], identifying two main issues that should be explored in this study through different topics, and defined the questions to enlighten them, as shown in Figure 5.4.

The first issue (*i.e.*, I1) was related to MyGang.G− >DG (our Design Guide), and the way in which it supports the design of group formation policies in MOOCs; while the second issue (*i.e.*, I2) was related to MyGang.T− >TP (our Tool Prototype) and its capabilities to support the formation and monitoring of the teams needed to carry out GLA in MOOCs.

The topics corresponding to I1 were aimed at exploring the three levels of aspects to be considered in the design of group formation policies (*i.e.*, context issues, GLA design and group configuration) as shown in Figure 5.3; while the topics of I2 were aimed at testing the feasibility of a software tool in a MOOC learning platform. The suitability of the GLA was first assessed in terms of complexity and duration, and secondly in terms of participation, compliance with requirements, and completion by the students. On the other hand, the adequacy of the criteria selected to create the groups were related to the achievement of as many active participants in a group as possible and the degree of satisfaction of the students with their teammates.

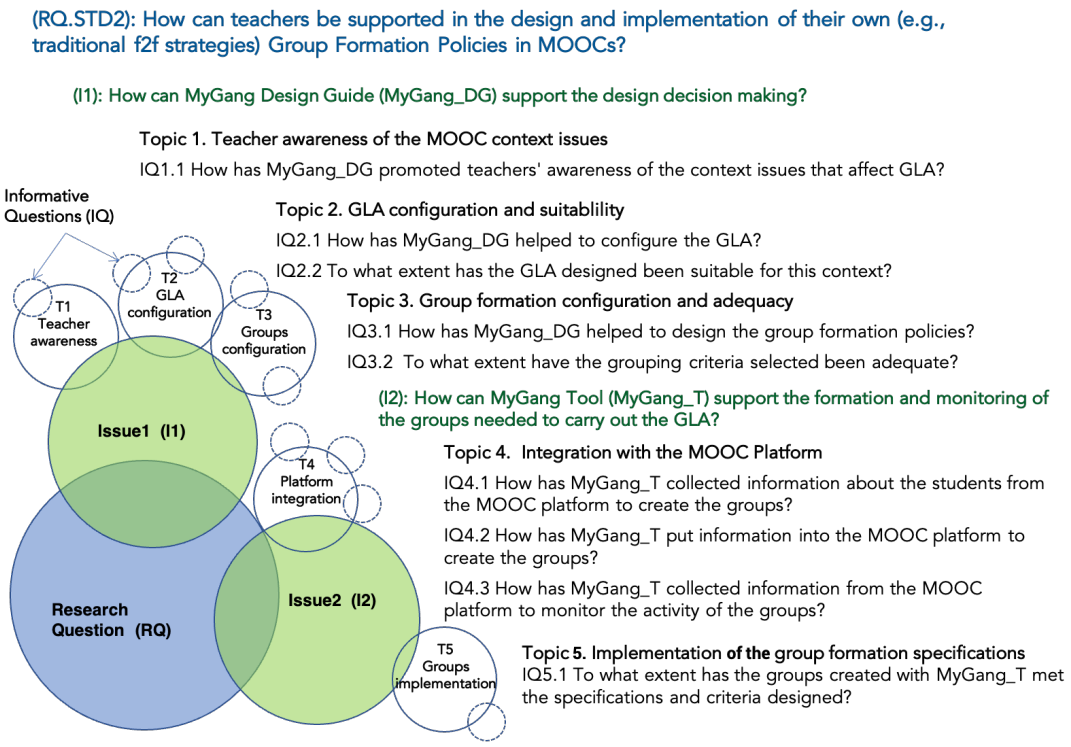


Figure 5.4: Anticipatory Data Reduction process to set the objectives of the study.

5.4.3 GLA Description

The Group Learning Activity (GLA) was composed of two parts. In the first, students were required to work individually to review and test five technological tools, one from each different category (a list of categories and tools were provided by the instructors of the course). After testing the selected tools, the student had to decide which one was the most suitable, in their opinion, to be used to enrich the learning scenario proposed by the teachers in the first week of the course. Then, the students were asked to reflect on how this tool could be used to enrich this scenario.

In the second part of the activity, the students were required to work in groups of five and share their work from the first part with group members and justify their choice in a shared Etherpad document. Then, they were asked to argue and discuss in the group forum to reach a consensus on the tool to be chosen and present it as a group proposal. All the groups were also asked to choose a spokesperson, who would be in charge of submitting the selected group proposal.

5.4.4 Grouping Strategy

The criteria selected by the teachers to create the groups for the activity included three levels of priority and used both static and dynamic factors as criteria. These criteria were meant to be applied to form homogeneous groups in some levels and heterogeneous ones in others.

Below, we summarize the criteria applied to form the groups, ordered in three levels of priority:

1. First priority level of criteria. In this level, two sets of static student data from the welcome survey were used: the language ("Spanish" or "English") and the preferred days to work in the course ("from Monday to Friday" or "Saturday and Sunday").

   These two criteria were applied to form homogeneous groups, resulting in four cohorts. Then, within

these cohorts, the rest of the grouping criteria were applied. In addition, all the students who had not filled out the welcome survey were placed in a separate, large group labeled NoQuestionnaire, where no criteria were applied.

2. Second priority level of criteria. The teachers chose to use a dynamic factor and student engagement levels to form heterogeneous groups at this priority level. It should be noted that separate clustering processes were applied for each of the four cohorts, which were derived from the application of the first priority level of criteria.

   To measure student engagement, three elements were taken into account: engagement with course contents, engagement with course discussions, and engagement with course assessments, in line with the criteria proposed by other authors [42].

   We used the following indicators collected from the platform analytics as the measures for each type of engagement, respectively:

   - number of page_views,
   - number of posted messages in forums, and
   - number of submitted assignments.

   These indicators were standardized and used to categorize the students from each cohort into as many levels as the number of required members of a team (five in our case). Then, in order to form the heterogeneous team, students belonging to each engagement level were assigned to every group. To choose the concrete student of each level to be included in a group, we needed to consider the criteria of the third level of priority.

3. Third priority level of criteria. In this level, five static student data variables gathered from the welcome survey were used, *i.e.*, ICT_experience, ICT_attitude, CL_experience, CL_attitude and knowledge_domain. All these variables were in the same scale, so no normalization was needed. They were applied to form heterogeneous groups. To do so, we applied Principal Component Analysis (PCA), a statistical procedure used to reduce the dimensionality of a dataset. In this way, we obtained a single resulting variable that could be integrated with the criteria of the second level, which was also intended for group heterogeneity. We achieved this integration by choosing the students from each level of engagement in a way that maximized the Euclidean distance with the resulting variable of the PCA.

5.4.5 Data Sources

We used a mixed methods approach, with a predominance of qualitative data, in order to better capture the effects of the instruments examined in the study. Mixed methods allowed us to complement and triangulate results [50] by using several data sources to collect information to answer the informative questions. This approach is a consequence of our underpinning pragmatic worldview, centered on the problem and oriented towards real world practice [28]. Accordingly, we gathered data from seven sources and three informants, shown in Table 5.1.

Figure 5.5 shows the timeline of the data collection from the various sources. The first event was the submission of MyGuide_DG to the teachers to make them aware of its contents and the questions and decisions they were going to take. Then, an interview (*i.e.*, pre-codesign session) with each teacher was scheduled in order to comment, discuss and give them advice about every item of the guide.

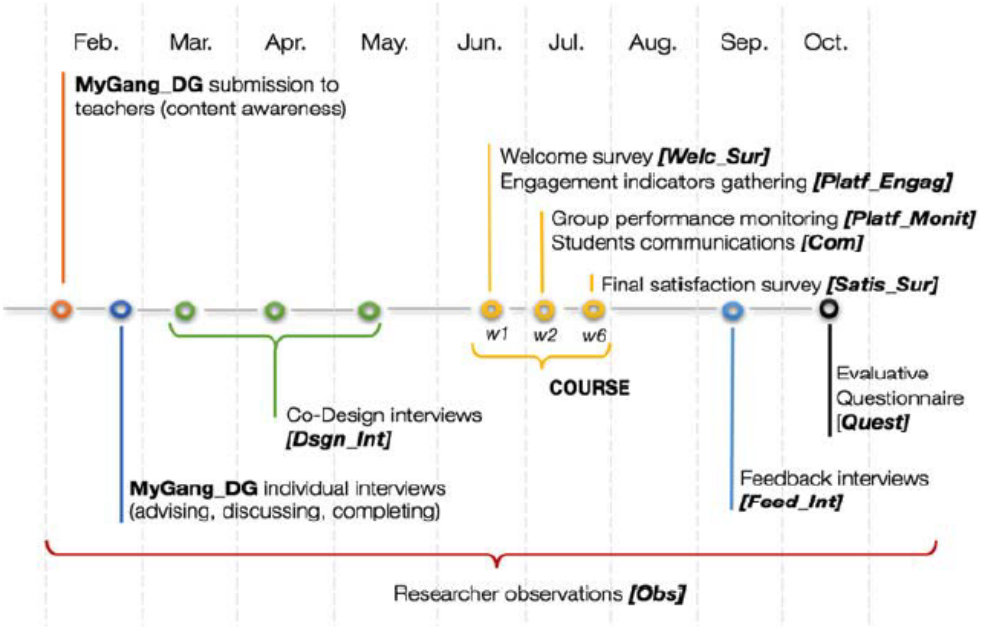


Figure 5.5: Data Collection Time Line.

Source/ Informant/ Code	**Description**
Interviews/ Teachers/ X_Int	(Interviews carried out after the use of MyGang _DG to: Dsng_Int - Co-design the GLA with the instructors and select the criteria for the group formation. Feed_Int - Collect instructors' feedback about their satisfaction with the produced design and its enactment.
Learning Design/ Teachers/ LD	The learning design of the course provides information about how MyGang_DG helped configure the GLA and the group formation policy.
Questionnaire/ Teachers/ Ques_X	Questionnaire to assess the utility of MyGang_DG. Quest_T$< n >$ - Filled out by Teacher$< n >$
Observation/ Researcher/ X_Obs	Researcher observations to determine: Gen_Obs - Observations on the achievement of objectives. Crit_Obs - To what extent groups created with MyGang_T met the criteria and specifications designed by the teachers. Intg_Obs - How MyGang_T was integrated within the MOOC Platform.
Surveys/Students/ X_Sur	Mandatory course surveys, composed of open-ended and closed questions in a 7-point Likert scale. Welc_Sur - Used at the beginning of the course to get demographic data and preferences of the students that will be used as grouping criteria. Satis_Sur - Used at the end of the course to measure student satisfaction with the GLA.
Platform Analytics/ Students/ Platf_X	Canvas LMS REST API used to collect data about: Platf_engag - #page_views, #submitted assignments and #posted messages in forums. These data were used to compute the student engagement level (to be used as grouping criteria). Platf_Monit - Students participation in groups to identify: active teams, active members in each team, etc. used to evaluate the suitability of the GLA designed and the groups formed in second week.
Communications/ Students/ Com	Emails and personal messages sent in the MOOC platform from the students to teachers during the GLA assignment.

Table 5.1: Data sources and informants used (codes indicated in a box) to create the groups and to answer the informative questions.

5.5 Results and Findings

In this section, we first present the responses to the informative question posed in Figure 5.4 regarding the use of our Design Guide (MyGang.G− >DG) and our Tool Prototype (MyGang.T− >TP). Then, we summarize the main findings of the study, and we finish by setting out some lessons learned from the pitfalls of this experience.

5.5.1 How can our Design Guide support the decision making?

-[IQ1.1]- *How has MyGang.G− >DG promoted teachers' awareness of the context issues that affect GLA?*

Teacher1, very experienced in CL, highlighted the utility of section 4 of MyGang.G− >DG. This section, related to Dynamic Factors, helped him to make decisions regarding the design of the GLA and the grouping criteria. ("Perhaps section 4 has made me think about the things. Mainly, having to think about which "MOOC-like" criteria I had to keep in mind. This can help someone experienced in CL but not in MOOCs." Quest_T1). Moreover, Teacher1 considered that the guide could help teachers who are less experienced in CL than him. ("Probably for someone less experienced in CL, this would be much more useful." Quest_T1. In his own opinion, as Teacher1 already knew the possible issues emerging from MOOC contexts, the guide did not help him much beyond reminding him of these issues. However, the observations made by the researcher Gen_Obs showed that Teacher1 underestimated the complexity introduced by the MOOC context, and consequently few students could follow precisely the instructions of the GLA, and complete accordingly these activities Platf_Monit and Gen_Obs. Additionally, the guide helped him to focus on the aspects needed to classify students to make successful groups in this context. ("Maybe it helped me to think what focus on to "classify" students in order to group them." Quest_T1).

Teacher2, stated that the guide helped her to better understand the issues affecting GLA because it enabled her to reflect on various characteristics of MOOCs which she had never taken into account in other learning contexts. ("It helped me because it made me reflect on questions I do not have in mind in small scale contexts, for instance, on when to close the enrollment in order to allocate all the students to groups. There are many aspects that must be considered from the very beginning of the conception of the MOOC" Quest_T2). She also mentioned that her point of view changed regarding the usefulness and effectiveness of homogeneity applied with certain criteria to form student groups. Previously, she had followed the dominant learning sciences stance, *i.e.*, that heterogeneity in groups provides better results in terms of overall learning, social skills, equity, etc. However, after the use of the guide, her opinion was that in MOOCs some homogeneity could be needed to achieve groups of students that may be suitable to work together. ("There were some things very clear to me in the small scale context, such as the promotion of groups as heterogeneous as possible in order to [...] but now I think that in the MOOC context, it is good to have some homogeneity regarding certain characteristics". Quest_T2). The guide made her also consider several aspects of the GLA, such as the way to assess and tutor it. ("There were some aspects that I have never considered before, such as that the way of assessing and tutoring must be adapted to these contexts". Quest_T2).

-[IQ2.1]- *How has MyGang.G− >DG helped to configure the GLA?* The teachers were able to decide on several aspects of the GLA description through their individual interviews with the guide and the co-design interviews Dsgn_Int that enabled them to:

(i) reflect on the possibilities of applying a Collaborative Learning Flow Pattern, such as jigsaw or pyramid. ("The researcher presents a draft design of a jigsaw, but teachers reject it selecting to design the first level of a pyramid." Dsgn_Int);

(ii) choose activity properties such as the production of an artifact and the need for a preliminary discussion of individual ideas in order to reach an agreement;

(iii) select the activity duration (*i.e.*, one week). ("The teachers reflect on selecting three days of duration but the researcher recommendations make them reflect about the lack of availability of some students during working days" Dsgn_Int);

(iv) decide on how to assess the activity, evaluating it as "Passed" if they submit both the individual and the group proposals and

(v) decide on how to tutorize the activity and solve the students' doubts.

-[IQ2.2]- *To what extent has the GLA designed been suitable for this context?* The suitability was analyzed in terms of adequacy to the context, mainly regarding its complexity and duration. We also analyzed some success parameters as a measure of its feasibility regarding participation, requirements accomplishment and completion by the students. The number of submissions for the mandatory assignments in each week was: w1: 70, w2: 64, w3: 40, w4: 35 and w5: 32. Therefore, the GLA of the second week was the second assignment of the course in terms of participation and completion. This indicates a regular rate, considering the progressive decrease of participation in the MOOC. However, many students did not accomplish the steps stated in the assignment specification (e.g., writing in the forum that was specified in the assignment description, justifying their choice, selecting the spokesperson, etc.). To explain this fact, we collected the teachers' opinions through feedback interviews Feed_Int and revised the students' communications. This information, together with the researcher observations, gave us some possible reasons for the poor attainment of the activity, and therefore some suitability issues:

(i) several students did not read the GLA description carefully, since it was too long;

(ii) the GLA complexity was rather high, since it involved several ICT tools and

(iii) the time needed to carry out the GLA was longer than expected.

-[IQ3.1]- *How did MyGang.G− >DG help instructors design the group formation policies?* The guide supported teachers in configuring multiple aspects of group formation:

(i) the use of criteria for group formation, *i.e.*, groups were neither formed randomly, nor through self-selection by students;

(ii) the group size, five students per group. The possibility of oversizing the group to seven, in order to have some redundancy to prevent a low rate of participation, was discussed in the Dsgn_Int , but finally not selected;

(iii) the static data that should be included in the welcome survey, to be used as grouping criteria, *i.e.*, language, preferred days to work on the course, experience in CL, attitude towards CL, experience in ICT, attitude towards ICT, and the domain of knowledge in which they had teaching experience;

(iv) the dynamic data, that should be collected from the platform analytics, to be used as grouping criteria, *i.e.*, the engagement indicators;

(v) the levels of priority for each set of criteria and

(vi) the use of homogeneity or heterogeneity in each level.

-[IQ3.2]- *To what extent have the grouping criteria selected been adequate?* The adequacy of the criteria was analyzed in terms of the achievement of as many active participants in a group as possible and the degree of satisfaction of the students with their teammates. The analysis of the group activity and performance gave us the following information: There were 35 groups created by the tool according to

the group formation criteria configured by the instructors, but it was necessary to create two more groups (one for each language) to reallocate some students who expressed their dissatisfaction with the group they belonged to, because of the absence of their teammates. Therefore, the final number of collaborative groups was 37. One more group was created to allocate the students who did not fill out the survey, since some of the criteria used to form the groups employed data from this survey. There were 28 active groups (75.7%), that is, they had activity in their forums (*i.e.*, posted messages) and submitted the assignment. In the remaining 9 groups, none of the members performed any action. Within the active groups, 5 of them had 3 active members who participated in the activity (2 of these groups were created afterwards to reallocate dissatisfied students); 14 groups had 2 active members and 9 groups had only 1 active member. In their communications to teachers Com and the satisfaction survey Satis_Sur, many students expressed their dissatisfaction with their group work experiences. Their main complaint was about the presence of inactive students in their group. This fact confirmed our previous finding and recommendation to teachers about the advantage of applying criteria to achieve as many active students in a group as possible [127]. Although all students that constituted the dataset of the group formation had filled out the welcoming survey, and had therefore shown at least a minimum level of participation in the course, the heterogeneous distribution of students regarding their engagement level led to groups with many inactive students.

5.5.2 How can our Tool Prototype support the formation and monitoring of the students' groups?

-[IQ4.1]- *How has MyGang.T− >TP collected information about the students from the MOOC platform to create the groups?*

The data from the welcome survey were downloaded from the Canvas Platform in a .CSV file, which fed the tool prototype, which then processed and stored them in order to create the feature vector used for group formation. The tool also used the Canvas LMS REST API to obtain information about the students' activity during the course. The GET functions used were:

(i) GET course-level student summary data. - Used to obtain the number of pages viewed by each student, stored in the variable num_page_view of the feature vector.

(ii) GET user-in-a-course participation data. - Used to identify the concrete pages visited by each student in order to extract their participation in the forums, stored in the variable num_post_mess of the feature vector. This function was also used to obtain the number of assignments submitted by each student, stored in the variable num_subm_assi of the feature vector. With these variables the tool gauged the engagement level of each student in the Dynamics Processing module, categorizing it into five levels.

-[IQ4.2]- *How has MyGang.T− >TP put information in the MOOC Platform to create the groups?*

To create the groups, the tool prototype used the following Canvas LMS REST API functions:

(i) POST Create a group. - Used to create a group within an existing category.

(ii) PUT Edit a group. - Used to modify a group, it allows members to be assigned to the group by specifying in one of its parameters an array containing the member IDs.

-[IQ4.3]- *How has MyGang.T− >TP collected information from the MOOC platform to monitor the activity of the groups?*

To monitor the groups' activity, the tool prototype used the following Canvas LMS REST API functions:

(i) GET List discussion topic. - Used to obtain the group discussion (*i.e.*, group forums).

(ii) GET a single topic. - Used to obtain every topic of the forum and identify its owner. With this information, by means of a recursive function, the tool determined the participants of each group, the number of messages sent by each participant and the number of active participants in the group.

(iii) GET List groups in group category. – Used to obtain the list of groups.

-[IQ5.1]- *To what extent have the groups created with MyGang.T− >TP met the specifications and criteria designed?*

The first level of grouping criteria implemented in MyGang.T− >TP aimed to create homogeneous subsets of students according to their preferred language of instruction and the preferred days to study the course. According to the results, the tool was able to create fully homogeneous subsets of students as desired by the instructor. The criteria of the second level of priority must be applied to form heterogeneous groups regarding students' engagement levels. To meet this criterion precisely, it would be necessary to have exactly the same number of students from each engagement level. However, there were more students with low levels of engagement than those with high levels of engagement. As a result, there were some groups which contained higher numbers of low engagement students, thus resulting in a heterogeneity lower than intended. The criteria of the third level of priority, by definition, should have a lower impact than the previous levels. To apply the third level criteria, we used a PCA process to reduce the five variables selected by the teachers into one resulting variable. This allowed us to combine this variable with the criteria of the previous level (*i.e.*, by maximizing the Euclidean distance regarding this variable when selecting the students of each level). Therefore, the impact of these third level criteria had a slight impact on some groups.

Besides the main findings shown in Table 5.2, we present below some lessons learned from the pitfalls of this experience that can help us to improve MyGang.G− >DG and MyGang.T− >TP for the next iteration:

- It would be desirable to offer clear and complete guidelines to students to accomplish the GLA; however, very long descriptions can tire and bore the students. Therefore, alternative ways to describe the activity, such as graphics, schemas or videos, could be implemented.

- It would be convenient to schedule the GLA in the second half of the course in order to have a stable dataset regarding students' engagement.

- It would be recommendable to achieve groups with as many active students as possible, thus avoiding inactive students, which frustrate their teammates.

- When the observed participation of the students in the course is quite low, the application of complex pedagogical criteria to group them has only a minor impact. Instead, it would be better to connect the active students together.

- Regarding the application of several levels of criteria, it is convenient to prioritize those related to connecting the active students and then to apply the rest of the criteria with a lower priority.

- Instead of taking the final decision on the grouping criteria during the design phase, software tools can serve to analyze the student dataset during the course enactment in order to recommend grouping criteria adapted to the concrete population.

- Even if the teachers were able to identify issues related to MOOCs, it was not sufficient to obtain a suitable collaborative design. We should find out, in future works, how to make teachers aware of the problems of CL in MOOCs.

Topic	Finding (Data Sources)
Topic 1. MOOC issues' awareness	The guide promoted teacher awareness of the context issues that affect GLA and made them reflect on the aspects that can have impact on group formation. (Quest1, Quest2, Feed_Int) The guide made teachers change their point of view with respect to their usual collaborative designs to adapt them to MOOC contexts. (Quest2) Enrollment closing, requisites to obtain the certificate, and students' geographic dispersion were aspects to consider from the set out of conception of a MOOC with CL. (Quest2) Teachers became aware of the impact of several items presented in the guide after the course ending. (Gen_Obs)
Topic 2. GLA configuration	The moment in the course timeline when the GLA is scheduled was relevant, because the patterns of students' engagement affect its performance. These patterns tend to stabilize about the middle of the course. (LD, Feed_Int) The complexity, time required to accomplish it, and way of describing the activity must be carefully measured in order not to excessively overload students with the GLA. (LD, Feed_Int, Gen._Obs, Com, Satis_Sur)
Topic 3. Groups' configuration	The factors related with the course activity (Dynamic Factors) were relevant to configure the groups. (Ques_T1) Homogeneity over certain criteria, such as students' timetables, can be useful to obtain suitable groups. (Quest_T2) Inactive students in a group strongly affect the satisfaction with the GLA of their teammates. (Satis_Sur) To achieve groups with many students' active it is effective to require homogeneity on students' engagement. (Gen_Obs)
Topic 4. Tool integration	Supporting tools can be integrated into the MOOC platforms through the platform APIs and by processing the files produced by the platform (e.g., .CVS files or internal databases). (Intg_Obs)
Topic 5. Tool requirements.	The accomplishment of requirements and criteria strongly depend on the students' dataset. (Crit_Obs)

Table 5.2: Summary of findings of the study organized by topic.

5.6 Chapter Conclusions

The study reported in previous sections explored a way in which teachers can be supported in the design and implementation of group formation policies in MOOCs. The information obtained with the study has served to extract conclusions and recommendations that could facilitate the orchestration of collaborative groups and, therefore, the implementation of GLA in a MOOC context.

The guide helped teachers to be aware of the MOOC context issues, to design the GLA and to configure the groups. However, we have extracted some lessons learned from this MOOC in order to design more successful GLA (*i.e.*, with higher participation, better understanding and accomplishment of the task requirements, and greater student satisfaction) in MOOC contexts. These lessons learned should be included in new versions of the guide in order to offer recommendations to the teachers. We also learned about the criteria that allow suitable groups to be formed in the MOOC context, finding that it is desirable to achieve groups that avoid inactive members. A heterogeneous distribution of students regarding their engagement level leads to many groups with several inactive students, so it therefore seems preferable to require homogeneity regarding student engagement.

The tool met the specifications, created the groups applying the criteria selected by the teachers, and also served to monitor the activity of the groups. It was successfully integrated with the MOOC platform (*i.e.*, Canvas Network) through a REST API. However, the prototype should continue to evolve and be enriched with new capabilities, such as an interface that included recommendations, which could be based on an analysis of the available students' dataset, when the teacher selects the grouping criteria. It can also include alerts to inform teachers of the groups' performance as a part of the monitoring capability. The alerts and report information on the groups' activity could be sent daily to teachers so that they can react and intervene if necessary.

The results of the experiments confirmed that the strategies used in f2f scenarios do not work well in on-line contexts, where the number of student is variable or even massive and their motivation and engagement present high variability. Comparing results from the experiments documented in this chapter with those in the preceding one, we found that the heterogeneous grouping based on static criteria produced similar outcomes to the random grouping (the slightly-improved control group in our prior hypothesis) and significantly worse outcomes than homogeneous grouping based on student engagement (*i.e.*, a dynamic factor).

In the short term, we plan to carry out another iteration of the DSRM process with a new version of the guide and new tool functionalities to continue exploring and evaluating the framework in new MOOC interventions. The main findings of this study will be checked and analyzed in these future interventions.

Chapter 6

Towards the Framework Validation. Third Study (STD3) and Second Round of Expert Opinions (EO2).

Summary: After testing our prior hypotheses, which have been documented in the preceding chapters, we faced the final iteration of our research process that intended to: (i) validate prior findings, (ii) test and evaluate the artifacts generated across our research process, and (iii) check new strategies and tool functionalities. To do so, we undertook a third study in a real MOOC scenario, where we incorporated new strategies such as the monitoring of teams and the possibility of restructuring those teams where the collaboration failed. Furthermore, we carried out an experiment intended to gather the opinion of experienced teachers skilled in MOOC development and research, concerning the utility of our Design Guide. Furthermore, the model questionnaire we created for the evaluation of our Design Guide, as well as the fieldwork corresponding to the fulfillment of this questionnaire and the results of using our Design Guide by the teachers participating in this experiment, are available in Appendix F.

6.1 Introduction

The last iteration of our research process was aimed at validating the findings raised along this dissertation and the artifacts of our framework, produced as a consequence of our research work. Thus, the work carried out during this stage produced a conference paper [126]. A summary of the main findings of this paper is presented in Chapter 7, in the Conclusions section.

As explained in the first chapter of this report, the main goal of our research project was to support teachers in the design and implementation of Group Formation Policies to carry out GLA in MOOCs. To that aim, we generated a variety of artifacts that should be evaluated in order to assess their utility.

In the fourth iteration of our research process, we tackled a third study, in a real MOOC, aimed at validating prior findings and testing the usefulness of our instrumental artifacts (*i.e.*, the proofs of concept of our schema models) to advise teachers in the aforementioned stages (*i.e.*, design and implementation). Furthermore, we decided to carry out a second round of gathering expert opinions aimed at validating the Design Guide newly produced in the third cycle. Therefore, the fourth iteration of our research process was mainly evaluative.

Throughout the following sections of the chapter, we present: (i) the overall goals of the current cycle, (ii) the description of the third study carried out in a real MOOC scenario, (iii) the description of our second round of collecting expert opinions, (v) the description of the components of our final proposal for a framework, MyGang, and (v) the conclusions of this iteration.

6.2 Cycle Goals

This cycle was led by two research questions, as shown in Figure 6.1, which set the global objectives of the iteration. The first Research Question of the cycle (RQ5) was related to our first grouping proposal which proved to be more successful in terms of obtaining teams in which several students participated in the CL, as well as in terms of student satisfaction than the traditional grouping strategies the teachers carry out in f2f scenarios. On the other hand, the second Research Question of this cycle (RQ6) was related to the advice that has come out of the process of researching this dissertation and given to the teachers to put into practice suitable grouping strategies for MOOC contexts.

Thus, in the fourth cycle, we aimed to find out the following:

RQ5: *Is the Homogeneous-Engagement Criteria Grouping Approach (H-ECGA) a strategy* ***suited*** *to carrying out GLA (e.g., CL, PBL...) in MOOCs?*

RQ6: *How can teachers be advised to put into practice grouping strategies* ***suited*** *to GLA (e.g., CL, PBL...) in MOOCs?*

The fourth cycle of our dissertation was planned to be mainly evaluative, as a consequence of our research process based on the DSRM [107] model, which we supplemented with some DBR methodology [92] principles. To that aim, we planned two experiments (*i.e.*, our third study in a MOOC and our second round of expert opinions), as mentioned above.

Thus, the nature of the third study was mainly evaluative, in order to find out additional evidence supporting our prior findings and testing the capabilities of the latest version of our Tool Prototype, developed as a proof of concept for the Tools Architecture element of the Framework (MyGang.F− >TA). Furthermore, we also continued to explore some new features of the H-ECGA strategy and functionalities for our Tool Prototype, such as the group monitoring and restructuring, so as to foster collaboration.

The gathering of expert opinions was mainly implemented by means of questionnaires; although we complemented this information with the researcher's observations and by recording our meetings, co-design sessions and focus groups with the teachers. Other important sources of information we collected were the MOOC and GLA designs resulting from the use of the Design Guide by the teachers.

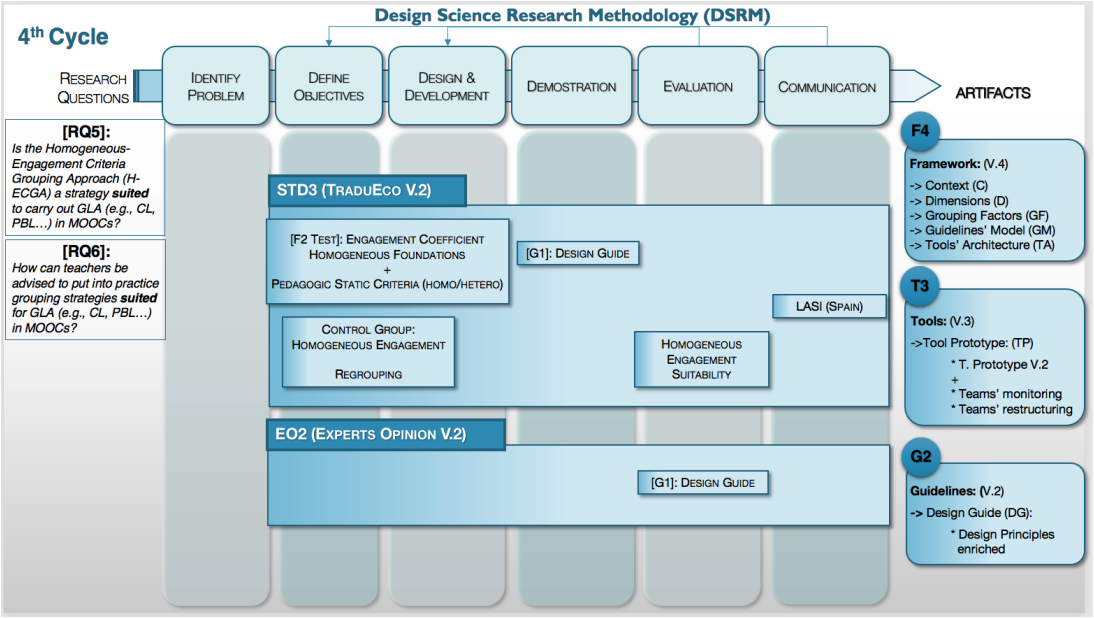


Figure 6.1: Evaluative and exploratory tasks carried out through the fourth iteration of the process model.

6.3 Description of the Third Study

In this section, we report on the design of a third study intended to accumulate evidence to validate prior findings. In addition, we also explored the usefulness of one of the artifacts generated in our research process, the Tool Prototype (MyGang.T− >TP), developed as a proof of concept for a component of the F artifact, the Tools Architecture (MyGang.F− >TA), thus validating the capabilities of this TP (and by extension of our TA) to support teachers in the deployment of the H-ECGA on the learning platform. This third study was carried out in the second edition of the same MOOC used to accomplish our first exploratory study. The reason for choosing the same course as in our first study (*i.e.*, the same structure, activities, etc.) was the possibility of comparing the results of both studies with different samples of students' population, in order to check if the outcomes of the H-ECGA were somehow reproducible.

6.3.1 Context

The study was carried out in a seven-week MOOC that taught the translation of economy and finance-related texts from Spanish to English. The course was offered by the University of Valladolid, Spain and it was deployed in the Canvas Network platform between March 12th and April 30th, 2018. The enrollment was closed at the end of the first week to allow us to properly configure the groups for the collaborative assignments. A free certificate was granted to the students who completed the mandatory assignments (one per week) in addition to two compulsory surveys.

The total number of enrollments was 905, and 653 of these students fulfilled the mandatory survey that was a requirement to see the course content. 173 students achieved the certificate (more than 19% of the enrolled students and 26.5% of those who accessed to the course content).

6.3.2 Objectives

This study was carried out to get additional data and evidence about the performance of the Homogeneous-Engagement Criteria Grouping Approach (H-ECGA) used in our first study with a different student

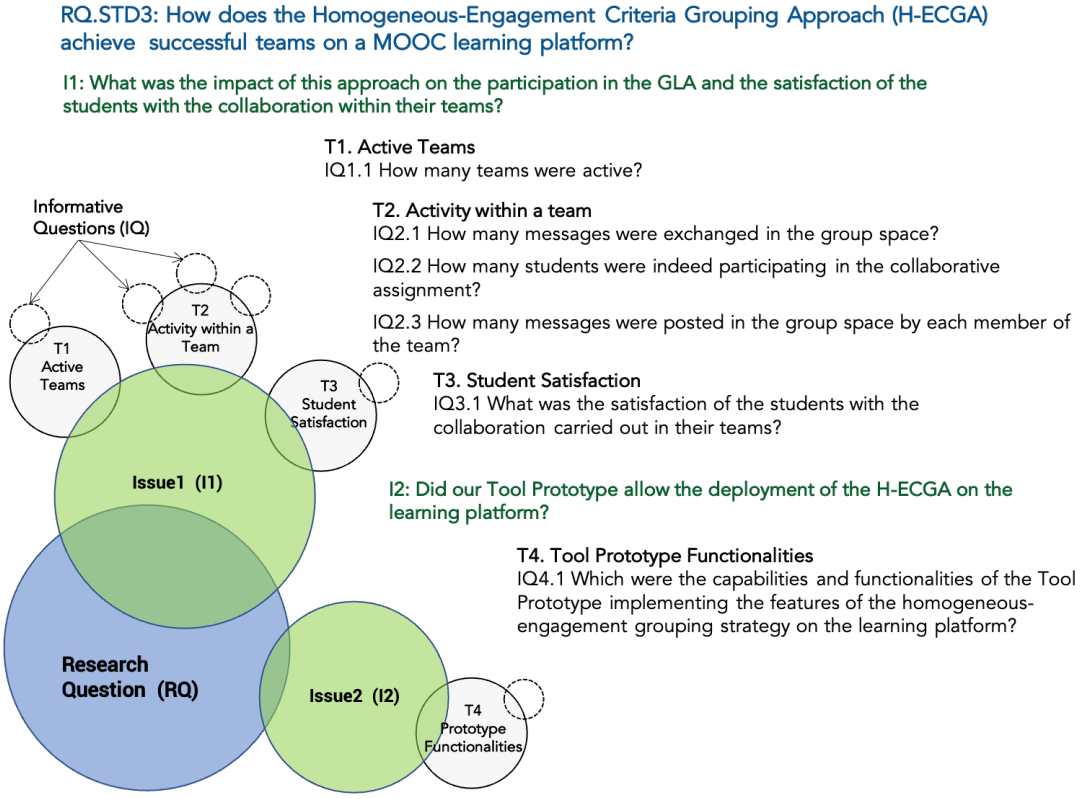


Figure 6.2: Anticipatory Data Reduction process to set the objectives of the third study.

population. Therefore, the main objective of this study was to validate the suitability of the H-ECGA to produce successful teams in terms of students' participation and satisfaction. Furthermore, as a secondary objective, we tested the suitability and utility of our Tool Prototype (TP), aimed at deploying the H-ECGA on the learning platform. As explained above, this TP was developed in the third cycle of our research process, incorporating the capabilities of the first prototype we developed for our first study in the second cycle, by addition including functionalities to tackle our second study. In this fourth cycle, it was also necessary to implement new routines to cover new functionalities for our third study (e.g., the monitoring and restructuring of teams). From its second version, the TP was designed from the Tools Architecture model of our Framework (MyGang.F− >TA), as a proof of the concept, and therefore the validation of this proof of concept would serve us to validate, by extension, the model that it reproduces.

Thus, taking into account our overall research question (*How can teachers be supported in the design and implementation of Group Formation Policies in MOOCs?*) and the global goals of the cycle related to the validation of our prior findings and artifacts, we raised the specific objectives and research questions of this intervention. To that aim, we performed an anticipatory data reduction process [94], identifying two main issues that should be explored in this study through different topics, and we also defined the questions to enlighten them, as shown in Figure 6.2.

The first issue, I1, was aimed at validating the impact of our first grouping strategy, based on requiring a homogeneous level of engagement among the members of each team. Concretely, this first issue referred to the participation levels and the performance of the groups. The second issue, I2, was related to the suitability and capability of our Tool Prototype to deploy the H-ECGA in the learning platform, thus validating its utility to implement a grouping strategy suited to MOOC contexts.

The success of the resulting groups was measured in terms of:

1. participation level in the collaborative activity (*i.e.*, number of posted messages and number of active participants in each team) and

2. student satisfaction regarding the collaboration carried out in their team.

The final goal was to validate whether this approach is able to achieve teams with several active students who carry out many interactions within their group, and also to minimize the number of teams with a single active student. The perception of the students about the collaboration within their teams, and its relationship with the grouping strategy, is also covered in the study.

Thus, we monitored team performance during the activity retrieving data about:

- the messages exchanged in each group space,
- the active participants in each team.

Furthermore, we introduced new aspects in the experiment to explore new functionalities in the Tool Prototype that should be tested, such as:

a) the monitoring of teams, supervising their activity and detecting possible issues within the group, and

b) the possibility of reorganizing those groups in which the collaboration was not working.

Concretely, the candidates to be reorganized in this course were those students who were the only active student of their groups, since we deemed that no collaboration is possible within a team with a single active student. However, the teacher could set other constraints, based on the monitored activity of the groups, to trigger the regrouping.

6.3.3 Experimental Design

To implement the H-ECGA, learning analytics were employed to track MOOC learners' activities using the Canvas Network platform API. Three types of elements were taken into account to gauge student engagement: engagement with course content, with course assessment, and with course discussion [41]. Then, we used the following variables (codes indicated in a box) as measures of student engagement:

- Number of page views (coded as num_page_view) as a measure of the engagement with content.
- Number of seconds of connection time in the course (coded as sec_conn_time), as a second measure of engagement with content.
- Number of submitted assignments (coded as num_subm_assi), as a measure of engagement with assessments and commitment to the course.
- Number of posted messages in forums (coded as num_post_mess), as a measure of the engagement with discussions and active participation in the course.

The algorithm selected for implementing the homogeneous grouping was k-means clustering, as it has been shown to be effective with large datasets [148]. Since the k-means algorithm does not necessarily result in clusters of the same size, the process was slightly modified by applying a same-size k-means variation, to ensure that the resulting clusters had the same size. Prior to the clustering process, the four engagement indicators were standardized in order to ensure that they had the same weight in the calculations of the grouping algorithm, as recommended in [96].

This strategy was applied to the group formation process in two collaborative assignments planned for two different weeks of the course, *i.e.*, at weeks four and six respectively. It is noteworthy that in both assignments, a window of 21 days was used to trace data about the students' activity in the platform. For the first collaborative activity, this length was the distance between the course start and the beginning

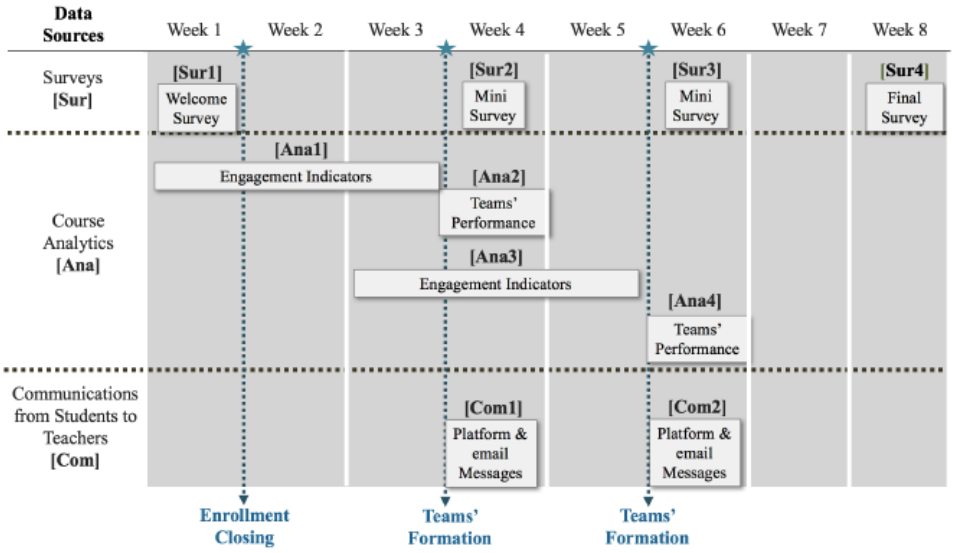


Figure 6.3: Data Collection Timeline.

of the activity. The same window length was also applied when obtaining the trace data in the second assignment.

To measure the experimental results, we gathered data about the activity carried out in each team (*i.e.*, exchanged messages, active participants) using the Canvas Network API. We also collected information from four surveys deployed in the course. The first one was necessary to access the course content and the following surveys were intended to measure the students' satisfaction. Furthermore, the messages sent from the students to the teachers through the platform during the collaborative assignments were also captured in order to detect potential complaints and issues. Table 6.1 shows the data sources used in both experiments and Figure 6.3 depicts the time-line of this data gathering.

Source	Description
Surveys SurX	Course surveys composed of open-ended and closed questions including 4-point Likert items (1 = strongly disagree, 2 = disagree, 3= agree, 4= strongly agree, + don't know/no answer) were administered: • Sur1. - Mandatory survey at the beginning of the course to get ethnographic data and preferences of the students. • Sur2. - Optional mini-survey at the end of the 4th week activity to score satisfaction and gather positive and negative perceptions regarding the collaboration carried out in the teams. • Sur3. - Optional mini-survey at the end of the 6th week activity to score satisfaction, and gather positive and negative perceptions regarding the collaboration carried out in the teams. • Sur4. - At the end of the course (mandatory) to obtain students' satisfaction with the course.
Platform use Analytics AnaX	Canvas LMS API was used to collect indicators about: • Ana1, Ana3. - Students' engagement variables (*i.e.*, sec_conn_time, num_page_view, num_subm_assi and num_post_mess) used to inform the group formation process. • Ana2, Ana4. - Activity carried out during the group assignments (active teams, activity carried out within a team), used to evaluate the impact of the strategy implemented.
Communication from students to teachers Com	Emails and personal messages sent in the Canvas platform from the students to the teachers during the collaborative assignments (4^{th} and 6^{th} weeks).

Table 6.1: Data Sources of both experiments.

6.3.4 Results, Findings and Conclusions of the Third Study

We now present the outcomes of each of the experiments carried out in our third study by organizing them in terms of the two issues raised from the RQ leading this study and shown in Figure 6.2.

6.3.4.1 I1: Impact of the H-ECGA on the participation and satisfaction of the students

Once the data analysis had been completed, we summarized the results in Table 6.2. Table 6.2 was structured so as to compare the results of the two interventions deployed during the fourth and the sixth week of the course. Furthermore, the table has also been designed to facilitate the comparison between the results of this study (in bold font), with those in our first exploratory study, which was carried out in a prior edition of the same MOOC. This was due to the fact that the main goal of the current third study was to validate prior findings, specifically those findings emerged from our first exploratory study, which took place in the first edition of the same MOOC.

We have used the term "many active students", in the second row of the results table, to refer to numbers greater than half the total number of team components. In our case, as we were forming 6 member teams, the term "many active students" means three students or more.

	4th Week		6th Week	
	Current Study	**1st Study**	**Current Study**	**1st Study**
# teams with a single active student	16%	24%	10%	6%
# teams with many active students	40.3%	40%	82.5%	75%
# messages per active team	14.56	14.88	17.05	21.8

Table 6.2: Summary of data collected from the API comparing experiments in two weeks and in two studies.

This summarized presentation of the data gathered from the Canvas API allowed us to observe that the percentages of interactions and active students per team were in a similar range of values to those in the first study.

	Current Study	**First Exploratory Study**
	Scored Satisfaction	**Satisfactory Collaboration Within Their Team**
4thW Experiment	6.64	55%
6thW Experiment teams with many active students	7.78	70%

Table 6.3: Comparison between students' satisfaction in both experiments and in both studies.

As shown in Table 6.3, the satisfaction of the students with the collaboration carried out in their teams was measured in a different manner to in the previous study. In the study reported in this chapter, the students were required to score their satisfaction on a scale from 0 to 10 at the end of the assignment. In the fourth week, they scored it 6.64 and in the sixth, the average score was 7.78. In the prior edition of this MOOC, the students had to express their agreement or disagreement with the statement "the

collaboration carried out in my team was satisfactory". 55% agreed in the fourth week and 70% in the sixth.

Therefore, following the data analysis of the third study, we can share these findings:

1. The number of teams with a single active participant represents a low percentage of the total number of active teams, below 10% in the sixth week (*i.e.*, the second running of the experiment in both interventions).
2. The homogeneous engagement grouping approach resulted in groups with "many" active members (*i.e.*, more than half of the total number of team members). In the experiment of the sixth week, this type of team exceeds 75% of the active teams.
3. The number of interactions per team remained in the same range as in the previous intervention and it was more than double that of the random approach, used as a control group in the first study.
4. The students' satisfaction with the collaboration carried out in their team was positive.
5. The second experiment (carried out in the sixth week) achieved better results than the first one (carried out in the fourth week) in terms of peer interactions, number of active members per team and student satisfaction. This fact confirmed a finding of the prior study and we deem that it can be due to two reasons:
   a) The engagement of the students is more stable in the second half of the course and this approach based on engagement improves its accuracy.
   b) The students are familiar with the mechanics of carrying out a collaborative task (instructions, recommendations, available tools in the platform) and this information allows them to perform better, thus increasing their satisfaction.

6.3.4.2 I2: Capabilities of the TP to deploy the H-ECGA on the learning platform

On the other hand, and responding to IQ4.1, the Informative Question raised from the second issue on Figure 6.2, the TP we developed as a proof of concept of our proposal of TA did in fact allow us to deploy the grouping strategy validated in this study in the Canvas Network Learning Platform. The last version of this TP also enabled us to test new functionalities, such as the monitoring of teams' activity and the reorganization of those teams where only a single student participated in the GLA.

In the preceding chapter, we showed how our TP managed to implement the grouping strategy selected by the teachers, and we did it by explaining the methods of the Canvas Network API used to do so (see section 5.5.2). In the current study, and in order to answer IQ4.1, we revised the functionalities of the TP that enabled us to deploy the H-ECGA, as well as their matching with the corresponding module of the TA. In this way, we can move forward to a new evaluation step by validating how these capabilities fit the Tools Architecture (TA), thus validating our architecture schema (the structure of this architecture model is depicted in Figure 5.2).

1. The gathering of the grouping strategy to apply (*i.e.*, the H-ECGE) in terms of: grouping criteria, group size, reorganization triggering and constraints, etc., was provided to the system by means of a configuration file including the concrete values stored in constants. This configuration file acted as the Interface Module of the TA.
2. The monitoring of the students' activity prior to the grouping (to calculate their engagement), and during the GLA enactment, as well as the monitoring of the teams' activity, was implemented by means of calls to the API functions which made up the Gathering Data Adapter of the TA.
3. The calculation of the student engagement from the four variables collected by means of the API functions was carried out by means of python routines, constituting the Dynamics Processing Module of the TA.

4. The creation of teams was implemented in two stages: firstly in a python routine (as explained in Section 6.3.3), which constituted the Grouping Module of the TA by storing all the necessary data in python lists and dictionaries; and secondly, in the Canvas Learning platform by means of calls to the API methods acting as the Dynamic Deployment Module.

5. The restructuring of teams was implemented in a similar way to the prior point. It was necessary firstly to configure the new teams to be created internally with the isolated students as a part of the Grouping Module, and secondly to apply this configuration in the Canvas Platform as a part of the Dynamic Deployment Module.

6. The business rules and flow control were integrated in several python routines which constituted the Control Module.

Therefore, this third study showed that the TP proved its utility to deploy the H-ECGA in the learning platform and, by extension, the ability of our TA to generate tools in compliance with this model schema, which would be useful for implementing the grouping strategies designed by the MOOC teachers.

6.4 Second Round of Experts' Opinions

As explained in the first chapter of this report, the main goal of our research project was to support teachers in the design and implementation of Group Formation Policies to carry out GLA in MOOCs. To that aim, we generated a variety of artifacts that should be evaluated in order to validate their utility. To do so, in addition to the third study on a real MOOC just explained above, we also decided to implement a second round of expert opinion gathering in order to evaluate our Design Guide.

The objectives, experimental design and results of this intervention are explained in the following subsections.

6.4.1 Objectives, Experimental Design, Methods and Data Sources

Taking into account our overall research question (*How can teachers be supported in the design and implementation of Group Formation Policies in MOOCs?*), we raised the specific objectives and research questions of this intervention aimed at validating the Design Guide we developed as a part of our framework, MyGang. To do so, we performed an anticipatory data reduction process [94], identifying two main issues that should be explored in this study through different topics, and defined the questions to enlighten them, as shown in Figure 6.4.

The first issue (*i.e.*, I1) was related to the way in which our Design Guide (MyGang.G− >DG) supports the design of group formation policies in MOOCs when it is used in Standalone Mode (SAM). On the other hand, the second issue (*i.e.*, I2) focused on how useful this Design Guide is when used in a co-design session with the researcher, author of this report. We named this mode of use of the Design Guide as Supervised/Tutored Mode (STM).

The first topic in both issues focuses on the teachers' understanding and awareness of the MOOC context and its issues, and how it affects the formation and success of collaborative groups of students; while the second topic is aimed at finding out how the Design Guide impacted their GLA designs and their groups configuration.

The informants that make up the source of this experiment were selected because of their participation in a European Project called colMOOC [1] in which the author of this report was also involved. Thus, six teachers experienced in MOOC design and implementation and interested in improving the instructional quality of this type of courses were selected to take part in this intervention intended to validate our Design Guide. All these teachers belonged to universities other than that of the author of this report, and all of them had worked with Collaborative Learning. Their contribution to the colMOOC project was based on the development of Conversational Agents (CA) aimed at fostering the participation of the students in MOOCs.

[1] https://colmooc.eu

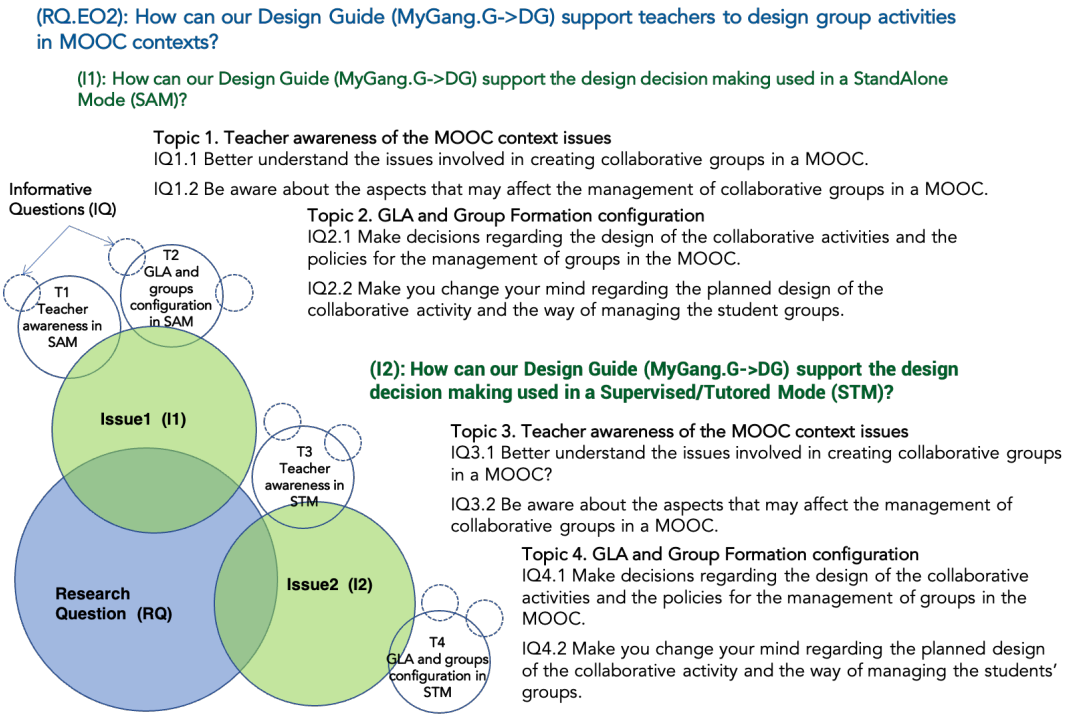


Figure 6.4: Anticipatory Data Reduction process to set the objectives of the second round of Experts' Opinions.

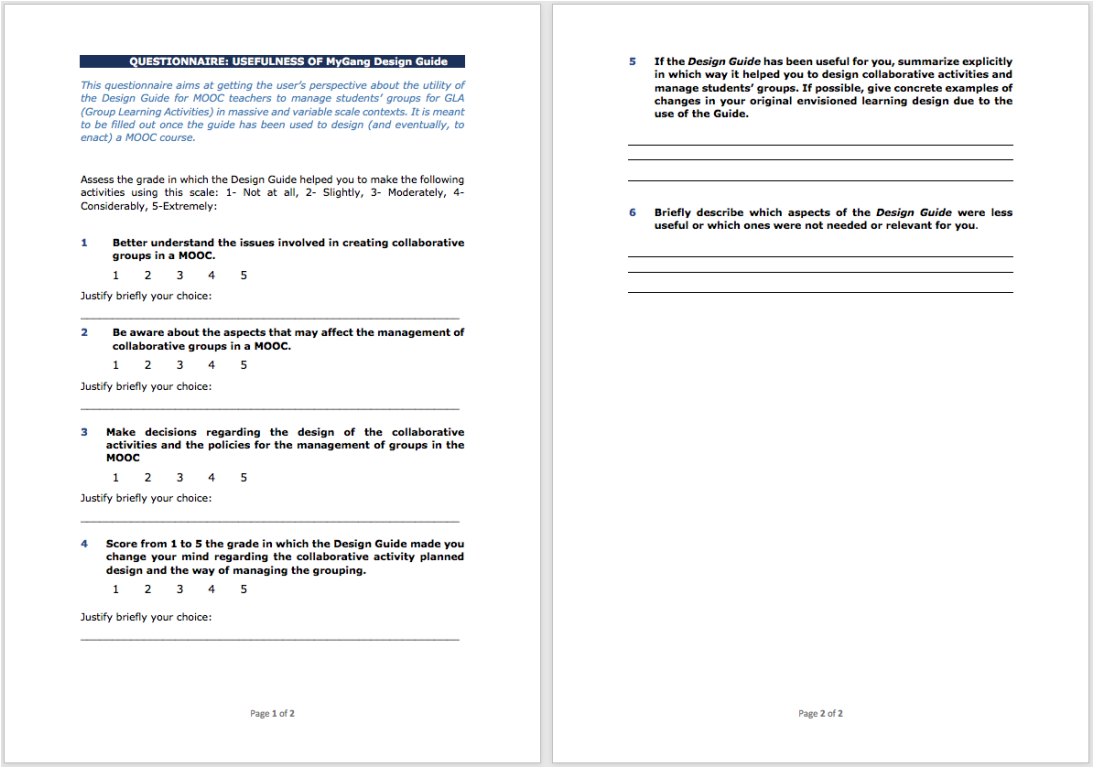
The six experts selected were divided into two subsets, attending to their availability for making the experiment. Thus, three of them were invited to use the DG by themselves in an autonomous mode we called Standalone Mode (SAM). However, they took part later on in a focus group with the researcher in order to analyze the points in which the DG was insufficient and they needed help to understand or make certain decisions. The remaining three teachers used the guide in a supervised or tutored mode, by holding a co-design session with the researcher, where each question of the DG was analyzed and discussed. All the meetings were recorded, constituting a meaningful source of information.

Therefore, the information gathered from this experiment came from three diverse channels through which the teachers provided their experience using our Design Guide. These channels were:

1. An evaluative questionnaire intended to collect direct assessment from the teachers about their perception of the utility of the Design Guide. The questionnaire included four questions in which the teacher had to score the utility of the DG by means of a Likert scale (see Figure 6.5). Although these four questions were closed, all of them were supplemented with an open section to justify their response. Furthermore, the questionnaire included two open questions aimed at capturing the insights of the teachers using the DG (see Figure 6.5).

2. The results of using the Design Guide by each of the six teachers. That is, the design of grouping policies produced as a consequence of using our DG.

3. The researcher's observations supported by the recordings of the co-design sessions and the focus group held with all the teachers involved in the experiment.



QUESTIONNAIRE: USEFULNESS OF MyGang Design Guide

This questionnaire aims at getting the user's perspective about the utility of the Design Guide for MOOC teachers to manage students' groups for GLA (Group Learning Activities) in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which the Design Guide helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 3 4 5

Justify briefly your choice:

4 **Score from 1 to 5 the grade in which the Design Guide made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 4 5

Justify briefly your choice:

Page 1 of 2

5 **If the *Design Guide* has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

6 **Briefly describe which aspects of the *Design Guide* were less useful or which ones were not needed or relevant for you.**

Page 2 of 2

Figure 6.5: Closed (page 1) and open (page 2) questions on the Evaluative Questionnaire to validate our Design Guide

6.4.2 Results

The model questionnaire created for the evaluation of the DG, together with the fieldwork corresponding to the fulfillment of this questionnaire and the results of using our Design Guide by the teachers is available in Appendix F.

The huge amount of data collected through this intervention and the significant weight of the qualitative information gathered (*i.e.*, researcher observation, recorded meetings, open questions in the evaluative questionnaire and grouping strategies designed by the teachers using our DG) forced us to prioritize the processing according to the importance of the information collected and the feasibility of the processing in a suitable timing. Therefore, due to this prioritization, the processing of the data coming from the researcher's observations and the recording of her meetings with the teachers was postponed, to be tackled as future work. Thus, the first item to be processed, due to its relevance, was the responses in the evaluative questionnaire, scoring the usefulness of our DG as perceived by the teachers.

Table 6.4 shows the responses of six teachers, three for the Standalone Mode or SAM (*i.e.*, SAM1, SAM2 and SAM3) and the other three for the Supervised/Tutored Mode or STM (i.e, STM1, STM2 and STM3).

As can be observed in Table 6.4, the questions related to the understanding and awareness of the teacher on the issues of the MOOC context related to the formation of teams, that is, Q1 and Q2, obtained similar scores in the standalone mode and in the supervised one. Although the scoring was slightly higher in the supervised/tutored mode, the difference with the standalone mode had only a relative significance.

However, as shown in Table 6.4, those questions related to the decision making and changing of mind, that is, Q3 and Q4, presented significant differences between the two modes. The results were confirmed

		Tutored Mode			
		Q1	Q2	Q3	Q4
TM1		4	4	5	4
TM2		5	5	5	4
TM3		5	5	3.5	4
	Avg.	**4.67**	**4.67**	**4.5**	**4**
		Standalone Mode			
		Q1	Q2	Q3	Q4
SAM1		4	4	3	2
SAM2		4	4	2	2
SAM3		4	4	3	4
	Avg.	**4**	**4**	**2.67**	**2.67**
	Global avg.	**4**	**4**	**2.67**	**2.67**

Table 6.4: Responses to the evaluative questionnaire of the Design Guide.

in the responses to the open questions of the evaluative questionnaire. Table 6.5 shows a sample of comments focused on the needs in order to use the DG in a standalone mode.

Once the four closed questions scored in the evaluation questionnaire through a Likert scale cita had been processed, we analyzed the open responses in the "Briefly justify your choice" part of each question. We discovered that the teachers in the SAM:

- need more explanations on concrete issues and influential factors (both static and dynamic) that could appear when forming the teams,
- missed some examples or case studies to understand some concepts explained theoretically.

However, the DG in its current state was a twelve page document that turned out to be hard and laborious to manage for the teachers. Due to this fact, adding more pages to the DG did not seem to be the best solution. These opinions, together with the responses to Q5 and Q6, suggested the convenience of embedding these explanations and examples in a computational tool, maybe with the form of a wizard, that could give step-by-step advice, offering visual examples depending on the concrete stage of the process.

Once the evaluation questionnaires had been wholly processed, the researcher had a first insight into the utility of the DG which should be confirmed in future work by the remaining sources of data.

Teacher	**Open Question**	**Response**
SAM2	Q3	I would need more details (examples, step-by-step procedures etc) to say that it could help me to support decision making.
SAM3	Q3	I would expect more info on methods like JigSaw and what I can achieve with that.
SAM1	Q6	It would be helpful to know why a decision should be taken. What is the reason and what could be the pros/cons of each decision.

Table 6.5: Sample of responses to the open questions in the evaluative questionnaire of our DG.

Therefore, at the current stage, and pending the processing of the postponed data, we can conclude that the DG had slightly better results when it was used in a supervised mode, especially in those aspects related to making decisions or changing the teacher's mind regarding successful grouping strategies to be used in MOOC contexts.

6.5 MyGang Final Proposals

6.5.1 Framework

The artifact we have called Framework constituted the first contribution produced through our research process. It agglutinates five conceptual elements. The first three are graphical elements used to describe and conceptualize our problem context, its dimensions and the most influential aspects or factors that we deemed should be taken into account when planning and deploying a grouping strategy in a MOOC. To facilitate their understanding, all of these elements have been materialized by means of graphical representations which help to acquire a visual global view. On the other hand, the F artifact contains another two elements which constitute models to be taken as patterns for developing the instruments needed to design and implement grouping policies in MOO courses.

Thus, the F (Framework) artifact, in its latest version, is composed of the following elements:

- Context (C): This element presents the extrinsic characteristics of the MOOC context that affect the management of groups by deriving them from each intrinsic feature of the MOOCs (*i.e.*, Massive, Open, Online and Course). Its graphical representation can be checked in Figure 3.5 of Chapter 3.
- Dimensions (D): The purpose of this element is to describe the four levels of abstraction where the aspects to be taken into account to manage student teams in MOOCs can be framed. The representation aims to establish a metaphor similar to the one established concerning levels in programming languages, thus considering the lowest level to be the one closest to the machine, while the highest refers to the abstract high-level considerations of the teachers regarding their learning designs. This graphical representation can be seen in Figure 3.6 of Chapter 3.
- Grouping Factors (GF): This is probably one of the main elements of the framework artifact due to the key information it collects and the amount of other artifacts derived from it. The GF diagram presents a taxonomy of influential factors by means of a hierarchical representation in the form of a tree. This graphical representation can be checked in Chapter 3, Figure 3.7. However, due to the importance of this element, we created another representation which combined the hierarchical classification with the levels of abstraction where the influential factors can be framed. This new representation can be observed in Figure 6.6.
- Guidelines Model (GM): This schema model establishes the structure, topics and context that a Design Guide should include and intends to serve as a pattern to create specific design guides particularized for the specific context where they are going to be used.
- The Tools Architecture (TA) described in Section 5.3 of Chapter 5 can be seen in Figure 5.2. This element constituted a high-level design of the envisioned group-management supporting tools structure. It uses the pedagogical Grouping Factors (*i.e.*, Learning Design, Dynamic Data and Static Data) as data inputs for the system. The schema is composed of several modules that include:
  - A Gathering Data Adapter used to collect and import information from the learning platform through the available channels offered by the concrete platform, such as an API, native questionnaires or surveys of the platform, etc.
  - A Dynamic Deployment Adapter used to put into practice on the platform the grouping strategy designed by the teacher through the channels provided by the platform, such as an API or standards like LTI (Learning Tools Interoperability).
  - The Dynamics Processing Module in charge of calculating, reckoning and estimating dynamic factors (such as the engagement, the emerging role or the dropout probability) using the raw dynamic data collected from the platform.
  - The Grouping Module which configures the group structures based on the collected data and on the specifications given by the teachers. This module can be implemented with different grouping techniques and algorithms, such as clustering methods.
  - A Controller module intended to manage and lead the rest of the elements and the process flow. This module can also be implemented using different approaches which would lead to a characterization of the system as intelligent, adaptive, etc.
  - An Interface Module aimed at gathering the teacher requisites, learning designs and grouping strategies to deploy on the course.

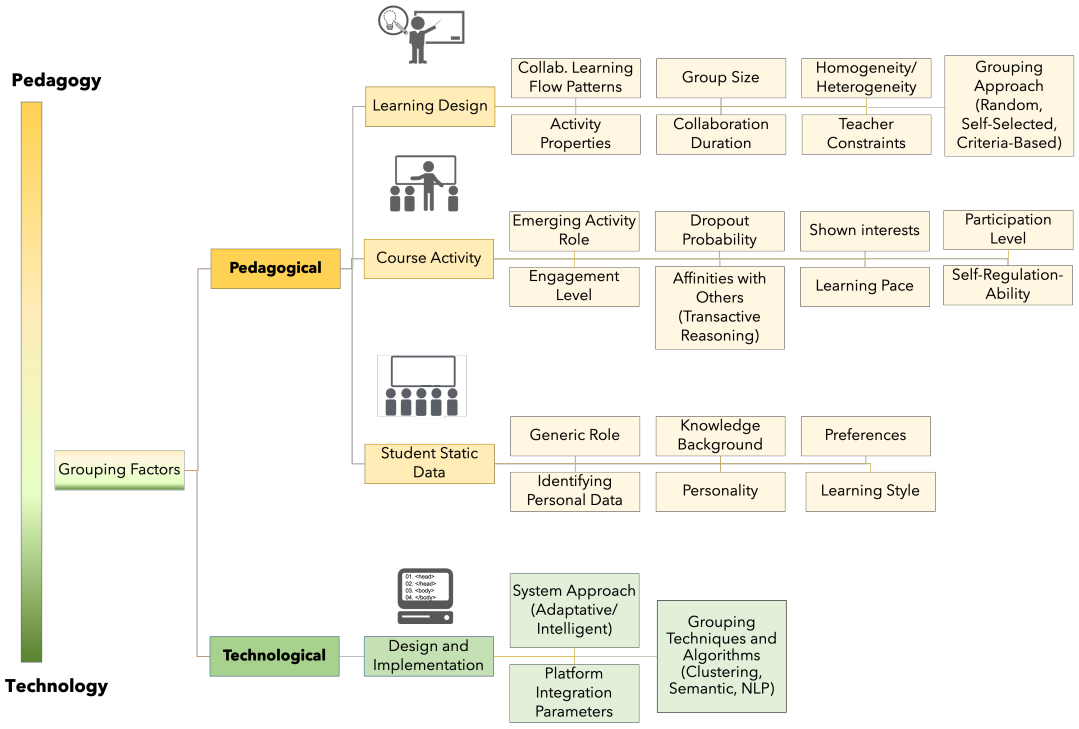


Figure 6.6: Hierarchy of Grouping Factors, presenting each branch framed into its level of abstraction.

6.5.2 Guidelines

The artifact identified as G (Guidelines) is composed of a single element we called the Design Guide (DG) for MOOC teachers, created as a proof of concept of the Guidelines Model of our Framework. This element was the evolution of the Teachers' Questionaire described in Section 4.3 of Chapter 4. The Design Guide consists of four sections related to the MOOC context features and the three dimensions of the pedagogical factors described in the previous subsection. In its current state, the DG may be used by the teacher or instructional designer, either in a standalone mode, or as a part of a co-design process with the researcher and the stakeholders in order to discuss every item included in it. We called this second mode of use the tutored or supervised mode, and it produces better results regarding decision making, as shown in Section 6.4.2. In the tutored mode, the researcher gives advice about the possible advantages and drawbacks of every decision taken by the teachers based on prior experiences, the literature and expert opinions. The first section of the guide is aimed at making teachers aware of the context features that affect group formation. It includes questions to reflect and select concrete characteristics of the envisioned MOOC using the researcher's recommendations. The rest of the sections of the guide should be filled out once for each GLA to be designed. The second section is focused on configuring the learning design characteristics of the GLA that have an impact on the group formation, e.g., the application of a Collaborative Learning Flow Pattern (CLFP). Sections three and four are intended to help the teachers elicit the static and dynamic data factors that can be considered to configure the groups by using them as grouping criteria. In these last sections, the teachers assess the importance and impact of using each factor in the envisioned GLA and choose which factors they would like to use in the group management

of each collaborative activity.

The Guidelines Model as well as its proof of concept, the Design Guide, can be observed in Appendix E.

6.5.3 Tools

The third artifact produced as a consequence of our research process has been named Tools (T) because it refers to the support given to the teachers to put into effect the grouping strategy they design on the concrete learning platform selected. To that aim, we produced an Architecture model based on the programming design pattern known as the "adapter" [47] and we created a proof of concept of this architecture by programming a set of python routines that, together with the API callings, allowed us to deploy all the grouping strategies tested throughout this dissertation on the Canvas Network learning platform. Thus, the Tools artifact is composed of one single element: the Tool Prototype (TP) generated from our architecture model.

The Tool Prototype (TP) developed to carry out our three studies in real MOOCs on the Canvas Network learning platform constituted a proof of concept of the Architecture. This TP served us to validate the viability and suitability of the proposed Architecture. In its latest version, it still needs some fine tuning and is formed by a set of python routines. It also includes a rudimentary version of an interface module, which receives the input (e.g., group size, grouping criteria, etc.) through a configuration file and produces on-demand reports about the groups' performance. The functionalities of its modules were developed to satisfy the concrete specifications of each study. The adapters were programmed to meet the Canvas Network platform requirements and the grouping module to implement the group configuration specifications provided by the teachers. The functionalities to configure the groups included:

- Three levels of priority where criteria should be applied.
- Several criteria in each level.
- The use of both homogeneity and heterogeneity with respect to the criteria chosen.

6.6 Chapter Conclusions

To sum up, this third study served to get additional evidence about the eventual advantages of applying homogeneous-engagement policies to form small groups in MOOC contexts. After the analysis of the data, several advantages of the H-ECGA have been confirmed.

When the objective to create small groups in learning contexts is to carry out a collaborative task, an unavoidable requirement is to achieve more than one active student in the group. The approach validated in this study has shown it can achieve better results in this regard than a random grouping.

It has also been shown that this approach achieves better results than a random grouping in terms of peer interactions and number of active students per team, while it also obtained a considerable percentage (40% in the fourth week and more than 75% in the sixth week) of teams in which more than half the students of the team were active. This feature does not guarantee an enriching collaboration, but it is a first step towards achieving such an objective. Furthermore, the satisfaction of students with the collaboration carried out in teams formed with this approach is reported by them as being positive.

Although the results of the second and third study can not be directly compared, it seems that the H-ECGA also achieve better results than the traditional f2f strategies based on forming heterogeneous groups in terms of student profile information (*i.e.*, static factors).

All these positive results were even better when the experiment is carried out a second time and deployed using data analytics from the second half of the course.

Furthermore, the Tool Prototype developed and improved throughout the research process proved to be useful for implementing the H-ECGA on the Canvas Network learning platform. Thus, it could be considered as a proof of concept of the Architecture included in the MyGang Framework which certifies the viability and suitability of this Architecture.

On the other hand, the second round of expert opinion showed that the Design Guide (DG) was useful to make teachers aware of the MOOC context issues and pitfalls, either when used in a standalone mode or in a supervised co-design session. However, to make teachers change their mind or to foster the decision making, the DG worked better when the researcher met the teachers in a co-design session aimed at deepening and discussing all the critical aspects of each decision. When the teachers used the DG in a standalone mode, they missed more explanations, examples and cases of study, but we guess that including them in a textual artifact would make it much longer and hard to handle, so we deemed it would be better to include these explanations and examples the teachers require in the grouping tool in the form of an on-line help such as a wizard.

Moreover, our DG have been used in a supervised mode in the three studies carried out throughout the dissertation (STD1, STD2, and STD3) proving to serve as a useful instrument to make teachers aware of the Group Formation issues in the MOOC context, as well as to design the group formation policy for the GLA implemented in their courses. We considered this fact contributed to test the validity of such DG, the proof of concept of our Guidelines Model.

Anyhow, the evaluation of our DG done just by experts is a start and should be developed by different evaluation techniques in the future. Therefore, we plan to implement a thorough evaluation process by using the EREM (Evaluand-Oriented Responsive Evaluation Model) framework [66] in our future work, not only with the Design Guide, but also with the model from which it was derived, the Guidelines Model of our framework.

Chapter 7

Conclusions and Future Work

Summary: This chapter concludes our dissertation, summarizing how we accomplished its overall goal (to support MOOC teachers in the design and implementation of group formation policies aimed at carrying out GLA) by undertaking the three partial objectives that arose from this goal. We document how we fulfilled these partial objectives by undertaking, in each cycle, specific research questions that were answered through a variety of research techniques and studies in real MOOCs. We also present in this chapter the contributions proposed, and the way in which the said contributions were evaluated along the dissertation. As a result of this validation, we can conclude that our thesis objectives have been accomplished, although new research lines related to our dissertation are already envisioned to be addressed in future work. The publication of seven papers (five of them in international conferences, while the remaining two belong to international JCR-indexed journals) related to the contents of this dissertation can be considered an indicator of the originality and relevance of the proposals documented in this report, as well as a boost to tackle the aforementioned future work.

7.1 Introduction

As explained in the first chapter of this report, the research process selected to address the objectives of this thesis involved an iterative process which began with exploratory iterations and moved forward towards increasingly more evaluative cycles. Once the four cycles of our research process had been accomplished, and the findings and contributions generated as a consequence had been validated, we were prepared to present the rest of our conclusions of the dissertation, as well as the lines of future work that we deem should be undertaken in the short and medium term.

7.2 Conclusions

The unquestionable importance of MOOCs democratizing access to education around the world moved us to investigate how to improve their instructional quality by including active pedagogies in this kind of courses. However, the intrinsic characteristics of these courses, such as their massiveness and openness, lead to a volatile and low motivated population, which in turn hamper the formation of successful student teams necessary for implementing most of these active pedagogies (e.g., collaborative learning, project based learning, etc).

Thus, we considered that the first step in the complex objective of transforming MOOCs into higher instructional quality courses should be to provide support to those teachers interested in carrying out active pedagogies. To do so, we decided to overcome one of the obstacles that hinder the implementation of such active pedagogies by facilitating the design and implementation of small student groups formed with sound criteria suited to the MOOC contexts.

Therefore, and as explained throughout this report, we stated the main goal of this dissertation as the answer of this research question: How can teachers be supported in the design and implementation of Group Formation Policies to carry out GLA (Group Learning Activities) in massive and variable scale online learning contexts? (see Figure 1.1). In order to reach such a goal, we defined three partial objectives, emphasizing some of the current challenges for helping teachers to put group formation strategies suited for MOOC scenarios into practice:

1. To identify and classify the aspects and dimensions to consider in the design and management of grouping policies in massive and variable scale courses.

2. To support teachers in the design of grouping strategies in MOOCs to introduce GLA in these courses.

3. To provide technological support to implement the grouping strategy designed on the learning platform and to manage (creation, monitoring, restructuring) student groups in massive and variable scale contexts.

Next, we document how we accomplished this goal by fulfilling its three partial objectives.

- To attain our overall goal and fulfill its three secondary objectives, we adopted, as explained in Chapter 1, the DSRM process model proposed by Peffers [107], a well-known research methodology used in information systems research aimed at developing various types of artifacts intended to solve human problems. The nature of this methodology is iterative, improving the versions of the artifacts generated in each cycle as a consequence of the undertaking of its six phases (see Figure 1.7). However, the complex nature of our research goal (involving both educational and technological aspects and stakeholders) moved us to supplement the DSR Methodology selected to undertake our goal in first place, by employing some Design-Based Research principles. Thus, following the DBR criteria, our research process comprised several iterations with the aim of improving educational practices based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories. Moreover, our pragmatic worldview conditioned the methods and research approaches used during the process, leading to a mixed-methods approach aimed at acquiring a better understanding of the problem analyzed, and more robust results by means of triangulation and complementarity [65], [28]. According to Greene [50] and Cook [26], a "better understanding" means a more comprehensive (deeper, wider) understanding, more defensible and stronger.

- Accordingly, we deemed that the problem should be faced firstly from a holistic point of view that would allow us to acquire a broad understanding of the problem context, its issues and the connections between them. We thus carried out a literature review (LR) that was then triangulated (due to our underpinning methodological assumptions) with the gathering of the opinion of several experts (EO1). As a consequence of these tasks, we produced a first version of our framework depicting the problem context and a classification of influential factors to be taken into account in our research problem, as well as the dimensions or levels in which these influential factors could be framed.

- Taking the classification of influential factors, we analyzed the results in order to find out those factors that really characterize the MOOC scenarios by differentiating it from other learning contexts. Thus, we focused on those factors we called Dynamic because they capture the essential features of the MOOC context which distinguish this type of courses from others.

- We started by retrieving raw data from the learning platform *i.e.*, number of pages of the course visited by each student, time connected, number of tasks submitted and number of messages posted in forums) and using the said data to "cook" (by reference of other authors [77], [41], and [42]) the dynamic factor known in the literature as student engagement. Our first study in a real MOOC scenario (STD1) showed that requiring homogeneity from the engagement of the students in a team

produced good outcomes in terms of the number of active students per team, student participation and student satisfaction, while minimizing the number of teams with a single active participant (a frustrating circumstance in collaborative settings). The results of this strategy were significantly better than a random grouping in which the no-show students [3] were previously segregated. To do so, we developed a tool prototype that allowed us to deploy the homogeneous engagement criteria strategy on the learning platform.

- Once we had a framework and a tool prototype, we decided to put into practice the strategies preferred by teachers highly experienced in CL in traditional f2f scenarios in a second intervention in a real MOOC scenario (STD2). We advised them on the issues of the MOOC context by means of a design guide used in a co-design session; although we implemented their grouping strategy which used static factors as the first level of criteria to form the teams by requiring homogeneity regarding them (*i.e.*, language and the preferred days to work in the course), thus producing four homogeneous cohorts in terms of these static factors. However, the teachers chose for the second level of criteria (to be applied in each of the aforementioned cohorts) to require heterogeneity regarding the students' engagement and also a heterogeneity requirement in terms of other static factors gathered in a survey, which should be applied in a lower level of priority (*i.e.*, ICT experience, ICT attitude, C experience, CL attitude and knowledge domain). This strategy was similar to that they applied in their f2f classes and is very popular among several authors who defend that heterogeneity enriches the groups because individuals with low levels (of the selected feature) take advantage of the high level of their partners [140]. However, these conclusions have generally been applied to what we call "static factors", because the dynamic factors were not gathered in traditional f2f learning settings. The requirement of heterogeneity in the engagement of the team members turned out to produce similar outcomes to those of a random grouping. This led us to assume that traditional learning settings include by default some kind of homogeneity (most of the students are indeed in the course and attend the classes), which is not present in the MOOC contexts and should therefore be required in the first instance in order to build sound teams in such contexts. During this stage, we produced models and schemas that could be taken as reference by those stakeholders interested in creating their own design guides and computational tools.

- Finally, we decided to get additional evidence of our first hypothesis/proposal for a grouping policy with a different sample of population in order to validate and strengthen our findings. To do so, we undertook our third study in a real MOOC scenario (STD3) and enriched our tool prototype to monitor and restructure the teams under conditions stated by the teacher. The Homogeneous Engagement Criteria Grouping Approach continued to show coherent and positive results, while the tool prototype implemented the strategy successfully. In order to test the adequacy, improve the quality and validate the utility of our design guide and its modes of use, we performed a second round of gathering expert opinions (EO2) with a set of faculty members of a European funded research project which aims to make MOOCs more collaborative so as to support teachers and engage and motivate students, the colMOOC project [1]. By means of questionnaires, recorded co-design sessions and the results of the fulfillment of the design guide by these teachers, we validated its utility while envisioning future new roads to improve its efficiency.

7.3 Summary of Results and Contributions

The three partial objectives set out above tackle three outstanding challenges emerging from the literature and our own observations (see Chapter 2). Even if each of the proposed contributions addresses one problem separately, and can be used separately, they are not independent of each other. Rather, these contributions have informed each other throughout the entire research process. Nevertheless, not only are these contributions related through their respective development processes, but they can also be combined in their use. In this way, they are completely compatible with each other, and they can be (and have

[1] https://colmooc.eu

been) applied in a combined manner, by the different stakeholders (*i.e.*, teachers and researchers), in concrete authentic MOOC scenarios. For instance, the classification of influential factors and the whole conceptual and technological framework was used to structure the contents of the envisioned guidelines and design guides. Subsequently, the researcher and the MOOC teachers used the technological support developed in this dissertation to deploy and manage, in real-time, the groups needed to carry out the grouping policies just designed by means of the aforementioned guidelines.

The contributions of this Ph.D. thesis ordered by goals, as well as the publications achieved with them, are explained in the following subsections:

7.3.1 First Objective: Identification and classification of the aspects and dimensions involved in our research problem

The main purpose of the first cycle (summarized in Chapter 3) of our research process was to explore the problem while acquiring a broad view of its context, thus deepening our understanding of the first of our partial objectives. Thus, to fulfill this objective, we undertook a literature review (LR) and a gathering of expert opinions (EO1) that produced the first version of a conceptual and technological framework describing, classifying and hierarchizing the aspects and dimensions to be taken into account to implement grouping policies suited for MOOCs.

The work developed during this stage produced two short papers presented in two international conferences:

- The Intelligent Support for Learning in Groups (ISLG) workshop of the 13th the Intelligent Tutoring Systems (ITS2016) [129].

  1. Sanz-Martínez, L., Ortega-Arranz, A., Dimitriadis, Y., Muñoz-Cristóbal, J. A., Martínez-Monés, A., Bote-Lorenzo, M. L., & Rubia-Avi, B. (2016). Identifying Factors that Affect Team Formation and Management in MOOCs. In Proceedings of the 5th Workshop on Intelligent Support for Learning in Groups (ISLG-2016) on the 13th International Conference on Intelligent Tutoring Systems (ITS2016).

- The International Symposium on Computer in Education (SIIE2016) [123].

  2. Sanz-Martínez, L., Dimitriadis, Y., Martínez-Monés, A., Alario-Hoyos, C., Bote-Lorenzo, M. L., Rubia-Avi, B., & Ortega-Arranz, A. (2016). Influential factors for managing virtual groups in massive and variable scale courses. In 2016 International Symposium on Computers in Education (SIIE) (pp. 1–4). https://doi.org/10.1109/SIIE.2016.7751851

Later on, during the successive iterations, the framework was refined, improved, enriched and validated to its final version, described in Chapter 6, Subsection 6.5.1. In its most recent version, the framework includes not only the graphical elements identifying and classifying the aspects and dimensions involved in our research problem, but also two conceptual elements (an architecture schema and a guidelines model) that connected with and served to attain the remaining objectives of this dissertation that are documented below.

7.3.2 Second Objective: Support for the teachers in the design of grouping strategies to introduce GLA in MOOCs

Once the framework had been created in the first cycle of our research process, we realized that in its graphical form, it seemed to be useful for other researchers, but difficult to understand and use for the teachers, the subject of our dissertation goal. Because of this, we decided to transform the graphical elements into new elements that were understandable as well as useful for the teachers. Thus, we first created a questionnaire with reference to the Context and the Grouping Factors graphical elements, which served to develop a Guidelines Model aimed at being a kind of template for the teachers to develop their own Design Guides adapted to their context and environmental peculiarities. The Guidelines Model is described in Chapter 6, Subsection 6.5.1 and its proof of concept, a Design Guide adapted for our learning

platform and the methods and data it allows and provides, and for the concrete factors we deemed as the most relevant, is described in Chapter 6, Subsection 6.5.2. Furthermore, Appendix C includes the Teachers' Questionnaire used to design the MOOC and GLA characteristics and the grouping strategies for our first intervention (STD1), both the model and the fieldwork carried out by the three teachers involved, while Appendix E contains the Guidelines Model and its proof of concept, the Design Guide (template), together with the teachers' fieldwork of the second intervention (STD2).

The work related to the support provided to the teachers has been documented in the following publication:

- JCR-indexed international journal, Journal of Universal Computer Science (JUCS) [124].

  3. Sanz-Martínez, L., Er, E., Dimitriadis, Y., Martínez-Monés, A., & Bote-Lorenzo, M. L. (2018). Supporting teachers in the design and implementation of group formation policies in MOOCs: A case study. Journal of Universal Computer Science, 24(8), 1110–1130.

7.3.3 Third Objective: Technological support for the teachers to implement the grouping policies designed in the learning platform

To put into practice the grouping policies designed by the teachers, it was necessary to develop a tool prototype. This was used in our first intervention in a real MOOC scenario (STD1) and allowed us:

a) to gather data about the students' dynamics from the learning platform,

b) to deploy the grouping policy designed by the teachers on the learning platform, and

c) to retrieve data from the platform about the performance of the teams created.

The work developed during this stage produced two publications:

- International conference paper in the 12th European Conference of Technology Enhanced Learning (ECTEL2017) [127].

  4. Sanz-Martínez, L., Martínez-Monés, A., Bote-Lorenzo, M. L., Muñoz-Cristóbal, J. A., & Dimitriadis, Y. (2017). Automatic group formation in a MOOC based on students' activity criteria. In Proceedings of the 12th European Conference on Technology Enhanced Learning (EC-TEL-2017), Tallinn (Estonia), 12-15 September 2017 (Vol. 10474 LNCS, pp. 179–193). https://doi.org/10.1007/978-3-319-66610-5_14.

- JCR-indexed international journal, Behaviour and Information Technology (B&IT)[125].

  5. Sanz-Martínez, L., Er, E., Martínez-Monés, A., Dimitriadis, Y., & Bote-Lorenzo, M. L. (2019). Creating collaborative groups in a MOOC: a homogeneous engagement grouping approach. Behaviour and Information Technology, 38(11), 1107–1121. https://doi.org/10.1080/0144929X.2019.1571109.

However, the main technological contribution of our dissertation is the architecture schema we described in Chapter 6, Subsection 6.5.1, aimed at serving as a reference to create technological tools independent from the learning platform selected, which will allow the teachers to implement their own grouping strategies. As a proof of concept of this model of architecture and taking it as a reference, we created a new version of the tool prototype which served us to deploy our second and third studies in real MOOC scenarios (STD2 and STD3 respectively).

The work developed in our third study was documented in the following publication:

- International conference paper in the CEUR Workshop proceedings [126].

  6. Sanz-Martínez, L., Martínez-Monés, A., Bote-Lorenzo, M. L., & Dimitriadis, Y. (2018). Validating performance of group formation based on homogeneous engagement criteria in MOOCs. In CEUR Workshop Proceedings (Vol. 2188, pp. 38–49).

Summarizing, and apart from the papers and articles published, we deem that the main contribution of this thesis which attains the three partial objectives posed in Chapter 1, Section 1.2 is the framework, the F artifact described in Chapter 6, Subsection 6.5.1 by means of its elements:

- The C, D and GF graphical elements attained the OBJ_CLA.
- The GM element attained the OBJ_DES.
- The AM element attained the OBJ_IMP.

Conversely, the G (guidelines) artifact described in Chapter 6, Subsection 6.5.2 and its single element, the Design Guide, is also a minor contribution to attain the OBJ_DES, while the T (tools) artifact described in Chapter 6, Subsection 6.5.3 and its single element, the Tool Prototype, is also a minor contribution to attain the OBJ_IMP.

7.4 Future Work

Besides the aforementioned lessons learned during the research process of this thesis, several issues and opportunities emerged that suggest future research lines. The most significant ones are presented in this section.

Although every line of future work would involve both educational and technological aspects, due to the research area in which this dissertation is framed (*i.e.*, Technology Enhanced Learning, TEL, and Computer Supported Collaborative Learning, CSCL), we have divided the future projects we envision and propose according to what we deem their main component (*i.e.*, pedagogical vs. technological).

Thus, the future lines of work we propose from the pedagogical point of view are:

- **Wizard Interface**

  It would be a major advance in the teacher support to develop a usable and user-friendly graphical interface for the tool in which the Design Guide principles, examples and recommendations are to be embedded. It should act as a wizard, asking the teacher about his/her preferences, while showing on the screen examples and warnings concerning each choice. To do so, it will be necessary to evaluate, with the stakeholders, how to embed the lessons learned throughout this dissertation into the tool's assistance module, in order to provide teacher support and guidance.

- **Deepen the collaborative quality of the teams formed**

  The monitoring of the formed teams is essential to assess the quality of the collaboration carried out within the groups. We used mainly quantitative data (e.g., number of messages shared in the group space) when assessing the activity level of the groups; while the quantitative analysis was performed mainly to discover student satisfaction. Future research should also look into the quality of the messages exchanged, within the group space, among the team members through qualitative data analysis methods. This could include recognition pattern techniques to delve into the meaning and quality of the messages, as well as into the students' perception of the GLA and their performance during it.

- **Extend the inquiry to other types of GLA, such as those based on CLFP**

  The proposed homogeneous-engagement approach produced good outcomes when it was tested in our studies in a specific type of collaborative activity. To further support its relevance and effectiveness, in future research, this approach should also be tested in other types of collaborative activities. It would also be desirable to develop, for instance, specific grouping algorithms for those activities based on Collaborative Learning Flow Patterns such as jigsaw or pyramid.

- **Explore other factors (static or dynamic) to be used as grouping criteria**

  Figure 3.7 shows a hierarchical classification of the influential factors identified in our framework. Those factors could be potentially used as grouping factors, if we are able to estimate them from certain available variables. These variables could be obtained from the course, either through the platform analytics, for those factors with a dynamic nature; or through student surveys, for those considered as static. However, this choice should be carefully pondered after a thoughtful decision process, clearly argued that, if possible should be based on evidence.

- **Test a two-level-criteria strategy (homogeneous dynamic basis + static factor heterogeneity) on huge samples**

  In our studies, the homogeneous-engagement has been the only grouping criteria applied to form the groups which have demonstrated better outcomes than a random grouping (slightly improved by the segregation of the no-show students). However, it also could be the first step in the whole group formation process, prior to applying other possible grouping criteria. Future work plans could include the application of two levels of criteria. The first level would set the homogeneous-ground based on the student activity indicators needed to build successful teams. Once this homogeneity has been established, we would be able to apply a second level of criteria to implement the pedagogical objectives of the collaborative activity, taking advantage of the massive scale and enriching heterogeneity of MOOCs. To do this, a large sample of students (larger than that of our three studies, which had just over a thousand students) would be necessary in order to create control groups in terms of the second level of criteria, that related to the pedagogical criteria selected by the teachers.

- **Inquiry on Heterogeneity vs. Homogeneity**

  It would also be interesting to check the differences between a random grouping slightly improved by the segregation of no-show students and the application of heterogeneous criteria regarding different variables. In the future, we would also like to delve into the outcomes of applying homogeneity on Dynamic Factors by testing it with different indicators and variables, such as the students' connection patterns.

- **Delve into reorganization strategies**

  In our third study, we implemented a strategy for reorganizing the teams under certain conditions chosen by the teacher. Specifically, we reorganized the teams that had only one active participant after half the days of the activity had elapsed, by putting together those students that were isolated, in a new team. However, comparing the results of STD1 and STD3, we could see that this strategy had hardly any impact on the final results. It would be advisable to delve into other possible methods of reorganizing those teams which are not working as the teacher planned in order to try to find strategies for relocating students who are isolated in their original team.

On the other hand, the projects we deem necessary from the technological point of view are:

- **Multi-platform Adapters**

  To extend our tool prototype to other learning platforms, such as Open edX, MiriadaX or even Moodle platforms, new adapter modules should be developed taking into account the methods and data provided by the selected learning platform. However, in addition, the routines included in the Grouping Module (see the Architecture Schema in Figure 5.2 and its explanation in Chapter 6, Section 6.5, Final Proposals, Subsection 6.5.1, Framework, in its Architecture point) should be revised and enriched due to the variety of tracing data offered for each different platform.

- **Grouping Methods and Algorithms**

  To implement new grouping methods distinct from clustering, such as classification methods (for instance SVM, Support Vector Machines) or CNN (Convolutional Neural Networks) to enrich the tool efficiency, it would be specially interesting to incorporate a regrouping functionality to allow

a reorganization of the groups in real time. Till now, we have carried the formation of the groups in a batch process executed just the night before the beginning of the GLA. The regrouping was also carried out on a concrete date in a batch process at night. The time taken to form the groups was not decisive under these circumstances. However, to solve issues within the teams as quickly as possible, it would be desirable to develop efficient algorithms to monitor and carry out an immediate and effective regrouping.

- **New Methods to "cook" the Platform Raw Variables**

  The input data used to establish the homogeneous engagement base only considered three (in our first study) or four (in our third study) variables regarding engagement, and all of them have been used with the same weight in the clustering process. However, other students' digital traces from the platform analytics (e.g., video logs, private messages to teachers) could be further explored to form a more rigorous approach to set the homogeneous engagement or other indicators concerning student dynamics. Anyhow, the choice of variables or indicators used to estimate engagement should be related to the pedagogical design of the course [69].

Appendix A

Mapping Tables

Summary: In this Appendix, we include the tables created to map the information gathered during the first cycle of our research process. We used these mapping tables to process and synthesize the information gathered by means of a Literature Review (LR) and a set of semistructured interviews aimed at collecting the Expert Opinion of several teachers skilled in Collaborative Learning and MOOCs (EO1). The tables created from the Literature Review were labeled as TableLR1, TableLR2, etc, to identify the origin of the table (with LR for Literature Review) and an ordinal number to sort the presentation of the results. Similarly, the tables generated from the collection of Expert Opinions were labeled as TableEO1, TableEo2, etc.

A.1 LR Tables

In the following subsections we present the tables created from the Literature Review.

A.1.1 TableLR1

Table A.1 (TableLR1) depicts the MOOC extrinsic characteristics, linking each one to the intrinsic characteristic from which it is derived.

Extrinsic Characteristic	Derived From... Intrinsic Characteristic	Selection of References
Heterogeneity	Open	[3], [147], [43]
Latecomers	Open	[4], [3]
Low Motivation	Open	[151], [150]
Low Engagement	Opens	[41], [42], [95], [77], [159], [57]
High Dropout Rate	Open	[101], [156], [119], [120], [135]
Geographic Spread	On Line	[38], [132]
Different Time Zones	On Line	[147], [137]
Asynchronous Predominance	On Line	[61], [60], [86], [33], [23]
No tutoring or low teacher tutoring	Massive	[38], [147], [43], [58], [72]
Tutoring among students	Massive	[3], [95], [49], [58], [67]
Scalable Content	Massive	[51], [16], [68]
Scalable Assessment	Massive	[61], [60], [157], [72], [44]
Specific Platform	Massive	[4], [86], [16], [29], [9], [58], [43]
Non-formal Education	Course idiosyncrasy	[25], [82], [108]
Independent Subjects	Course idiosyncrasy	[72], [23], [108]
Modularized Content	Course idiosyncrasy	[72], [23], [108]
Video Predominance	Course idiosyncrasy	[41], [1], [72], [23], [81], [130]
Modalities (Scheduled Self-Paced)	Course idiosyncrasy	[130], [24], [157], [75]
Pedagogical Approaches (xMOOC, cMOOC...)	Course idiosyncrasy	[24], [88], [43], [29], [9], [14], [36], [21], [82], [134]
Duration - Workload (5-14 weeks - 2-5 hours/week)	Course idiosyncrasy	[16], [106]

Table A.1: TableLR1: List of extrinsic characteristics of MOOCs linked to the intrinsic characteristic from which they are derived and the literature works where they have been identified.

A.1.2 TableLR2

Table A.2 (TableLR2) shows, in its rows, each of the dimensions or levels of abstraction in which the factors can be categorized. Each row specifies, in its second column, the concrete literature references where the dimension was clearly identified.

Dimension	**Selection of References**
Learning Design	[25], [51], [18], [42], [43], [36]
Static Data from the Student	[97], [136], [159], [103], [11]
Course Dynamics	[95], [59], [3], [1], [21], [119], [120], [120], [5]
Technological Implementation	[43], [16], [159], [135], [7], [8], [147], [22], [63], [62], [104], [78], [85]

Table A.2: TableLR2: List of identified dimensions linked to a sample of research works where they were identified.

A.1.3 TableLR3

Table A.3 (TableLR3) lists the factors related to the learning design, each one linked to the references in which it is mentioned.

Learning Design	References
CLFP (Collaborative Learning Flow Patterns)	[55], [85], [2], [54], [142], [25]
Activity Characteristics	[34], [153], [152], [86], [31]
Group Size	[34], [151], [152], [31], [87], [135]
Duration of Collaboration	[34], [31], [100]
Homogeneity / Heterogeneity	[146], [105], [159], [78], [86]
Teacher Constraints	[103], [105], [34], [19]
Grouping Approach (random, self-selection, criteria-based)	[159], [103], [122], [104], [5], [63], [137], [19]

Table A.3: TableLR3: Factors related to Learning Design. List of factors related to the learning design, linked to the literature references where they were identified.

A.1.4 TableLR4

Table A.4 (TableLR4) depicts the aspects we called static factors of the student, collected generally at the beginning of the course. The literature references in which these factors were mentioned are also included in the table.

Student Static-Data	References
Identifying personal data	[19], [22], [159], [43]
Predefined Role	[11], [35]
Previous Knowledge	[153], [19], [22], [43], [105], [63]
Learning Style	[22], [89], [51], [159], [152], [38], [14], [97], [63], [43], [73]
Preferences	[43], [89], [137], [136], [159], [152], [31], [5]
Personality	[22], [159], [137], [136], [5], [105], [63]

Table A.4: TableLR4: Factors related to the Student Static-Data. List of Student Static Factors linked to the literature references in which the factor was identified.

A.1.5 TableLR5

Table A.5 (TableLR5) includes those aspects we named as dynamic, related to the activity and behavior of the students during the course. The references in which these factors appear are also included in the table.

Course Dynamics	References
Emerging Role	[87], [3], [36]
Participation Level	[41], [95], [150], [77], [51], [18], [3], [1], [31]
Engagement Level	[77], [95], [41], [83], [15], [57], [27]
Dropout Probability	[156], [58], [101], [61], [60], [15], [119], [120], [53]
Affinity with others (transactive reasoning)	[147], [11], [100], [13]
Shown Interests	[140], [147], [4], [3]
Learning Pace	[76], [75], [17], [58], [130]
Self-regulation ability	[36], [75], [76], [95], [42], [62], [87], [155]

Table A.5: TableLR5: Factors related to the course dynamics. List of factors related to the course dynamics linked to the literature references where were identified.

A.1.6 TableLR6

Table A.6 (TableLR6) documents the factors we considered as related to the technical implementation. Each row specifies, in its second column, the concrete literature references where the technical factor was mentioned.

Technological Implementation	References
System type (adaptive / intelligent)	[85], [89], [16], [137], [22], [86]
Scientific/Computational Technique (Natural Language Processing, Semantic Web, Surviving Analysis, Predicting Methods...)	[22], [15], [156], [120], [150], [63], [104], [155], [120]
Grouping Algorithm (clustering, optimization, constraint satisfaction...)	[22], [104], [135], [103], [78], [5]
Platform integration parameters	[43], [41], [86], [29], [23], [9]

Table A.6: TableLR6: Factors related to the technical implementation. List of factors related to the technical implementation of the grouping linked to the literature references where they were identified.

A.2 EO Tables

In the following subsections we present the mapping tables created from the interviews that gathered Expert Opinions. The first column of each table contains the concept to be analyzed, whereas the second, third and fourth columns contain the information relative to the Expert 1, Expert 2 and Expert 3, respectively. In each table, we indicate the code IQ-X.Y to refer to the Informative Question from the interview to which the concept of the row is mapped or, the code E if it is an Emerging question. Table A.7.shows the codification of topics and categories of analysis we identified through an anticipatory data reduction process [94] as depicted in Figure 3.3.

TopicID	Topic	CategoryID	Category
T1	MOOC Characterization	IQ-1.1	Peculiarities that occur only in MOOC contexts
T1	MOOC Characterization	IQ-1.2	Tutors participating in a MOOC and distribution of tasks
T1	MOOC Characterization	IQ-1.3	Benefits and drawbacks of MOOC contexts and and reasons to consider them as such
T2	Problem Relevance	IQ-2.1	Do you implement CL in MOOCs? If yes, say how; if no, describe why
T2	Problem Relevance	IQ-2.2	If you had tools to help create groups would you include CL in your MOOC designs?
T3	Grouping Criteria	IQ-3.1	Describe your goals when creating groups
T3	Grouping Criteria	IQ-3.2	Criteria you apply when grouping students
T3	Grouping Criteria	IQ-3.3	What criteria are most important to you (those involving group stability, learning improvement, etc.)?
T4	Collaborative Activities	IQ-4.1	Collaborative activities that could be adapted to MOOCs
T4	Collaborative Activities	IQ-4.2	Activities that you would like to use in a MOOC but are not feasible now and requirements for their implementation in MOOCs
T5	Emergent	E	Aspects that arise during the interview and were not planned in advance

Table A.7: Topics and categories of analysis. List of topics and categories of analysis corresponding to the informative questions of the semi-structured interview.

A.2.1 TableEO1

Table A.8 (TableEO1) depicts the MOOC characteristics previously identified in the literature,

Extrinsic Characteristic	E1	E2	E3
Heterogeneity	IQ-1.1 [pag 2, par 9, lin 7]		
Latecomers	IQ-1.1 [pag 3, par 7, lin 1]	E [pag 2, par 1, lin 15]	
Low Motivation	IQ-2.2 [pag 4, par 5, lin 4]		IQ-3.1 [pag 5, par 6, lin 2]
Low Engagement	IQ-2.2 [pag 4, par 5, lin 6]	IQ-1.1 [pag 2, par 3, lin 2]	
High Dropout Rate		IQ-1.1 [pag 2, par 3, lin 2]	
Geographic Spread	IQ-1.1 [pag 2, par 9, lin 8]		E [pag 1, par 3, lin 13]
Different Time Zones	IQ-1.1 [pag 2, par 9, lin 8], IQ-3.2 [pag 6, par 3, lin 1]		E [pag 1, par 3, lin 16], IQ-4.1 [pag 7, par 3, lin 2]
Asynchronous Predominance	IQ-1.1 [pag 2, par 9, lin 7], IQ-3.2 [pag 6, par 3, lin 6]		IQ-4.1 [pag 7, par 3, lin 1]
No tutoring or Low teacher tutoring	IQ-1.1 [pag 3, par 3, lin 11]	IQ-1.1 [pag 2, par 7, lin 7]	IQ-1.1 [pag 3, par 3, lin 4], IQ-1.2 [pag 3, par 5, lin 4]
Tutoring among students	IQ-1.1 [pag 2, par 7, lin 5]		IQ-1.2 [pag 3, par 5, lin 12]
Scalable Content		E [pag 2, par 1, lin 12]	
Scalable Assessment			
Specific Platform			IQ-2.1 [pag 4, par 3, lin 7], IQ-1.2 [pag 3, par 4, lin 7]
Non-formal Education			
Independent Subjects			

Modularized Content		
Video Predominance	E [pag 1, par 8, lin 2]	E [pag 2, par 4, lin 6]
Modalities (Scheduled / Self-Paced	IQ-1.3 [pag 3, par 7, lin 2]	IQ-1.2 [pag 3, par 5, lin 5]
Pedagogical Approaches (xMOOC, cMOOC...)	IQ-2.2 [pag 5, par 3, lin 9]	
Duration / Workload (5-14 weeks / 2-5 hours/week)		

Table A.8: MOOC extrinsic characteristics. List of extrinsic characteristics of MOOCs linked to the expert who identified them, indicating the Informative Question (IQ) or Emerging (E) category in which they do so and a reference (i.e., page, paragraph and line) to the evidence found in the interview.

A.2.2 TableEO2

Table A.9 (TableEO2) shows the aspects related to the learning design.

Learning Design	E1	E2	E3
CLFP (Collaborative Learning Flow Patterns)		E [pag 2, par 1, lin 13], IQ-1.1 [pag 2, par 7, lin 10], IQ-4.2 [pag 4, par 6, lin 1]	IQ-4.2 [pag 8, par 1, lin 1]
Activity Characteristics	IQ-2.2 [pag 4, par 4, lin 8], IQ-2.2 [pag 5, par 3, lin 9], IQ-2.2 [pag 5, par 7, lin 2]	IQ-3.1 [pag 3, par 9, lin 2], IQ-4.1 [pag 4, par 4, lin 1]	IQ-4.1 [pag 7, par 4, lin 1], IQ-4.1 [pag 7, par 5, lin 1], IQ-4.1 [pag 7, par 6, lin 1]
Group Size	IQ-2.2 [pag 4, par 4, lin 6]		IQ-4.1 [pag 7, par 6, lin 3]
Duration of Collaboration	IQ-2.2 [pag 4, par 4, lin 8], IQ-4.2 [pag 7, par 1, lin 6]	IQ-3.3 [pag 4, par 2, lin 2]	IQ-4.1 [pag 7, par 3, lin 7], IQ-4.1 [pag 7, par 3, lin 9]
Homogeneity/ Heterogeneity	IQ-3.2 [pag 6, par 3, lin 2]	IQ-3.1 [pag 3, par 11, lin 15]	IQ-3.2 [pag 6, par 3, lin 3]
Teacher Constraints			
Grouping Approach (random, self-selection, criteria-based)	IQ-2.2 [pag 5, par 3, lin 2]		E [pag 1, 3, 11], E [pag 8, par 9, lin 1]

Table A.9: Factors related to learning design. List of factors related to the learning design, linked to the experts who identify them indicating the informative question in which they do so and a reference to the evidence found in the semi-structured interview.

A.2.3 TableEO3

Table A.10 (TableEO3) contains the factors related to the static data of the students, collected generally at the beginning of the course.

Student Static-Data	E1	E2	E3
Identifying personal data	IQ-4.2 [pag 7, par 3, lin 1], IQ-1.1 [pag 2, par 9, lin 11], IQ-1.1 [pag 3, par 1, lin 1]		IQ-3.2 [pag 6, par 3, lin 6]
Predefined role			
Previous knowledge	IQ-1.1 [pag 2, par 9, lin 10]	IQ-3.1 [pag 3, par 11, lin 6]	
Learning style	IQ-3.1 [pag 6, par 1, lin 2]		IQ-3.2 [pag 6, par 3, lin 6]
Preferences	IQ-4.2 [pag 7, par 3, lin 2]	IQ-3.1 [pag 3, par 11, lin 9]	
Personality			

Table A.10: Static factors from the students. List of the student's static factors linked to the experts who identify them indicating the Informative Question (IQ) in which they do so and a reference to the evidence found in the semi-structured interview.

A.2.4 TableEO4

Table A.11 (TableEO4) includes those aspects we named dynamic related to the activity and behavior of the students during the course.

Course Dynamics	**E1**	**E2**	**E3**
Emerging Role	IQ-1.1 [pag 2, par 7, lin 5] y [pag 2, par 9, lin 3]		
Participation Level	IQ-1.1 [pag 3, par 5, lin 3]	E [pag 2, par 1, lin 15], IQ-3.1 [pag 3, par 11, lin 11]	IQ-2.2 [pag 5, par 2, lin 7], IQ-2.2 [pag 5, par 4, lin 4], IQ-4.2 [pag 8, par 9, lin 4]
Engagement Level			
Dropout Probability			
Affinity with others (transactive reasoning)	IQ-3.2 [pag 6, par 3, lin 2]		
Shown Interests	IQ-3.2 [pag 6, par 3, lin 2]	IQ-3.1 [pag 3, par 11, lin 10]	
Learning Pace	IQ-3.2 [pag 6, par 3, lin 6]	IQ-2.1 [pag 3, par 5, lin 1]	IQ-2.2 [pag 5, par 2, lin 4]
Self-regulation capacity			E [pag 2, par 7, lin 9], IQ-3.2 [pag 6, par 3, lin 13], IQ-3.2 [pag 7, par 4, lin 1]

Table A.11: Factors related to course dynamics. List of factors related to course dynamics, linked to the experts who identify them indicating the Informative Question (IQ) in which they do so and a reference to the evidence found in the semi-structured interview...

Appendix B

Semi-Structured Interview to Gather Expert Opinions

Summary: In this Appendix, we include the interview model, as well as the transcriptions of the three recorded interviews that we carried out with the experts.

B.1 Interview Model

Figure B.1 shows the model of interview in Spanish, the original original language in which it was created.

Although the interviews were conducted in Spanish, which was actually the native language of the three experts, we have translated the interview model so that more people can understand its meaning.

1. INTERVIEW MODEL

Esta es una versión aproximada del guion de la entrevista, que podrá ser adaptada en función del desarrollo de la misma y los posibles temas emergentes que surjan en ella.

Preguntas de apertura:

- Pregunta Apertura.1. Puede describir brevemente el puesto en el que trabaja, su experiencia en CL: años, trabajos realizados...
- Pregunta Apertura.2. ¿En cuántos MOOCs aproximadamente ha participado, de forma directa o de forma? ¿Recuerda cuándo (año) participó en el primer MOOC? ¿Qué papel realiza: diseñar contenidos, coordinar a otros profesores, tutorizar? ¿Puede describir en qué consiste este papel?
- Pregunta Apertura.3. Puede explicar brevemente algo sobre su forma de entender el aprendizaje: actividades, agrupamientos...

Preguntas objetivo 1 – Caracterización MOOC:

- Pregunta 1.1 – ¿Puede describir peculiaridades que sólo se observan en MOOC y no ocurren en otros entornos?
- Pregunta 1.2 – En la "tutorización" de MOOC en los que ha intervenido, ¿Cuántos profesores participan atendiendo a los alumnos? ¿Cómo distribuyen sus tareas?
- Pregunta 1.3 – ¿Hay alguna característica de los MOOC que considere una desventaja o problema? ¿Por qué? ¿Y alguna que le parezca una ventaja? ¿Por qué?

Preguntas objetivo 2 - Relevancia del problema:

- Pregunta 2.1 ¿Ha participado (coordinador, diseñador, tutor) en algún MOOC donde se pusiera en práctica CL? Si es que sí, descríbelo, si es que no ¿Por qué razones cree que no se ha puesto en práctica CL en estos cursos?
- Pregunta 2.2 ¿Si tuviese herramientas y ayuda para poder diseñar sus cursos incluyendo actividades de grupo y para poder gestionar esas agrupaciones, incluiría este tipo de prácticas en sus diseños de MOOCs?

Preguntas objetivo 3 – Criterios de agrupación:

- Pregunta 3.1 - ¿Qué objetivos busca cuando crea agrupaciones (generar debate, disminuir el abandono, que unos alumnos apoyen a otros...)?
- Pregunta 3.2 – ¿Qué criterios tendría en cuenta a la hora de agrupar a los alumnos?
- Pregunta 3.3 – ¿Por qué cree que esos son los criterios más importantes? ¿A qué es a lo que le da más importancia (estabilidad de los grupos, mejora del aprendizaje)?

Preguntas objetivo 4 – Actividades colaborativas:

- Pregunta 4.1 – Describa el tipo de actividades colaborativas que cree que podrían ajustarse bien a este tipo de cursos MOOC.
- Pregunta 4.2 – Describa actividades que le gustaría poner en práctica pero que cree que no se ajustan a este tipo de cursos. ¿Qué necesitaría para poder ponerlas en práctica?

1

Figure B.1: Interview model in the original language in which it was created.

B.2 Interview Model Structure and Content

This is an approximate version of the interview script, which may be adapted depending on the development of the interview and possible emerging themes.

B.2.1 Opening questions

Opening Question 1: Can you briefly describe the position in which you work, your experience in CL: years, work done....

Opening Question 2: Approximately how many MOOCs have you participated in, directly or formally? Do you remember when (year) you participated in the first MOOC? What role do you play: designing content, coordinating other teachers, tutoring? Can you describe what this role consists of?

Opening Question 3: Can you briefly explain something about your understanding of learning: activities, groupings...?

B.2.2 Questions related to Objective 1 - MOOC Characterization

Question 1.1 (Q1.1) - Can you describe peculiarities that are only observed in MOOCs and do not occur in other environments?

Question 1.2 (Q1.2) - In the "tutoring" of MOOCs in which you have been involved, how many teachers are involved in assisting students? How do they distribute their tasks?

Question 1.3 (Q1.3) - Is there any feature of MOOCs that you consider a disadvantage or problem? Why? And is there one that you consider an advantage? Why?

B.2.3 Questions related to Objective 2 - Problem Relevance

Question 2.1 (Q2.1) - Have you participated (coordinator, designer, tutor) in any MOOC where CL was put into practice? If yes, describe it, if no, for what reasons do you think CL has not been implemented in these courses?

Question 2.2 (Q2.2) - If you had tools and help to be able to design your courses including group activities and to be able to manage those groupings, would you include this kind of practices in your MOOC designs?

B.2.4 Questions related to Objective 3 - Grouping criteria

Question 3.1 (Q3.1) - What objectives do you seek when creating groupings (generate discussion, decrease dropout, have some students support others...)?

Question 3.2 (Q3.2) - What criteria would you take into account when grouping students?

Question 3.3 (Q3.3) - Why do you think these are the most important criteria? What do you attach most importance to (stability of groups, improvement of learning)?

B.2.5 Questions related to Objective 4 - Collaborative activities

Question 4.1 (Q4.1) - Describe the type of collaborative activities that you think would be a good fit for this type of MOOC course.

Question 4.2 (Q4.2) - Describe activities that you would like to implement but that you think would not fit this type of course. What would you need to be able to implement them?

B.3 Fieldwork of the Interviews

In the following sections we copy the transcription of the three interviews carried out.

B.3.1 Interview of Expert 1 (E1)

B.3.1.1 Opening Questions

Researcher: en primer lugar, preguntarte un poco sobre tu perfil personal, sobre tu experiencia, entonces para ver si podrías describirme brevemente, muy brevemente, el puesto en que trabajas y tu experiencia en aprendizaje colaborativo. ¿Cuántos años llevas? y ¿has hecho muchos trabajos?

E1: bueno el puesto de trabajo es muy variado, oficialmente soy investigador postdoctoral en el departamento de ingeniería telemática, lo cual lleva además una carga de docencia, con lo cual tengo que dar clase, por lo tanto soy profesor de grado y master. Y a la vez también doy apoyo a los profes que quieren poner en marcha MOOCs y SPOCs dentro de la Universidad Carlos III, dentro de un grupo que se llama la "unidad de tecnología educativa e innovación docente" que lo que hace es hacer un seguimiento desde que un proyecto de tipo MOOC y SPOC es aprobado por la universidad para ponerse marcha, hasta que ese MOOC y SPOC termina, es decir, desde que se diseña hasta que se despliega en la plataforma, el periodo impartición hasta que termina. Y luego he tenido experiencia como profesor también en varios MOOCs y SPOCs concretamente en tres MOOCs, el tercero se lanza ahora en 15 días y en un SPOC. En cuanto a aprendizaje colaborativo, yo llevo trabajando en aprendizaje colaborativo desde finales de 2007, cuando entré a trabajar en el grupo, en el GSIC en Valladolid. Entonces por un lado, como investigación siempre me ha gustado mucho el aprendizaje colaborativo. Mi tesis se basaba en la integración de herramientas de terceros en plataformas de aprendizaje para promover aprendizaje colaborativo. Después de mi tesis trabajando en MOOCs y SPOCs he explorado la colaboración que se produce en las herramientas sociales alrededor de los MOOCs. Y luego en mis clases habituales intento poner en práctica actividades colaborativas en diferentes niveles.

Researcher: muy bien. Con todo lo que me has dicho ya me has respondido a unas cuantas preguntas más. La siguiente: ¿más o menos en cuantos MOOCs crees que puedes haber participado de forma directa o indirecta? ¿Me podrías dar una cifra?

E1: de forma directa en tres, y de forma indirecta he participado... pues de forma indirecta además de esos tres he participado, por lo menos, en otros 10.

Researcher: ¿Y recuerdas más o menos en qué año sería en el que participaste en el primero?

E1: sí, en enero de 2013.

Researcher: en enero 2013, vale, la última ya. Me las contado qué papel realizas, que si diseñas contenidos, coordinas a otros profesores, tutorizas... que si podías describir ese papel. Como eso ya me lo has dicho...

E1: Todo. Un poco todo. En los MOOCs en los que trabajo como profesor diseñas los contenidos y los implementas y los desarrollas tanto vídeos como ejercicios. En los MOOCs en los que trabajas dando apoyo al profesorado coordinas a los profesores y haces un apoyo continuo, desde qué se aprueba el proyecto hasta que se lanza. Entonces haces más trabajo de gestión, en ese caso, que de creación de contenidos. La creación de los contenidos pertenece a los profesores. Sí que he colaborado alguna vez en esos MOOCs en tareas que podrían estar dentro de la creación de contenidos, como por ejemplo hacer el subtitulado de algún vídeo que había que hacer en inglés en algún MOOC, pero no, no es el eje.

Researcher: jajaja luego, muy breve también porque también me lo has dicho al principio y ya ha quedado más o menos claro, si podrías explicar algo sobre tu forma de entender el aprendizaje, si eres partidario de incluir actividades incluyan agrupamientos, que las personas trabajen en grupos...

E1: dices el aprendizaje general o el aprendizaje colaborativo

Researcher: el aprendizaje general

E1: el aprendizaje general. Yo soy partidario de que el aprendizaje que conlleva una gran carga práctica, especialmente en las temáticas de ciencias y tecnología, entonces eso implica que hay que ponerse a hacer cosas. Y además es bueno que esas cosas que pueden hacer los estudiantes lo hagan equipos, porque así aprenden unos de otros ¿no? Entonces yo soy partidario de que las clases sean muy prácticas

en general, de que los MOOCs sean muy prácticos a pesar de que tienen que tener videos, también que haya interacción, y soy partidario de trabajar en equipos, dependiendo del contexto de diferentes tamaños

B.3.2 Questions of Objective 1 – MOOC Charaterization:

Researcher: [**Q1.1**] - pasamos entonces a una segunda categoría, que es un poco acerca de las características especiales de MOOC, sí podrías decirme algunas peculiaridades que tú hayas observado que sólo ocurren en este entorno y no ocurren en otros

E1: bueno la escala en la que suceden los acontecimientos. Cuando eres un profesor tienes una pregunta a la semana de tus alumnos en tu correo, o dos preguntas. Cuando estás en un MOOC tienes 1000 ¿no? Entonces esa escala es algo que no se produce. Además, se produce una cosa muy interesante que es que unos alumnos se responden a otros muchas veces antes de que llegue el propio profesor y eso es algo que de alguna forma se podría ver también en una clase tradicional, siempre hay uno que sabe más y otros le pueden preguntar y así responde, pero cuesta más, no sé por qué, pero esa interacción...

Researcher: les da vergüenza, a lo mejor. Les da más vergüenza en una presencial que ahí, que como no les ve nadie...

E1: sí, y ahí, bueno bajo ese anonimato de soy el usuario no sé qué no tengo ningún problema en intentar contestar ¿no? También ocurre una cosa que puede ser un poco más desagradable, es que existen troles qué directamente lo único que hacen es comentarios no constructivos, destructivos, simplemente, pues bueno, para molestar. O para minusvalorar el trabajo de profesores, o de otros compañeros. Eso es importante. Y algo que ocurre también en este entorno que no ocurre en otros es la diversidad de estudiantes, la heterogeneidad, que te encuentras estudiantes de la India, de Pakistán, pero también de Chile y de Noruega y a la vez de Sudáfrica en un mismo entorno intentando aprender sobre una misma temática. Y eso enriquece mucho el curso. La variedad cultural también es positiva eso en un entorno tradicional no sucede de esa manera Y también no solo origen, sino también la edad y la madurez, de cada persona Que esté trabajando una persona de 16 años con una de 60 en un mismo contexto es algo extraño, y aquí se produce, y por lo menos esas cosas son distintas

Researcher: [**Q1.2**] y [**Q1.3**] - algunas de esas cosas que me has dicho las podrías ver, aunque está muy relacionado, como desventaja problema, y algunas que podrían ser como ventajas ya casi me has dicho, el tema de la diversidad es más bien una ventaja, el tema de la escala, porque cuando has dicho que te pueden llegar miles de mensajes, me imagino que notificaciones del aula, ¿en un curso con tantísimos alumnos hay un tutor sólo o dependiendo del número de alumnos metéis más tutores o menos?

E1: más que dependiendo del número de alumnos, dependiendo del número de recursos qué tienes. Metes lo que tienes. Da igual que haya 1.000 que 10.000 vas con lo que tienes. Normalmente lo que puedes permitirte es tener un número de horas de soporte a la semana. La primera... el primer MOOC grande que tuvimos que tuvimos 70.000 inscritos, en ese, pues bueno, intenté estar bastante atento con otra persona más técnica también. Y con otros profesores que intentaban entrar de vez en cuando, sobre todo al principio, la primera semana es la más grande. Luego un poco va decayendo el número de estudiantes que están realmente activos. Ahora tenemos una persona que está a media jornada y que nos ayuda en los foros. Entonces claro, eso es una desventaja en el sentido de que tú no puedes conocer a los estudiantes como conoces en el aula presencial, no puedes personalizar tanto los mensajes, pero bueno, eso es un poco desventaja, pero la ventaja es que los propios estudiantes entre sí pueden llegar a formar una comunidad y contestarse unos a otros. Lo que pierdes por un lado con la escala, lo puedes ganar con la interacción que existe entre los propios estudiantes, pasando el profesor a formar un papel, pues más pequeño. Y luego ventaja diversidad y desventaja el anonimato puede servir para potenciar los troles en este tipo de cursos

Researcher: [**Q1.1**] - Y no la tenía preparada esta, pero a colación de lo que has dicho, sí que has observado en todos los que has participado y si puedes tener datos a lo mejor de alguno la cadencia que tienen, es decir, has dicho: la primera semana es cuando más jaleo hay, y luego normalmente decaen ¿no hay otros que el jaleo sea al final, no? De haber lío es al principio sobre todo y luego la gente de desinfla más, o lo deja o...

E1: bueno por lo que hemos visto eso es la tónica general, luego hemos visto datos, porque tenemos las gráficas de edX de nuestros cursos, que te dice por semana cuantos están activos. Luego, por ejemplo,

a veces hay cursos en los que se estabiliza en algún momento, porque los que entran nuevos y están activos pues quitan, o compensan a los que se van. Se notan bajadas importantes, por ejemplo se nota una bajada importante en Navidad, la semana de Navidad, en general, que es un evento mundial, pues se nota una bajada bastante importante.

Researcher: [**Q1.1**] - porque la matrícula ¿sigue abierta entonces una vez comenzado el curso? ¿Siempre se puede seguir incorporando gente o una vez, por ejemplo, del inicio de curso no se incorporan más?

E1: bueno sí ahora mismo sí que dejamos que se incorpore gente, tenemos varios... tenemos dos modalidades. La modalidad que el curso tiene una duración limitada, entonces se imparte en cinco semanas, que son cinco semanas o seis como mucho para que acaben los exámenes, y en ese caso se pueden seguir matriculando pero luego el curso ya acaba. Y tenemos cursos que están abiertos durante un tiempo muy grande, entonces la gente puede entrar cuando quiera, puede hacer lo que quiera, puede irse cuando quiera, entonces en ese tipo de cursos tú puedes comparar bastante mejor donde llega esa estabilidad llega un momento en que se estabiliza a un cierto número a 2000, o a 3000 que están activos entonces se compensa un poco los entran por los que salen.

B.3.3 Questions of Objective 2 - Problem Relevance:

Researcher: [**Q2.1**] - vale muy bien muchas gracias. Ahora vamos a ver un poco si realmente... porque el otro día me ocurrió que una persona me dijo: "no es que eso que planteas no creo que tenga ningún sentido", bueno pues igual no lo tiene, o lo tiene solo para mí, entonces ¿tú has participado en algún MOOC donde se pusiera en práctica trabajo colaborativo?

E1: no directamente, o no potenciado por el profesor, porque es difícil gestionar los grupos en un MOOC. Puede haber trabajo colaborativo indirecto en los foros de discusión entre los propios alumnos, entonces eso sí que existe. Puede haber una cierta colaboración, aunque no tiene por qué ser trabajo colaborativo. Con las revisiones entre pares en las cuales, pues bueno tú haces un trabajo, otro te lo corrige y de eso aprendes. No es una colaboración directa porque yo no sé quién es la otra persona y no he formado un grupo fijo durante un periodo de tiempo, sino simplemente, pues bueno, otro estudiante como yo hemos colaborado y yo he aprendido porque él ha revisado mi trabajo, pero no hemos aplicado grupos para que trabajen de forma conjunta. Sí hemos aplicado grupos las "cohorts" de edX, para segregar en los exámenes, es decir, que no todo el mundo reciba el mismo examen entonces, automáticamente en función de cuándo entras a la plataforma te asigna el grupo A, el grupo B, el grupo C, y cuando llegas al examen, recibes un examen distinto.

Researcher: [**Q2.2**] - ¿si tuvieses herramientas de ayuda que te pudiera ayudar a diseñar actividades de grupo y a manejar los grupos crees que sí que lo usarías? ¿Para ti sí que sería importante contar con ello para poder hacer cosas que hasta ahora no has podido hacer?

E1: yo creo que sí, Yo creo que sí es interesante. Tienen que tener esas herramientas, tienen que ser suficientemente flexibles y tener algoritmos que permitan reconfigurar los grupos de forma dinámica muy rápidamente, porque la gente en los MOOCs es mucho más volátil que la gente en los cursos tradicionales entonces la gente entra, sale, va, viene... Y si quieres que hagan trabajos en grupos de cuatro, lo que te va a pasar es que de los 4, 3 no vienen, pero a la vez llegan otros 3 y tienes que asignarlos automáticamente... No lo sé, yo pienso, por ejemplo, pueden utilizarse grupos pensando en actividades muy cortas. No veo grupos estables, por ejemplo, sino, no sé, pienso... juegos por Internet, yo quiero jugar al póquer en línea, que ahora se lleva mucho, entonces yo voy a una aplicación y digo que estoy disponible la aplicación me dice: "Mira pues esta mesa te puedes incorporar" porque falta uno y vas y te incorporas y juegas; y de repente se va uno, entonces entra otro y luego se vuelve a ir uno y entra otro. Entonces ese tipo de flexibilidad que te da el poder hacer grupos para tareas muy cortas dinámicamente yo creo que es positivo, pero claro tienes que encontrar las tareas cortas.

Researcher: claro lo que decías tú de la restructuración de que si has hecho grupos de 4 y demás, imagino que también... no soy yo aquí la preguntada, pero imagino que tendrá que ser con ayuda de la herramienta porque si tienes a 60.000 por mucho que te ayude quiere decir que tú a lo mejor yo había pensado establecer tus criterios y que la herramienta cuando los grupos degraden por debajo de un X, de

un umbral, la herramienta los reconfigure porque claro yo creo que en esa escala para hacer el profesor a mano es bastante complicado.

E1: no, a mano no puede ser. Lo que yo no sé si es, o sea, yo veo varios modelos uno es que tú tengas una herramienta que la herramienta asigne grupos automáticamente lo cual tiene este problema que mucha gente no va a estar activa. Podrías hacer lo que los usuarios quieran, hacer grupos, entonces yo soy un usuario y estoy en el MOOC y me interesa participar en un grupo, entonces yo proactivamente doy al botón con el cual ya estoy dentro del grupo de gente que quiere formar grupos, y dinámicamente me asignan ese momento a un grupo que esté trabajando, entonces eso creo que si funcionaría bien, pero bueno, hay que ver en qué tipo de cursos y en qué tipo de cosas. Igual que te dicho antes en un juego la gente entra y entra a una actividad que es competitiva, pero que es en grupo, hay una cuestión, que es que todo el mundo conoce las reglas; yo se jugar, entonces no pasa nada que entre aquí o entre allí y sin embargo en un curso puede haber muchos niveles, no es lo mismo, bueno también en el póquer juega gente más profesional

Researcher: Si te toca jugar con el bueno o con el malo te fastidias jaja

E1: claro, entonces bueno, pues... y también lo que ocurre al póquer es que las partidas son muy cortas, es decir las partidas duran un minuto y medio, yo me incorporo y empieza otra partida nueva, sin embargo si aquí tuviésemos que hacer unos ejercicios, claro qué pasa si me incorporo cuando ya han hecho cuatro ¿entramos en el quinto?

Researcher: si ya han hecho 4..., si hay artefactos por ahí por medio...

E1: claro pues me he perdido todo lo anterior, eso hay que pensarlo, hay que pensar qué tipo de tareas serían susceptibles de entrar en este escenario de tareas cortas, y que el usuario proactivamente se le asigne a un sitio u otro

B.3.4 Questions of Objective 3 – Grouping Criteria:

Researcher: [**Q3.1**] - porque tú cuando creas agrupaciones ¿qué buscas con ellas, por ejemplo generar debate, o que unos alumnos apoyen a otros, o que se fomente la participación y así decrezca el abandono? ¿Para que los harías, con qué fin principalmente?

E1: ahora mismo las agrupaciones que puedes generar las generas manualmente, con lo cual puedes generar un número pequeño de agrupaciones no puedes generar 10.000 agrupaciones para 20.000 alumnos y ponerlos parejas, ¿no? Entonces, cuando tu generas cinco agrupaciones puedes hacerlo por varios motivos, uno es el que te dicho de los exámenes cada uno tiene un examen, y otra es por lo que se llama el A/B testing, el probar una cosa y a un grupo le enseñó un video y a otro grupo le enseño un texto Y ver a ver cuál de los dos grupos ha aprendido más poniéndoles el mismo cuestionario después, y así, pues bueno, puedo ver unas cosas u otras. Si un alumno es más visual y otro va a ser más textual sería para esto para que un alumno eligiese yo soy más visual pues voy aquí yo soy más textual pues voy aquí, ese es el A/B testing. Claro son pocos grupos, pero no puedes crear 10.000 grupos manualmente, entonces ese es el propósito principal para el que hemos usado hasta ahora los "cohorts", y es el que se usa. No se usa para el modelo tradicional de decir creo grupos de cuatro alumnos para que trabajen en una actividad.

Researcher: [**Q3.2**] - por ejemplo tuvieras que hacer ya equipos, equipos de que colaborasen más pequeños, con ayuda de una herramienta, por supuesto, ¿qué criterios usarías? ¿Todo homogéneo? O por ejemplo ¿lo voy hacer de forma que coincidan en zona horaria?, en qué cosas pensarías a la hora de darle a esa herramienta criterio 1 esto, criterio 2 esto, criterio 3 esto

E1: desde luego es importante que coincidan en zona horaria. Y que tengan unos intereses más o menos comunes, por eso te decía que si ellos son proactivos, y son los que deciden me quiero unir a un grupo ahora, es porque ahora estoy trabajando, entonces quiero trabajar en este momento con otra gente que también está trabajando. A lo mejor yo pongo a gente de la misma zona horaria pero uno trabaja de noche, otro trabaja de mañana y otro trabaja de tarde, entonces es difícil que se coordinen. Y como pienso en tareas pequeñas, no en tareas muy grandes la coordinación tiene que ser inmediata, no puede ser "bueno pues ya quedamos y la semana que viene yo tengo sábado libre", "y yo también", entonces el criterio, el principal, es que quiera trabajar ahora en este momento. Y luego, pues bueno, el idioma tiene que ser, yo creo un criterio importante que se defiendan en el idioma del curso que tengan más facilidad para estar relacionados en un mismo idioma, y bueno si la zona horaria puede ser algo interesante

Researcher: [**Q3.3**] - valoras sobre todo digo yo la estabilidad estos grupos puedes hacerlos pensando en que sea lo mejor para ellos para para aprender es decir poner jóvenes con mayores hay expertos o en este caso como parece ser que el problema es estos cambios de escala esta esta anarquía lo más importante para ti seria esos grupos tuvieran estabilidad

E1: estabilidad a corto plazo para trabajar ya en las próximas dos horas vamos a vamos a trabajar esto, y luego ya el grupo pues se separa

B.3.5 Questions of Objective 4 – Collaborative Activities:

Researcher: [**Q4.1**] vale la última categoría que era un poco de actividades colaborativas porque está anterior era de criterios de agrupación pues casi también ya me has dicho muchas cosas porque era qué tipo de actividades crees que podrían ajustarse bien a este tipo de curso ya me has dicho qué actividades cortas, casi un aquí te pillo aquí te mato, nada de parejas estables

E1: no es muy difícil que sean parejas estables aquí

Researcher: [**Q4.2**] - claro es complicado eso ya me las respondido y la última que es un poco la pregunta del millón es qué cosas te gustaría poner en práctica pero crees que no se puede, por cómo están hechos los MOOC no se puede, y si hay algo que crees que necesitarías si hubiera ALGO que con eso ya sí se podría

E1: el problema de estos cursos esta escala ¿no? Los cursos online pequeños tú puedes poner en práctica actividades colaborativa sin ningún problema Y que los alumnos utilicen herramientas de videoconferencia de chat para comunicarse aquí el problema es la escala y la inestabilidad para mí son los dos problemas ¿no? entonces las actividades que no puedes poner en práctica son las que tienen un trabajo muy largo las que son muy elaboradas porque los grupos antes de que se termine esa actividad se van a separar Es decir yo no puedo llevar una actividad tradicional que hago en mi clase de programación en la cual yo les digo tenéis que hacer un proyecto de aquí a dentro de mes y medio no lo puedo llevar a un MOOC les puedo decir tenéis que hacer este mini trozo de aquí a dentro de una hora Pero no les puedo decir hasta dentro de mes y medio

Researcher: el problema es que ahí sí hay algo que perdemos es decir aunque si tuviéramos una varita mágica que te dijéramos bueno los que si pudieran llegar a hacer un proyecto de esos a lo mejor que sí que lo hicieran ¿no? Para que no perdieran respecto aprendizaje es decir a lo mejor segregar de alguna manera a los que no participan, no se

E1: podrías plantear al principio del curso un cuestionario en el que tú digas cuál es tu compromiso con el curso pero aun así eso no te garantiza nada

Researcher: la dinámica es la que al final manda porque lo que se ha dicho desde el principio no sabemos, cada uno... No sabemos lo que va a pasar

E1: exacto entonces me quedo con la idea de tareas muy cortas, que también tiene su valor

Researcher: Bueno, como ya he terminado las preguntas, me puedo permitir el lujo de charlar un poquitín más, ¿sabes que en edX ponen teams además de cohorts están a punto de salir los teams?

E1: sí sí sí lo visto tenemos que ver cómo se puede poner en marcha tampoco sé qué tamaño...

Charla sobre edX...

B.3.6 Interview of Expert 2 (E2)

B.3.6.1 Opening Questions

Researcher: ¿Puedes describir brevemente el puesto en el que trabajas, tu experiencia en CL...?

E2: Yo soy profesora, Departamento de tecnologías de la información y comunicaciones, mi línea de investigación es tecnologías para la educación y una de las líneas de investigación principales es tecnologías para el apoyo al aprendizaje colaborativo, llevo trabajando en este tema desde el año 2003 2004.

Researcher: ¿En cuántos MOOCs has participado?

E2: He participado en 3 MOOCs, dos de ellos coordinando la implementación, sin trabajar directamente en ellos, me refiero a que no era yo la creadora de materiales, ni la educadora, ni la persona que hacia la configuración del sistema y las actividades, más bien coordinando como si fuera un proyecto.

Gestionando el proyecto, coordinando a alto nivel. Después otro que era más bien ayudando con una de las herramientas que se utilizaban desde el punto de vista de la tarea, desde el punto de vista más epistémico de la descripción de la tarea, de la realización de la tarea. En concreto era un MOOC sobre el diseño por parte de los profesores y utilizaban el ILDE y era la proveedora de la herramienta que era objeto de aprendizaje.

Researcher: ¿Puedes explicar algo de tu forma de entender el aprendizaje?

E2: La cuestión es que en el MOOC donde mi labor era más de provisión de la herramienta, no de apoyo al MOOC, sino como objeto del aprendizaje lo que aprendían a utilizar no participé en ningún momento en el planteamiento didáctico-pedagógico de las actividades del MOOC. En los otros casos, la participación fue baja. Mi concepción del aprendizaje es una concepción bastante mixta, en el sentido de que diferentes aproximaciones pedagógicas pueden coexistir, pero donde el papel del aprendizaje social es muy importante. Sin embargo, y a pesar de que es lo que utilizo normalmente en mi propia práctica, el papel que esto ha tenido (el aprendizaje social) en los MOOCs en los que he participado ha sido diversa o más baja de lo que me gustaría. Es verdad que en el MOOC donde yo no participaba a nivel de coordinación sino a nivel de provisión de herramienta que se utilizaba como objeto de aprendizaje sí que había bastante interacción social en los foros o la revisión entre pares de diseños hechos en el propio ILDE pero no era estructurado, mediante la invitación a las personas a revisar las creaciones de otros participantes. En los otros dos MOOCs, en uno de ellos la participación fue muy baja, fue más un piloto de un MOOC, no un MOOC en sí, fundamentalmente tener los materiales y ponerlos a disposición para poder justificar un proyecto, y no hubo prácticamente interacción social entre los participantes. En el tercer MOOC había interacción libre en flujos de discusión, con bastante participación, se fomentaba bastante que discutieran en el foro, de nuevo, no estructurado, y en este MOOC también utilizamos una herramienta que está haciendo Kalpani Manathunga, que es una es una estudiante de doctorado que intenta entender si una estructura piramidal puede ser útil en escala, para estructurar la interacción social entre participantes, de manera que los resultados de las actividades colaborativas sean limitados y puedan luego también ser revisados por el profesor. En ese caso sí que utilizamos la herramienta de pirámide para este MOOC pero de forma muy experimental cuando decía que estábamos en lucha contra viento y marea es que teníamos dificultades para que nos la dejaran utilizar. El nivel de experimentación que teníamos fue limitado. Luchando contra viento y marea para poder hacer la experimentación. Hicimos de forma muy modesta, muy tímida, esta prueba de la herramienta, con pocas interacciones y de forma muy opcional digamos que no era del core del MOOC, pero nuestro interés está en determinar si estas de formas de interacción más estructuradas pueden escalar. En la propuesta que ha hecho Kalpani de la estructura piramidal, ha tenido en cuenta diversos factores que a lo mejor coinciden con cosas que estás pensando con cosas que se ven en los MOOCs, participación variada, personas que llegan tarde, otras que se van pronto, y son las cosas que el diseño de la herramienta intenta salvar.

Researcher: **[Q1.1]** - Peculiaridades que se solo se observan en los MOOCs y no en otros entornos

E2: La mayor peculiaridad es que es masivo, el número de estudiantes, y que es muy opcional. El nivel de involucración y la tasa de finalización es más baja que en otros tipos de escenarios educativos.

Researcher: **[Q1.2]** - ¿Cuántos profesores participan atendiendo a los alumnos? ¿Cómo se distribuyen sus tareas?

E2: En el de Handsome MOOC, en el que usaron el ILDE, (puedes ver varios artículos de los que ponían en marcha el MOOC) donde explican el modelo de facilitación, con muchos facilitadores, incluso en algunas de las iteraciones del MOOC utilizaban voluntarios, que los, hacían un "Call for facilitators" y los formaban, les hacían una pequeña formación y después ellos hacían de facilitadores del MOOC. En los otros dos MOOCs, en uno de ellos la profesora hacía de facilitadora, pero era una cosa pasiva, solamente si pasaba algo reaccionaba, pero no llego a pasar nada porque era un piloto de un MOOC más a nivel de los materiales, y en el otro, que es donde hemos probado el tema de la pirámide, en este era Kalpani la facilitadora.

Researcher: ¿Había muchos alumnos?

E2: Sí, había muchos alumnos. 6000 inscritos, luego activos menos. Dedicaba muchas horas (Es complicado y necesitas ayuda)

Researcher: **[Q1.3]** - ¿Hay alguna característica de los MOOCs que considere una desventaja o

problema? ¿Por qué?

E2: La masividad sobre todo.

Researcher: [**Q1.3**] - ¿Y alguna que le parezca una ventaja?

E2: Sí, también, el hecho de que sea masivo hace que la probabilidad de que haya algo de actividad sea alta

B.3.7 Questions of Objective 2 - Problem Relevance

Researcher: [**Q2.1**] - ¿Ha participado en algún MOOC donde se pusiera en práctica el CL? Ya está respondido.

Researcher: [**Q2.2**] - ¿Por qué razones no se pone en práctica el CL en este tipo de cursos?

E2: Se asocia el MOOC a aprendizaje individual por el tema de aprender a tu propio ritmo. Hay una percepción en algunos casos de poca relevancia, pero quizá esta percepción viene sobre todo del desconocimiento de las bondades del CL, del aprendizaje social en muchos casos. Por otro lado de la dificultad de implementación que hay personas que piensan que la dificultad de implementar el CL no merece la pena.

Researcher: [**Q2.3**] - ¿Si tuviese herramientas de ayuda para poder diseñar sus cursos incluyendo actividades de grupo incluiría estas prácticas en sus diseños de MOOC?

E2: Sí, pero estoy sesgada.

B.3.8 Questions of Objective 3 - Grouping Criteria

Researcher: [**Q3.1**] - ¿Qué objetivos que busca cuando crea agrupaciones?

E2: Depende del escenario. Estoy sesgada también. Generar debate, depende de la tarea, ideas de otras compañeros que son opuestas, para que puedan generar debate, que se puedan ayudar entre ellos, puede haber diferentes escenarios

Researcher: [**Q3.2**] - ¿Qué criterios tendrías en cuenta a la hora de agrupar los alumnos?

E2: Depende también del escenario. Con esta chica que está haciendo el tema de los algoritmos para formar grupos estamos teniendo en cuenta diferentes tipos de parámetros. Depende del escenario, pensando en escenarios de datos de mis estudiantes de master, como tengo datos de estudiantes de diferentes masters, a veces me interesa hacer agrupaciones por el tipo de master y por tanto de intereses que tienen a la hora de proponerles un trabajo conjunto, pero es muy específico de ese escenario. En otros escenarios puede interesar más que tengas expectativas similares sobre lo que quieran aprender en el marco de un curso, porque en función de eso es lo que se quieren esforzar a la hora de realizar un trabajo, que es algo que se considera poco, pero puede ser relevante. Igual que antes decía que sean del mismo master, a veces interesa que sean de diferentes programas de master cuando propongo trabajos en mi asignatura conjuntos porque así se pueden poner más ejemplos de diferentes disciplinas, entonces busco más heterogeneidad en vez de más homogeneidad.

Researcher: [**Q3.3**] - ¿Qué prefieres al formar grupos? ¿Mejora de aprendizaje del grupo o estabilidad? Que los criterios fueran basados en la mejora del aprendizaje o un grupo más estable en el tiempo

E2: Depende del escenario. Si el escenario es un trabajo que se plantea con una gran duración en el tiempo, pienso que es mejor que el trabajo sea cómodo a pesar que el potencial del beneficio del aprendizaje sea más limitado. Si son aprendizajes más efímeros es más interesante el impacto del aprendizaje. Depende del escenario.

B.3.9 Questions of Objective 4 - Collaborative Activities:

Researcher: [**Q4.1**] - Describa el tipo de actividades colaborativas que cree que podrían ajustarse a este tipo de cursos MOOC

E2: Pues no lo sé. Creo una producción conjunta de largo recorrido sería bastante difícil en este contexto, pero quitando esto, no se me ocurren otros escenarios extremadamente difíciles.

Researcher: **[Q4.2]** - Describa actividades que le gustaría poner en práctica pero que cree que no se ajustan a este tipo de cursos

E2: Cuando hablábamos con Kalpi de hasta qué punto los patrones podrían escalarse, y hacíamos un análisis de ellos, patrones tipo JigSaw serían muy difícil de escalar, la pirámide serían más escalable y por eso es la que estamos escalando. Sin embargo los beneficios del tipo JigSaw me parecen muy interesantes, los utilizo con frecuencia en mi práctica de docencia presencial, con pocos alumnos.

B.3.10 Interview of Expert 3

B.3.10.1 Opening Questions

Researcher: Puede describir brevemente el puesto en el que trabaja, su experiencia en CL: años, trabajos realizados...

E3: Yo en el puesto actual trabajo desde hace dos años. Soy Profesora del departamento de ciencias de la computación En la pontificia católica de Chile. Además actualmente soy directora del área de educación en ingeniería. Es una nueva área que trata de explorar como innovar en educación y en ingeniería. En el área de CL yo empecé a trabajar en 2008, cuando hice mi tesis en 2007 o 2008. Justo cuando empecé a trabajar con Davinia Hernández Leo en mi tesis y trabaje sobre todo sobre orquestación de actividades de collaborative learning en distintos entornos en espacios distribuidos, distintos espacios físicos. Y ahí empecé a explorar un poco como las tecnologías pueden ayudar a orquestar. Distintas actividades en distintos entornos físicos. Durante mi postdoc, ya más adelante en 2011 y cuando termine la tesis, me voy de postdoc a la Carlos III de Madrid y allí empiezo a trabajar desde 2012 en MOOC lanzando y arrancando la iniciativa MOOC de la Carlos III de Madrid. Allí sigo intentando combinar mis dos mundos, durante la tesis estuve trabajando en la orquestación de espacios y por lo tanto me puse mucho en contacto con mobile learning Y entonces intento agrupar los dos mundos: el mundo MOOC y el de la orquestación de distintos espacios para investigar cómo herramientas educativas basadas en tecnología móvil que puedan apoyar el trabajo con MOOC y el trabajo colaborativo, ¿no? A través del móvil o celular, como se dice aquí en Chile.

A partir de entonces ya estoy más centrada en el mundo MOOC. De eso estoy explorando varias áreas dentro del MOOC. Tengo un estudiante de doctorado que sí trabaja en colaboración en MOOCs y ahí lo que hace es sobre todo... ha preparado un juego móvil que permite que varias personas, utilizando las características del Johnson and Johnson de colaboración efectiva, trabajen conjuntamente en el MOOC para resolver preguntas que se derivan de directamente del MOOC a través de esta app. Actualmente estamos trabajando en... está en la segunda fase de la tesis, ha hecho primero el prototipo, y ahora están trabajando en cómo agrupar a los distintos estudiantes que trabajan en el MOOC para formar estos grupos, porque de momento lo hace random. Pero estamos tratando de entender si es mejor hacer esta agrupación teniendo en cuenta el origen de los estudiantes MOOC, la geoposición ¿no? Porque como trabajamos con móvil podemos ver el geoposicionamiento. Y la idea sería utilizar este geoposicionamiento para ver si agrupando del mismo país se combinan por ejemplo zonas horarias para trabajo simultáneo en el MOOC. Tiene más sentido agruparlos de esta manera. Más que eso no he trabajado en MOOC y colaboración, porque es como un mundo bastante difícil. Porque la masividad lo hace un entorno más complejo que trabajarlo en un entorno menos masivo .

Researcher: ¿En cuántos MOOCs aproximadamente ha participado, de forma directa o de forma? ¿Recuerda cuándo (año) participó en el primer MOOC? ¿Qué papel realiza: diseñar contenidos, coordinar a otros profesores, tutorizar? ¿Puede describir en qué consiste este papel?

E3: Mira en el 2012 hacemos el primer MOOC en MiríadaX, creo que eso debe coincidir con la fecha que te dijo Carlos, porque lo hice con él y entonces no sé si es 2012 o 2013 La verdad estoy un poco perdida ahí, pero ahí empezamos a hacer el primer MOOC en MiríadaX donde los dos trabajamos como diseñadores y desarrolladores de contenidos. Grabamos un par de videos nada más pero nosotros sobre todo creábamos el contenido para que se introdujera en el MOOC. Luego a partir de ahí yo ya me vengo aquí a Chile a la católica y aquí he ayudado a desarrollar en dos años 11 MOOCs. He sido como la coordinadora la Project manager de los cursos para lograr que los MOOCx salgan adelante y doy talleres de diseño instruccional a los profesores. Esos son los 11 MOOC en los que he participado, bueno 11 que

ya están a disposición y tres más que van a salir ahora en septiembre van a ser un total de catorce.

Researcher: Puede explicar brevemente algo sobre su forma de entender el aprendizaje: actividades, agrupamientos...

E3: Yo creo que el aprendizaje debería ser una combinación de varias cosas. El aprendizaje para mí es el desarrollo de competencias en distintos ámbitos, entonces una de las competencias que hoy se busca mucho es el aprendizaje en grupo o el saber trabajar en equipo. El saber desarrollar competencias de trabajo en equipo y por tanto eso es una de las competencias muy importantes. Pero también existen sobre todo en el contexto MOOC una competencia súper relevante que no tiene que ver con el trabajo en equipo, sino que tiene que ver con el aprendizaje individual y que es la capacidad de autorregularse en estos entornos, para poder ser efectivo con tu aprendizaje, entonces autorregulación significa tener capacidad de metacognición, tener capacidad de autoconfianza, tener capacidad de gestionar tu tiempo y manejar tu tiempo, tener capacidad de dónde sacas la información y como la ordenas para trasmitir conocimiento etc. etc. Entonces son como dos cosas que son elementales en el mundo MOOC Una es la autorregulación a nivel individual y otra es la colaboración para sacar el máximo provecho al hecho de que haya muchísima gente conectada al mismo tiempo al mismo recurso educativo.

B.3.11 Questions of Objective 1 - MOOC Charaterization:

Researcher: [**Q1.1**] - ¿Puede describir peculiaridades que sólo se observan en MOOC y no ocurren en otros entornos?

E3: Mira, a diferencia de los entornos virtuales en línea tradicionales, una de las diferencias que yo encuentro más fuertes en los MOOCx es la autonomía que se requiere por parte de los estudiantes en este tipo de cursos. La gestión que hace el profesor de los estudiantes cuando tiene 5000 y cuando tienen 30 es completamente distinta. Puedes hacer un seguimiento más personalizado. Y ahí depende más del individuo el poder desarrollarse correctamente o no. Y lo tercero es la masa ¿no? La gran cantidad de gente que hay simultáneamente cursando, trabajando juntos, juntos pero no colaborando. Es verdad que la colaboración no se da tanto como quisiéramos, en los MOOC, es la cantidad de gente que potencialmente podría trabajar de forma conjunta.

Researcher: [**Q1.2**] - En la "tutorización" de MOOC en los que ha intervenido, ¿Cuántos profesores participan atendiendo a los alumnos? ¿Cómo distribuyen sus tareas?

E3: En realidad en el de MiríadaX había dos personas contestando al foro. No sé cuántos estudiantes tuvimos al final la verdad es que no lo recuerdo 6000 o 7000 u 8000 no lo sé, pero éramos dos éramos Carlos y yo. En los otros que he hecho aquí no hay tutorización por parte del profesor porque son on demand, están siempre disponibles entonces el profesor no puede estar siempre atendiendo a los foros. Lo que vamos a hacer ahora es incorporar a unos ayudantes que puedan estar como dos horas a la semana respondiendo las dudas más importantes en los foros. Pero eso se va arrancar a partir de agosto. Hasta ahora no hemos tenido ningún profesor que estuviera tanto. Era voluntad del profesor si se metía a los foros y lo hacía, pero no tenía ninguna obligación y no teníamos a nadie que se dedicará a eso. Los alumnos que se ayudan entre ellos básicamente.

Researcher: [**Q1.3**] - ¿Hay alguna característica de los MOOC que considere una desventaja o problema? ¿Por qué? ¿Y alguna que le parezca una ventaja? ¿Por qué?

E3: Mira la ventaja es justo una desventaja al mismo tiempo. La ventaja es que efectivamente tú tienes a disposición un montón de conocimientos siempre que quieras, y eso te permite refrescar continuamente, estar muy al día de las últimas tendencias, poder acceder como a una biblioteca virtual de conocimiento que utilizas a tú conveniencia. Pero por otra parte el hecho de tener tanta disposición y tanta libertad también es un problema, y es la principal desventaja y es que no tienes una guía para poderte ayudar a avanzar correctamente en el curso y conseguir finalizarlo. De hecho de eso viene el cinco por ciento de finalización no, ojo un 5 por ciento de finalización significa que el 95 por ciento también ha estado en el curso, aunque sea sólo mirarse el video introductorio. Es como ir a una gran biblioteca y hojear varios libros y leerte sólo uno Yo los MOOCs los veo un poco lo mismo, ¿no? Tienes muchos a tu disposición, Los ojeas y acabas los que te interesan. Entonces la ventaja qué es, que tienes a tu disposición mucha libertad y mucho conocimiento y ahí está la desventaja de que te sientas perdido y no seas capaz de avanzar.

B.3.12 Questions of Objective 2 - Problem Relevance

Researcher: **[Q2.1]** - ¿Ha participado (coordinador, diseñador, tutor) en algún MOOC donde se pusiera en práctica CL? Si es que sí, descríbalo, si es que no ¿Por qué razones cree que no se ha puesto en práctica CL en estos cursos?

E3: No, mira, yo lo único que he hecho es trabajar en MOOCs donde se pusieran en práctica actividades de peer assessment o revisión entre pares, si a eso le llamas colaborativo que yo no le llamaría colaborativo. Eso es lo máximo que hemos hecho. Yo creo que hay que diseñar para la colaboración, los MOOCs actualmente no se están diseñando para la colaboración. Es distinto diseñar para la colaboración que diseñar para un entorno más individual. Sin embargo las plataformas tampoco lo fomentan y esa es una de las limitaciones que tenemos. Las plataformas lo único que ofrecen de máxima colaboración es los foros y la revisión entre pares ¡chao pescao! Luego hay otras plataformas que ya están hechas bajo un prima más constructivista, como por ejemplo Future Learn, pero entonces ahí desde el diseño estas fomentado ya una parte de la colaboración. Qué tenga sentido o no tenga sentido, yo para mí es una tontería decir eso. Yo veo que las plataformas MOOC son una herramienta más que tú puedes tener a tu disposición y que puedes trabajar al máximo para conseguir un objetivo u otro. Si tú quieres fomentar el aprendizaje individual, pues haces un diseño y si quieres fomentar el aprendizaje colaborativo, pues tendrás que hacer otro diseño. Ahora, eso sí, vendrá siempre determinado por las opciones que te ofrezca esta plataforma, que efectivamente, muy preparadas para el aprendizaje colaborativo no están. Los foros y poco más. Siempre ha sido complejo desarrollar colaboración en entornos virtuales y sin son masivos, pues se multiplica la complejidad.

Researcher: **[Q2.2]** - ¿Si tuviese herramientas y ayuda para poder diseñar sus cursos incluyendo actividades de grupo y para poder gestionar esas agrupaciones, incluiría este tipo de prácticas en sus diseños de MOOCs?

E3: Yo creo que sí, pero es que tienen que ser muy inteligentes, estas herramientas, porque una de las cosas que nos va a ocurrir, y sobre todo en los on demand que yo hago es que los grupos de estudiantes se dispersan, por el ritmo de aprendizaje. Es decir, tu puedes empezar a la vez y avanzar muy rápido, o empezar a la vez y avanzar muy lento y hay como muchos grupos de actividad distintos, entonces, estas herramientas deberían ser capaces de detectar cual es la actividad real de los distintos estudiantes para poder efectivamente hacer una realización de grupo. Porque una cosa tan trivial como una peer assessment yo he tenido problemas porque la gente no llega o abandona antes, o la distribución de los grupos es muy compleja como para que la gente reciba el feedback cuando lo tiene que recibir, etc. etc. Entonces lo poco que hay, ya es muy complicado utilizarlo básicamente por la complejidad de los MOOCs que si tú estás on demand efectivamente hay mucha gente trabajando de forma muy diversa, dentro del MOOC y a diferencia de un grupo online cerrado, muchas veces no hay fecha de inicio y de final, por lo cual no te puedes asegurar que haya un pool de estudiantes trabajando simultáneamente, ¿no? sobre el mismo contenido.

Researcher: ¿Podría ser un sistema de elección de compañeros para una actividad ad hoc? Tipo "quien quiera hacer esta tarea conmigo ahora que se apunte en este tablón" o algo así.

E3: Pero esto en realidad en Coursera se supone que sea hace inteligentemente. El algoritmo de repartición de la tarea se hace por nivel de actividad, porque una cosa si es cierta, cuando tu preguntas al usuario jamás dice la verdad, el nivel de actividad lo tiene que medir la propia plataforma. Yo más que preguntar en un tablón de anuncios haría algo inteligente por debajo y que detecte la actividad de los distintos usuarios y que en función de eso infiera si ahora mismo está trabajando o no, que para eso tenemos la tecnología.

B.3.13 Questions of Objective 3 - Grouping Criteria

Researcher: **[Q3.1]** - ¿Qué objetivos busca cuando crea agrupaciones (generar debate, disminuir el abandono, que unos alumnos apoyen a otros...)?

E3: Yo en MOOCs no he aplicado ninguno de estos criterios ¿eh? Pero en general yo lo haría por 2 razones principalmente: una es la motivación, o sea yo creo que trabajar en equipo aumenta mucho la motivación, en general, de hecho muchos estudios lo dicen y eso yo creo que es positivo para que sigan

avanzando correctamente en el curso; y la segunda es para generar debate en torno a ideas distintas. Yo creo que una de las riquezas principales de la compartición y de la colaboración es que ofreces muchos puntos de vista de un mismo problema, entonces eso puede ayudar a muchos aspectos, y al aprendizaje también, por supuesto.

Researcher: **[Q3.2]** - ¿Qué criterios tendría en cuenta a la hora de agrupar a los alumnos?

E3: Bueno mira, si, de entrada a mí no me gusta definir un criterio único porque el criterio depende del objetivo que quieras conseguir. Es decir, si tú quieres generar debate, te interesará juntar a gente que tiene opiniones distintas. Si tú quieres consenso te interesarán ideas más cercanas. Si tú quieres conseguir algo más handsome que puedan hacer colaborativamente te interesará juntar por ubicación geográfica ¿no? Si quieres tener distintas opiniones sobre la cultura y tal te interesará agrupar por distintos países y género, por ejemplo. Dependiendo del objetivo que tú tengas tendrás que hacer una agrupación u otra, ahora, yo te digo que nosotros, particularmente, en nuestros estudios que estamos haciendo ahora para proporcionar un poco de feedback al estudiante que está haciendo MOOC para ayudarle a avanzar y guiarle un poco en su aprendizaje estamos juntando por su nivel de autorregulación, es decir, gente que tiene... hay muchos instrumentos que te permiten detectar cual es el nivel de autorregulación que tiene un estudiante en un MOOC y nosotros lo que estamos haciendo es a través de ese instrumento definir donde situamos a cada uno de los estudiantes y ahí ofrecerles una visualización particular. Entonces nosotros, ahora mismo estamos utilizando este sistema de agrupación y también estamos agrupando por estilo de aprendizaje, es decir, unos es más visual, mas no sé qué, también los juntamos. Ahora los objetivos son ofrecer apoyo al INDIVIDUO no al grupo, en el desarrollo de sus competencias en un MOOC. El nivel de autorregulación se refiere más que a los ritmos a sus características, sus competencias, porque nosotros hicimos un experimento donde preguntábamos intenciones y preguntábamos capacidad de autorregulación y no coincide la intención con su capacidad de autorregulación. Es decir, intencionalmente, casi todos te dicen que quieren terminar, y que quieren sacarse el graduado y que quieren hacer todos los ejercicios y todas las actividades. Nadie te dice que voy a hacer sólo los vídeos, nadie. De hecho el 95% te responden que la intención es hacerlo todo. Entonces, una cosa es que tu intención sea una cosa y luego es que tu capacidad real de autorregulación, que es lo que miden estos instrumentos.

Researcher: **[Q3.3]** - ¿Por qué cree que esos son los criterios más importantes? ¿A qué es a lo que le da más importancia (estabilidad de los grupos, mejora del aprendizaje)? (no se hizo porque había sido respondida anteriormente)

B.3.14 Questions of Objective 4 - Collaborative Activities:

Researcher: **[Q4.1]** Describa el tipo de actividades colaborativas que cree que podrían ajustarse bien a este tipo de cursos MOOC.

E3: Deberían ser asíncronas, bajo mi punto de vista, porque si no te fijas en la geoposición del estudiante estás trabajando en distintos usos horarios, por ejemplo, gente de México con gente de España, que llevan unas horas de diferencia. Entonces síncrono es complicado. O sea que yo diría que así a nivel abstracto, síncronas no haría demasiadas, haría actividades asíncronas, y dentro de las actividades asíncronas, y probablemente tiempos un poco más largos que los que harías en una actividad colaborativa en el aula. Justo por el hecho de ser asíncronas tendrían que ser probablemente periodos largos de actividad para que la gente se pudiera organizar y llegar a los mismos objetivos. La segunda característica que creo que deberían tener es que fueran muy guiadas, muy pautadas, con hitos muy concretos. Si uno tiene que revisar el trabajo de uno, pues que se quede claramente cuando lo va a tener que revisar y como lo va a tener que revisar, porque si no eso es un desmadre. Y otro tipo de actividades que yo haría porque tienen mucho sentido es actividades donde se debata, donde haya un intercambio de ideas, porque por las características culturales de los distintos estudiantes eso puede aportar mucho. Actividades de resolución de problemas, con distintos enfoques, pero distribuido, muy pautado y muy distribuido y con grupos de personas de no más de diez personas, te diría, si quieres hacer algo efectivo. Diez por el hecho de que 5 probablemente no participen, entonces tienes que hacer como... compensar.

Researcher: **[Q4.2]** - Describa actividades que le gustaría poner en práctica pero que cree que no se ajustan a este tipo de cursos. ¿Qué necesitaría para poder ponerlas en práctica?

E3: Mira, yo creo que Davinia ha empezado a hacer ese trabajo también, ¿no? las actividades que ya han resultado efectivas o nos son efectivas en un contexto tradicional, los patrones colaborativos tipo jigsaw, piramid, blablablá... Entonces estos patrones son muy útiles, pero trasladarlos a un contexto masivo es muy complejo. Entonces yo creo que mi intento sería empezar a trasladar este tipo de patrones a un entorno más complejo como los MOOCs, ¿vale? Entonces yo creo que ahí es clave tener una buena monitorización de lo que hacen los miembros de tu equipo. Es decir, no solo sirve decir "oye estáis aquí colaborad y estas son las pautas", sino que también tienes que saber lo que están haciendo tus compañeros. Entonces tener como una especie de pantalla de monitorización de monitoreo de lo que hacen, distintas actividades, cuando se conectaron por última vez, qué han ido haciendo en la actividad, si el tiempo que han estado en la actividad es A o B, etc. eso puede, aunque sea algo que típicamente no se ha hecho en colaboración, porque de alguna manera todo lo que se ha probado es muy presencial y entonces lo que tú tienes no hace falta verlo reflejado o lo puedes trasmitir de otra manera es muy importante que se vea gráficamente o visualmente en un MOOC, yo creo.

Researcher: ¿Que lo vea el alumno o el profesor?

E3: No, no, no, que el alumno lo vea. De hecho, para mí el profesor pierde bastante el rol importante para moderar todo esto, porque se hace poco escalable y yo creo que hay que cederle el paso, o sea yo lo que veo es que los MOOC son mucho más user centered que el aprendizaje habitual tradicional, donde el profesor sigue teniendo la palabra absoluta y es un traslado de lo tradicional al virtual, ¿no? En el MOOC yo creo que hay que cambiar esa tendencia y deberíamos empezar a proporcionar las herramientas para el propio alumno sea el que desarrolle ahí la colaboración y la monitorice, la entienda, la gestione, etc, etc.

Researcher: ¿aplicar principios de distribución de redes, quizás?

E3: Sí, sí. Efectivamente, y yo creo que para eso es clave saber lo que hacen tus colegas. O sea no solo sirve con tener una pauta de qué es lo que tengo que hacer yo, qué es lo que tiene que hacer Juanita, tienes que ver, tienes que ofrecer un awareness de lo que ocurre.

Researcher: Muchas gracias. Me has ayudado muchísimo.

E3: Muchas gracias a ti!

Researcher: Más adelante me gustaría hablar con tu alumno, el de la herramienta de juegos que está pensando en agrupar a los alumnos.

E3: Si, sí, ahora me de momento lo ha hecho random, pero está utilizando un artículo, que ha escrito René Kilzichek que usa geoposicionamiento para las agrupaciones, yo le estoy diciendo que explore esa posibilidad. El hace un juego y necesita descartar a los que no vayan participando porque es necesario para avanzar en las distintas fases del juego, entonces, eso lo va a tener que hacer porque si no el juego no funciona. Lo que está pasando ahora es que tú descartas al que no trabaja contigo, pero ese descarte te puede llevar a cero. El gran reto de los MOOCs es que los grupos son cambiantes.

Researcher: Como en los juegos online como el póker

E3: Claaaaro, pues hay que copiar los mismos algoritmos que usan allí.

Researcher: Muchas gracias

E3: Gracias Luisa, un abrazo, ciao!

Appendix C

Questionnaires used to Co-Design the TraduEco MOOC (STD1) with the Teachers

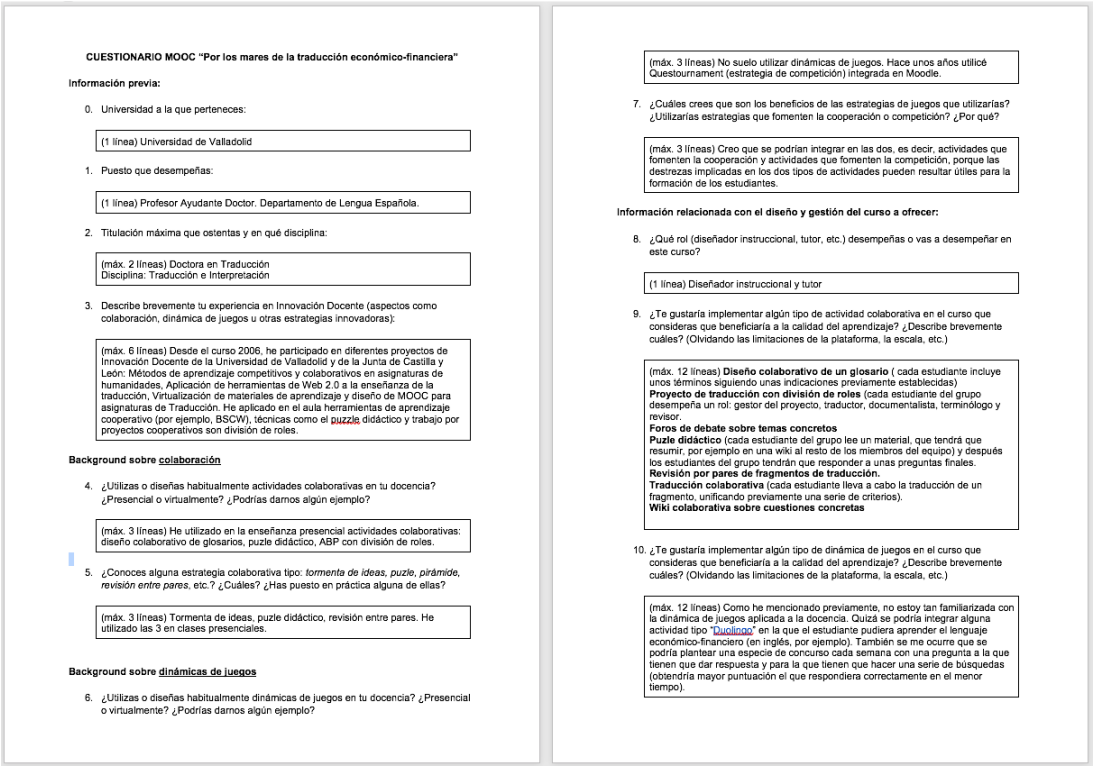
Summary: In this Appendix, we include the profile questionnaires fulfilled by the three teachers of the TraduEco MOOC (STD1), together with the Teachers' Questionnaire (TQ) model, as well as the fieldwork resulting from the consensus of the aforementioned three teachers to fulfill such a TQ.

C.1 Teacher Profile Questionnaire

First, we designed a questionnaire aimed at gathering information on the professional profile of the teachers involved in the MOOC to be developed and their competencies and experience in terms of collaborative learning and group tasks.

C.1.1 Profile Questionnaire of Teacher 1

The Teacher 1 was the instructional designer, coordinator and principal teacher of the MOOC we were envisioning and designing at this point. Her responses to our Profile Questionnaire can be seen in Figure C.1.



CUESTIONARIO MOOC "Por los mares de la traducción económico-financiera"

Información previa:

0. Universidad a la que perteneces:

(1 línea) Universidad de Valladolid

1. Puesto que desempeñas:

(1 línea) Profesor Ayudante Doctor. Departamento de Lengua Española.

2. Titulación máxima que ostentas y en qué disciplina:

(máx. 2 líneas) Doctora en Traducción
Disciplina: Traducción e Interpretación

3. Describe brevemente tu experiencia en Innovación Docente (aspectos como colaboración, dinámica de juegos u otras estrategias innovadoras):

(máx. 6 líneas) Desde el curso 2006, he participado en diferentes proyectos de Innovación Docente de la Universidad de Valladolid y de la Junta de Castilla y León: Métodos de aprendizaje competitivos y colaborativos en asignaturas de humanidades, Aplicación de herramientas de Web 2.0 a la enseñanza de la traducción, Virtualización de materiales de aprendizaje y diseño de MOOC para asignaturas de Traducción. He aplicado en el aula herramientas de aprendizaje cooperativo (por ejemplo, BSCW), técnicas como el puzzle didáctico y trabajo por proyectos cooperativos son división de roles.

Background sobre colaboración

4. ¿Utilizas o diseñas habitualmente actividades colaborativas en tu docencia? ¿Presencial o virtualmente? ¿Podrías darnos algún ejemplo?

(máx. 3 líneas) He utilizado en la enseñanza presencial actividades colaborativas: diseño colaborativo de glosarios, puzle didáctico, ABP con división de roles.

5. ¿Conoces alguna estrategia colaborativa tipo: *tormenta de ideas, puzle, pirámide, revisión entre pares*, etc.? ¿Cuáles? ¿Has puesto en práctica alguna de ellas?

(máx. 3 líneas) Tormenta de ideas, puzle didáctico, revisión entre pares. He utilizado las 3 en clases presenciales.

Background sobre dinámicas de juegos

6. ¿Utilizas o diseñas habitualmente dinámicas de juegos en tu docencia? ¿Presencial o virtualmente? ¿Podrías darnos algún ejemplo?

(máx. 3 líneas) No suelo utilizar dinámicas de juegos. Hace unos años utilicé Questournament (estrategia de competición) integrada en Moodle.

7. ¿Cuáles crees que son los beneficios de las estrategias de juegos que utilizarías? ¿Utilizarías estrategias que fomenten la cooperación o competición? ¿Por qué?

(máx. 3 líneas) Creo que se podrían integrar en las dos, es decir, actividades que fomenten la cooperación y actividades que fomenten la competición, porque las destrezas implicadas en los dos tipos de actividades pueden resultar útiles para la formación de los estudiantes.

Información relacionada con el diseño y gestión del curso a ofrecer:

8. ¿Qué rol (diseñador instruccional, tutor, etc.) desempeñas o vas a desempeñar en este curso?

(1 línea) Diseñador instruccional y tutor

9. ¿Te gustaría implementar algún tipo de actividad colaborativa en el curso que consideras que beneficiaría a la calidad del aprendizaje? ¿Describe brevemente cuáles? (Olvidando las limitaciones de la plataforma, la escala, etc.)

(máx. 12 líneas) **Diseño colaborativo de un glosario** (cada estudiante incluye unos términos siguiendo unas indicaciones previamente establecidas)
Proyecto de traducción con división de roles (cada estudiante del grupo desempeña un rol: gestor del proyecto, traductor, documentalista, terminólogo y revisor.
Foros de debate sobre temas concretos
Puzle didáctico (cada estudiante del grupo lee un material, que tendrá que resumir, por ejemplo en una wiki al resto de los miembros del equipo) y después los estudiantes del grupo tendrán que responder a unas preguntas finales.
Revisión por pares de fragmentos de traducción.
Traducción colaborativa (cada estudiante lleva a cabo la traducción de un fragmento, unificando previamente una serie de criterios).
Wiki colaborativa sobre cuestiones concretas

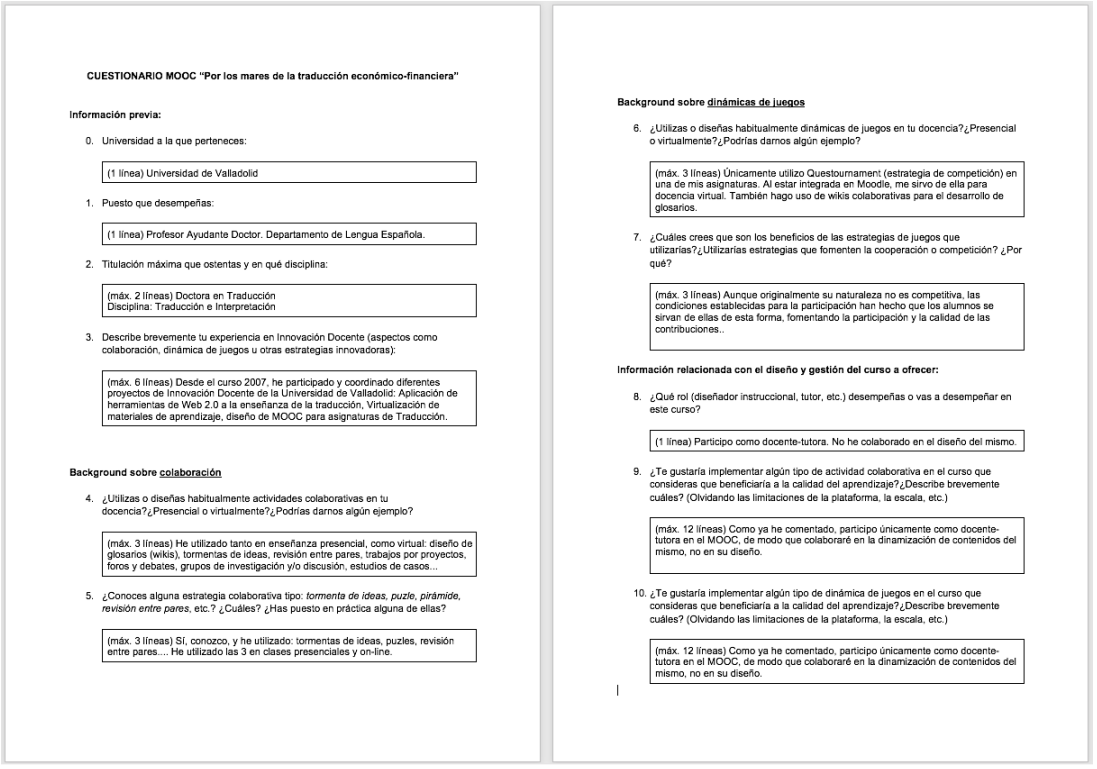
10. ¿Te gustaría implementar algún tipo de dinámica de juegos en el curso que consideras que beneficiaría a la calidad del aprendizaje? ¿Describe brevemente cuáles? (Olvidando las limitaciones de la plataforma, la escala, etc.)

(máx. 12 líneas) Como he mencionado previamente, no estoy tan familiarizada con la dinámica de juegos aplicada a la docencia. Quizá se podría integrar alguna actividad tipo "Duolingo" en la que el estudiante pudiera aprender el lenguaje económico-financiero (en inglés, por ejemplo). También se me ocurre que se podría plantear una especie de concurso cada semana con una pregunta a la que tienen que dar respuesta y para la que tienen que hacer una serie de búsquedas (obtendría mayor puntuación el que respondiera correctamente en el menor tiempo).

Figure C.1: Model of questionnaire to be used with the teacher in a co-design session (Part 1)

C.1.2 Profile Questionnaire of Teacher 2

The Teacher 2 was a supporting teacher aimed at helping students and answering their questions. Her responses to our Profile Questionnaire can be seen in Figure C.2.



CUESTIONARIO MOOC "Por los mares de la traducción económico-financiera"

Información previa:

0. Universidad a la que perteneces:

(1 línea) Universidad de Valladolid

1. Puesto que desempeñas:

(1 línea) Profesor Ayudante Doctor. Departamento de Lengua Española.

2. Titulación máxima que ostentas y en qué disciplina:

(máx. 2 líneas) Doctora en Traducción
Disciplina: Traducción e Interpretación

3. Describe brevemente tu experiencia en Innovación Docente (aspectos como colaboración, dinámica de juegos u otras estrategias innovadoras):

(máx. 6 líneas) Desde el curso 2007, he participado y coordinado diferentes proyectos de Innovación Docente de la Universidad de Valladolid: Aplicación de herramientas de Web 2.0 a la enseñanza de la traducción, Virtualización de materiales de aprendizaje, diseño de MOOC para asignaturas de Traducción.

Background sobre colaboración

4. ¿Utilizas o diseñas habitualmente actividades colaborativas en tu docencia?¿Presencial o virtualmente?¿Podrías darnos algún ejemplo?

(máx. 3 líneas) He utilizado tanto en enseñanza presencial, como virtual: diseño de glosarios (wikis), tormentas de ideas, revisión entre pares, trabajos por proyectos, foros y debates, grupos de investigación y/o discusión, estudios de casos...

5. ¿Conoces alguna estrategia colaborativa tipo: *tormenta de ideas, puzle, pirámide, revisión entre pares*, etc.? ¿Cuáles? ¿Has puesto en práctica alguna de ellas?

(máx. 3 líneas) SI, conozco, y he utilizado: tormentas de ideas, puzles, revisión entre pares.... He utilizado las 3 en clases presenciales y on-line.

Background sobre dinámicas de juegos

6. ¿Utilizas o diseñas habitualmente dinámicas de juegos en tu docencia?¿Presencial o virtualmente?¿Podrías darnos algún ejemplo?

(máx. 3 líneas) Únicamente utilizo Questournament (estrategia de competición) en una de mis asignaturas. Al estar integrada en Moodle, me sirvo de ella para docencia virtual. También hago uso de wikis colaborativas para el desarrollo de glosarios.

7. ¿Cuáles crees que son los beneficios de las estrategias de juegos que utilizarías?¿Utilizarías estrategias que fomenten la cooperación o competición? ¿Por qué?

(máx. 3 líneas) Aunque originalmente su naturaleza no es competitiva, las condiciones establecidas para la participación han hecho que los alumnos se sirvan de ellas de esta forma, fomentando la participación y la calidad de las contribuciones..

Información relacionada con el diseño y gestión del curso a ofrecer:

8. ¿Qué rol (diseñador instruccional, tutor, etc.) desempeñas o vas a desempeñar en este curso?

(1 línea) Participo como docente-tutora. No he colaborado en el diseño del mismo.

9. ¿Te gustaría implementar algún tipo de actividad colaborativa en el curso que consideras que beneficiaría a la calidad del aprendizaje?¿Describe brevemente cuáles? (Olvidando las limitaciones de la plataforma, la escala, etc.)

(máx. 12 líneas) Como ya he comentado, participo únicamente como docente-tutora en el MOOC, de modo que colaboraré en la dinamización de contenidos del mismo, no en su diseño.

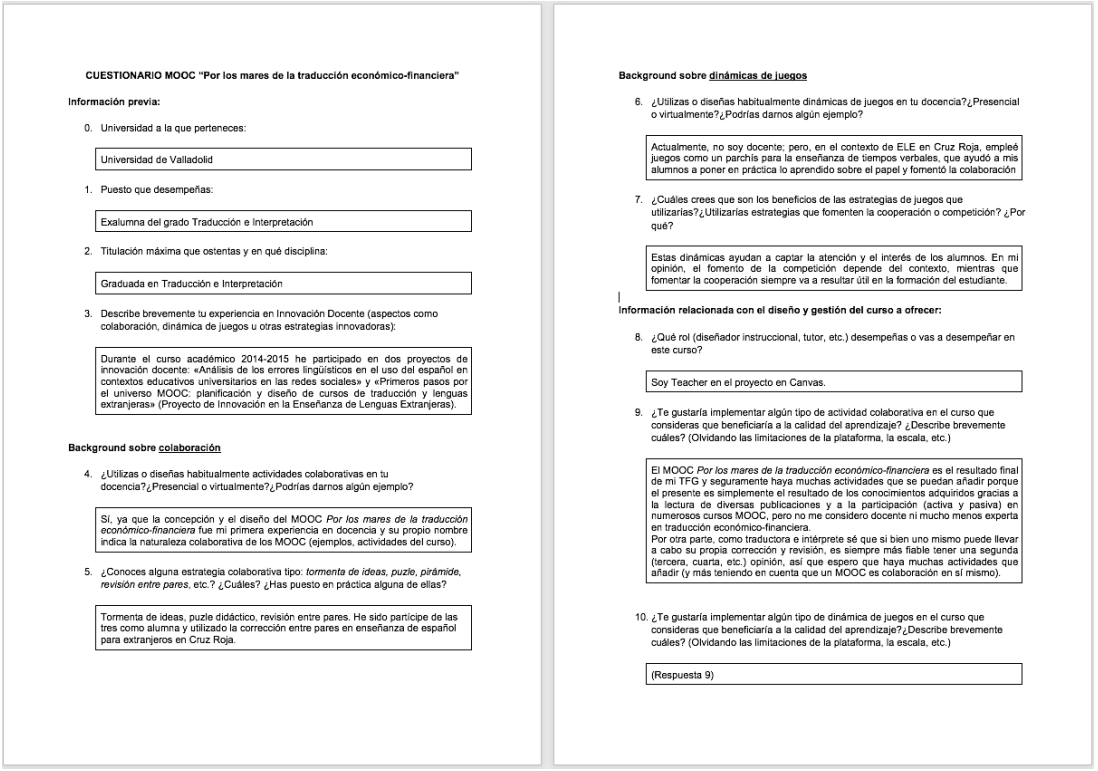
10. ¿Te gustaría implementar algún tipo de dinámica de juegos en el curso que consideras que beneficiaría a la calidad del aprendizaje?¿Describe brevemente cuáles? (Olvidando las limitaciones de la plataforma, la escala, etc.)

(máx. 12 líneas) Como ya he comentado, participo únicamente como docente-tutora en el MOOC, de modo que colaboraré en la dinamización de contenidos del mismo, no en su diseño.

Figure C.2: Model of questionnaire to be used with the teacher in a co-design session (Part 1)

C.1.3 Profile Questionnaire of Teacher 3

The Teacher 2 was a supporting teacher aimed at helping students and answering their questions. Her responses to our Profile Questionnaire can be seen in Figure C.2.



CUESTIONARIO MOOC "Por los mares de la traducción económico-financiera"

Información previa:

0. Universidad a la que perteneces:

Universidad de Valladolid

1. Puesto que desempeñas:

Exalumna del grado Traducción e Interpretación

2. Titulación máxima que ostentas y en qué disciplina:

Graduada en Traducción e Interpretación

3. Describe brevemente tu experiencia en Innovación Docente (aspectos como colaboración, dinámica de juegos u otras estrategias innovadoras):

Durante el curso académico 2014-2015 he participado en dos proyectos de innovación docente: «Análisis de los errores lingüísticos en el uso del español en contextos educativos universitarios en las redes sociales» y «Primeros pasos por el universo MOOC: planificación y diseño de cursos de traducción y lenguas extranjeras» (Proyecto de Innovación en la Enseñanza de Lenguas Extranjeras).

Background sobre colaboración

4. ¿Utilizas o diseñas habitualmente actividades colaborativas en tu docencia?¿Presencial o virtualmente?¿Podrías darnos algún ejemplo?

Sí, ya que la concepción y el diseño del MOOC *Por los mares de la traducción económico-financiera* fue mi primera experiencia en docencia y su propio nombre indica la naturaleza colaborativa de los MOOC (ejemplos, actividades del curso).

5. ¿Conoces alguna estrategia colaborativa tipo: *tormenta de ideas, puzle, pirámide, revisión entre pares*, etc.? ¿Cuáles? ¿Has puesto en práctica alguna de ellas?

Tormenta de ideas, puzle didáctico, revisión entre pares. He sido partícipe de las tres como alumna y utilizado la corrección entre pares en enseñanza de español para extranjeros en Cruz Roja.

Background sobre dinámicas de juegos

6. ¿Utilizas o diseñas habitualmente dinámicas de juegos en tu docencia?¿Presencial o virtualmente?¿Podrías darnos algún ejemplo?

Actualmente, no soy docente; pero, en el contexto de ELE en Cruz Roja, empleé juegos como un parchís para la enseñanza de tiempos verbales, que ayudó a mis alumnos a poner en práctica lo aprendido sobre el papel y fomentó la colaboración

7. ¿Cuáles crees que son los beneficios de las estrategias de juegos que utilizarías?¿Utilizarías estrategias que fomenten la cooperación o competición? ¿Por qué?

Estas dinámicas ayudan a captar la atención y el interés de los alumnos. En mi opinión, el fomento de la competición depende del contexto, mientras que fomentar la cooperación siempre va a resultar útil en la formación del estudiante.

Información relacionada con el diseño y gestión del curso a ofrecer:

8. ¿Qué rol (diseñador instruccional, tutor, etc.) desempeñas o vas a desempeñar en este curso?

Soy Teacher en el proyecto en Canvas.

9. ¿Te gustaría implementar algún tipo de actividad colaborativa en el curso que consideras que beneficiaría a la calidad del aprendizaje? ¿Describe brevemente cuáles? (Olvidando las limitaciones de la plataforma, la escala, etc.)

El MOOC *Por los mares de la traducción económico-financiera* es el resultado final de mi TFG y seguramente haya muchas actividades que se puedan añadir porque el presente es simplemente el resultado de los conocimientos adquiridos gracias a la lectura de diversas publicaciones y a la participación (activa y pasiva) en numerosos cursos MOOC, pero no me considero docente ni mucho menos experta en traducción económico-financiera.
Por otra parte, como traductora e intérprete sé que si bien uno mismo puede llevar a cabo su propia corrección y revisión, es siempre más fiable tener una segunda (tercera, cuarta, etc.) opinión, así que espero que haya muchas actividades que añadir (y más teniendo en cuenta que un MOOC es colaboración en sí mismo).

10. ¿Te gustaría implementar algún tipo de dinámica de juegos en el curso que consideras que beneficiaría a la calidad del aprendizaje?¿Describe brevemente cuáles? (Olvidando las limitaciones de la plataforma, la escala, etc.)

(Respuesta 9)

Figure C.3: Model of questionnaire to be used with the teacher in a co-design session (Part 1)

C.2 Teachers' Questionnaire Model

The Teachers' Questionnaire (TQ) created taking by reference the three graphic elements of the Framework in its first version, F1, was composed of five sections (see Section 4.3 for more information about the TQ structure and content) a total number of 32 questions and 6 pages.

Figure C.4 depicts the first part of the TQ model, while Figure C.5 shows the three last sheets of this TQ.

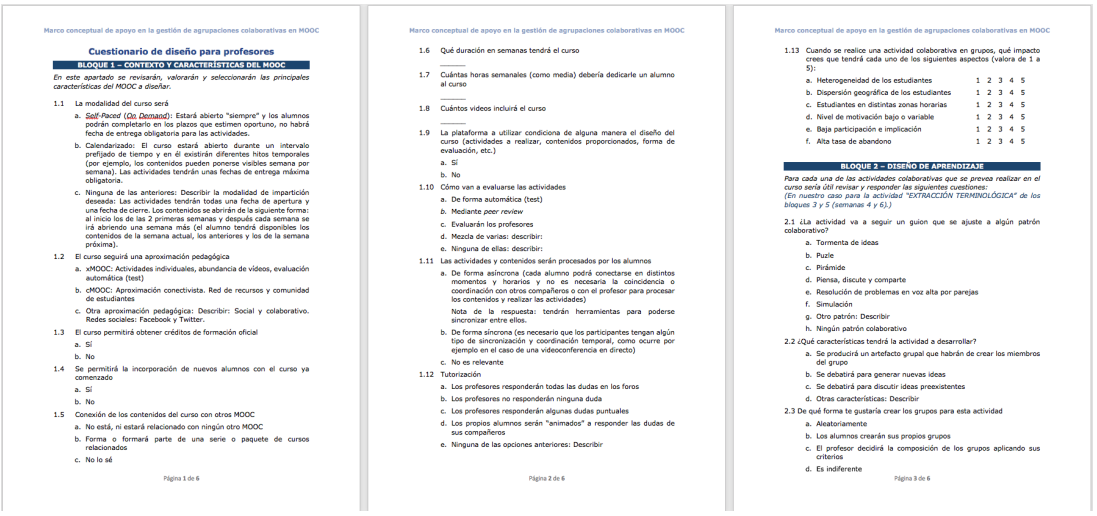


Figure C.4: Model of questionnaire to be used with the teacher in a co-design session (Part 1)

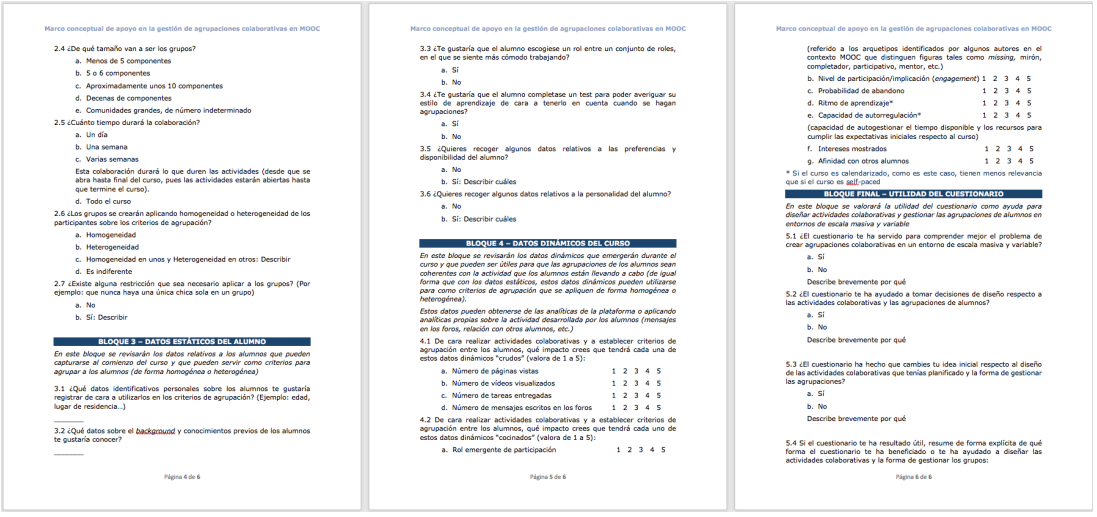


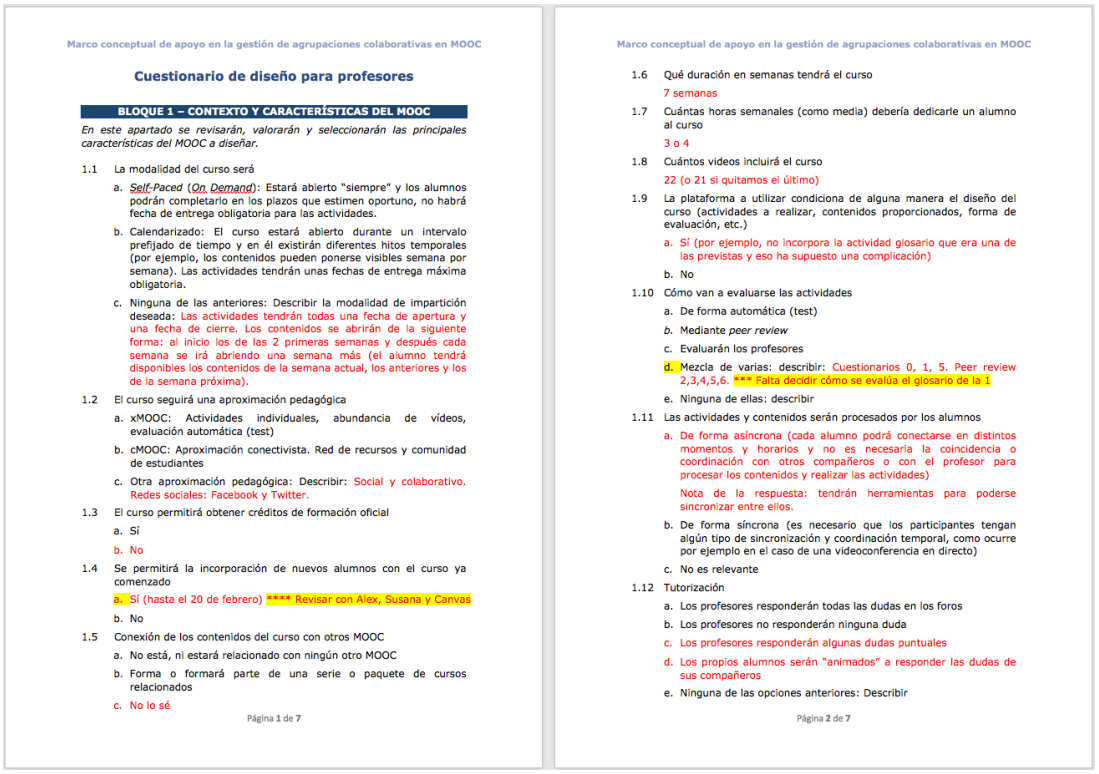
Figure C.5: Model of questionnaire to be used with the teacher in a co-design session (Part 2)

C.3 Fieldwork corresponding to the fulfillment of the TQ during the co-design session with the Teachers

All the teachers received the questionnaire at least a week prior to the first meeting with the researcher in order to have time to read and understand the concepts and questions included on it.

The face to face session of co-design with the main teacher of the MOOC lasted for eight hours and was recorded in order to be processed later on. During this session, each of the questions included on the TQ was revised, commented and discussed with the teacher, while envisioning future decisions about the course structure, contents and activities.

The three teachers in charge of tutoring the course fulfilled an agreed TQ later on, after having several on-line meetings with the author of this thesis. Their responses can be observed in Figures C.6, C.7, C.8,



Marco conceptual de apoyo en la gestión de agrupaciones colaborativas en MOOC

Cuestionario de diseño para profesores

BLOQUE 1 – CONTEXTO Y CARACTERÍSTICAS DEL MOOC

En este apartado se revisarán, valorarán y seleccionarán las principales características del MOOC a diseñar.

1.1 La modalidad del curso será

a. *Self-Paced* (*On Demand*): Estará abierto "siempre" y los alumnos podrán completarlo en los plazos que estimen oportuno, no habrá fecha de entrega obligatoria para las actividades.

b. Calendarizado: El curso estará abierto durante un intervalo prefijado de tiempo y en él existirán diferentes hitos temporales (por ejemplo, los contenidos pueden ponerse visibles semana por semana). Las actividades tendrán unas fechas de entrega máxima obligatoria.

c. Ninguna de las anteriores: Describir la modalidad de impartición deseada: Las actividades tendrán todas una fecha de apertura y una fecha de cierre. Los contenidos se abrirán de la siguiente forma: al inicio los de las 2 primeras semanas y después cada semana se irá abriendo una semana más (el alumno tendrá disponibles los contenidos de la semana actual, los anteriores y los de la semana próxima).

1.2 El curso seguirá una aproximación pedagógica

a. xMOOC: Actividades individuales, abundancia de vídeos, evaluación automática (test)

b. cMOOC: Aproximación conectivista. Red de recursos y comunidad de estudiantes

c. Otra aproximación pedagógica: Describir: Social y colaborativo. Redes sociales: Facebook y Twitter.

1.3 El curso permitirá obtener créditos de formación oficial

a. Sí

b. No

1.4 Se permitirá la incorporación de nuevos alumnos con el curso ya comenzado

a. Sí (hasta el 20 de febrero) **** Revisar con Alex, Susana y Canvas

b. No

1.5 Conexión de los contenidos del curso con otros MOOC

a. No está, ni estará relacionado con ningún otro MOOC

b. Forma o formará parte de una serie o paquete de cursos relacionados

c. No lo sé

Página 1 de 7

Marco conceptual de apoyo en la gestión de agrupaciones colaborativas en MOOC

1.6 Qué duración en semanas tendrá el curso

7 semanas

1.7 Cuántas horas semanales (como media) debería dedicarle un alumno al curso

3 o 4

1.8 Cuántos videos incluirá el curso

22 (o 21 si quitamos el último)

1.9 La plataforma a utilizar condiciona de alguna manera el diseño del curso (actividades a realizar, contenidos proporcionados, forma de evaluación, etc.)

a. Sí (por ejemplo, no incorpora la actividad glosario que era una de las previstas y eso ha supuesto una complicación)

b. No

1.10 Cómo van a evaluarse las actividades

a. De forma automática (test)

b. Mediante *peer review*

c. Evaluarán los profesores

d. Mezcla de varias: describir: Cuestionarios 0, 1, 5. Peer review 2,3,4,5,6. *** Falta decidir cómo se evalúa el glosario de la 1

e. Ninguna de ellas: describir

1.11 Las actividades y contenidos serán procesados por los alumnos

a. De forma asíncrona (cada alumno podrá conectarse en distintos momentos y horarios y no es necesaria la coincidencia o coordinación con otros compañeros o con el profesor para procesar los contenidos y realizar las actividades)

Nota de la respuesta: tendrán herramientas para poderse sincronizar entre ellos.

b. De forma síncrona (es necesario que los participantes tengan algún tipo de sincronización y coordinación temporal, como ocurre por ejemplo en el caso de una videoconferencia en directo)

c. No es relevante

1.12 Tutorización

a. Los profesores responderán todas las dudas en los foros

b. Los profesores no responderán ninguna duda

c. Los profesores responderán algunas dudas puntuales

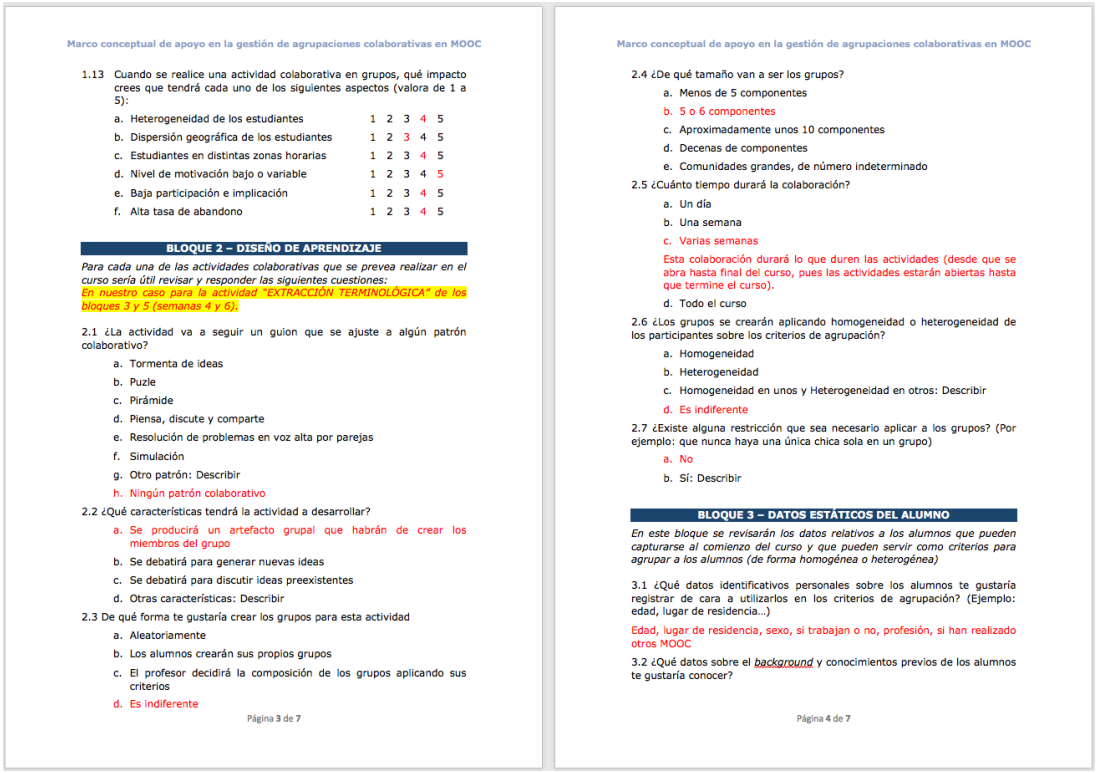
d. Los propios alumnos serán "animados" a responder las dudas de sus compañeros

e. Ninguna de las opciones anteriores: Describir

Página 2 de 7

Figure C.6: Model of questionnaire to be used with the teacher in a co-design session (Part 1)

C.9



Marco conceptual de apoyo en la gestión de agrupaciones colaborativas en MOOC

1.13 Cuando se realice una actividad colaborativa en grupos, qué impacto crees que tendrá cada uno de los siguientes aspectos (valora de 1 a 5):

a. Heterogeneidad de los estudiantes 1 2 3 4 5
b. Dispersión geográfica de los estudiantes 1 2 3 4 5
c. Estudiantes en distintas zonas horarias 1 2 3 4 5
d. Nivel de motivación bajo o variable 1 2 3 4 5
e. Baja participación e implicación 1 2 3 4 5
f. Alta tasa de abandono 1 2 3 4 5

BLOQUE 2 – DISEÑO DE APRENDIZAJE

Para cada una de las actividades colaborativas que se prevea realizar en el curso sería útil revisar y responder las siguientes cuestiones:
En nuestro caso para la actividad "EXTRACCIÓN TERMINOLÓGICA" de los bloques 3 y 5 (semanas 4 y 6).

2.1 ¿La actividad va a seguir un guion que se ajuste a algún patrón colaborativo?

a. Tormenta de ideas
b. Puzle
c. Pirámide
d. Piensa, discute y comparte
e. Resolución de problemas en voz alta por parejas
f. Simulación
g. Otro patrón: Describir
h. Ningún patrón colaborativo

2.2 ¿Qué características tendrá la actividad a desarrollar?

a. Se producirá un artefacto grupal que habrán de crear los miembros del grupo
b. Se debatirá para generar nuevas ideas
c. Se debatirá para discutir ideas preexistentes
d. Otras características: Describir

2.3 De qué forma te gustaría crear los grupos para esta actividad

a. Aleatoriamente
b. Los alumnos crearán sus propios grupos
c. El profesor decidirá la composición de los grupos aplicando sus criterios
d. Es indiferente

Página 3 de 7

Marco conceptual de apoyo en la gestión de agrupaciones colaborativas en MOOC

2.4 ¿De qué tamaño van a ser los grupos?

a. Menos de 5 componentes
b. 5 o 6 componentes
c. Aproximadamente unos 10 componentes
d. Decenas de componentes
e. Comunidades grandes, de número indeterminado

2.5 ¿Cuánto tiempo durará la colaboración?

a. Un día
b. Una semana
c. Varias semanas

Esta colaboración durará lo que duren las actividades (desde que se abra hasta final del curso, pues las actividades estarán abiertas hasta que termine el curso).

d. Todo el curso

2.6 ¿Los grupos se crearán aplicando homogeneidad o heterogeneidad de los participantes sobre los criterios de agrupación?

a. Homogeneidad
b. Heterogeneidad
c. Homogeneidad en unos y Heterogeneidad en otros: Describir
d. Es indiferente

2.7 ¿Existe alguna restricción que sea necesario aplicar a los grupos? (Por ejemplo: que nunca haya una única chica sola en un grupo)

a. No
b. Sí: Describir

BLOQUE 3 – DATOS ESTÁTICOS DEL ALUMNO

En este bloque se revisarán los datos relativos a los alumnos que pueden capturarse al comienzo del curso y que pueden servir como criterios para agrupar a los alumnos (de forma homogénea o heterogénea)

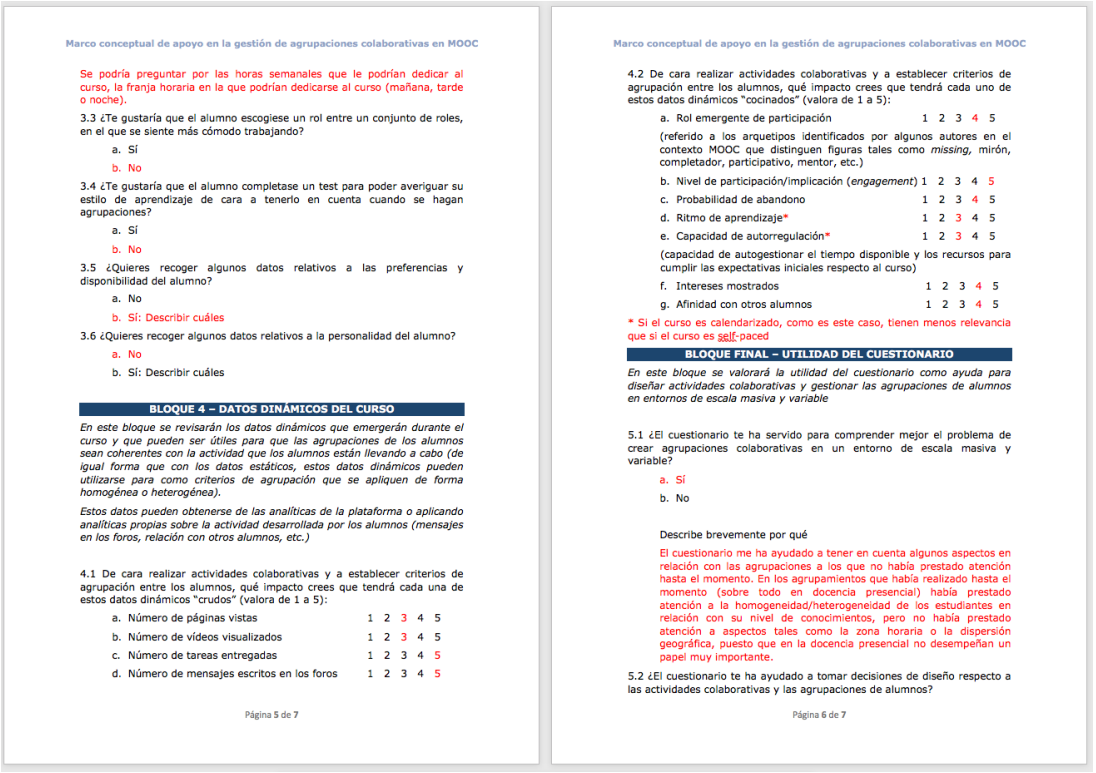
3.1 ¿Qué datos identificativos personales sobre los alumnos te gustaría registrar de cara a utilizarlos en los criterios de agrupación? (Ejemplo: edad, lugar de residencia…)

Edad, lugar de residencia, sexo, si trabajan o no, profesión, si han realizado otros MOOC

3.2 ¿Qué datos sobre el *background* y conocimientos previos de los alumnos te gustaría conocer?

Página 4 de 7

Figure C.7: Model of questionnaire to be used with the teacher in a co-design session (Part 2)



Se podría preguntar por las horas semanales que le podrían dedicar al curso, la franja horaria en la que podrían dedicarse al curso (mañana, tarde o noche).

3.3 ¿Te gustaría que el alumno escogiese un rol entre un conjunto de roles, en el que se siente más cómodo trabajando?

a. Sí
b. No

3.4 ¿Te gustaría que el alumno completase un test para poder averiguar su estilo de aprendizaje de cara a tenerlo en cuenta cuando se hagan agrupaciones?

a. Sí
b. No

3.5 ¿Quieres recoger algunos datos relativos a las preferencias y disponibilidad del alumno?

a. No
b. Sí: Describir cuáles

3.6 ¿Quieres recoger algunos datos relativos a la personalidad del alumno?

a. No
b. Sí: Describir cuáles

BLOQUE 4 – DATOS DINÁMICOS DEL CURSO

En este bloque se revisarán los datos dinámicos que emergerán durante el curso y que pueden ser útiles para que las agrupaciones de los alumnos sean coherentes con la actividad que los alumnos están llevando a cabo (de igual forma que con los datos estáticos, estos datos dinámicos pueden utilizarse para como criterios de agrupación que se apliquen de forma homogénea o heterogénea).

Estos datos pueden obtenerse de las analíticas de la plataforma o aplicando analíticas propias sobre la actividad desarrollada por los alumnos (mensajes en los foros, relación con otros alumnos, etc.)

4.1 De cara realizar actividades colaborativas y a establecer criterios de agrupación entre los alumnos, qué impacto crees que tendrá cada una de estos datos dinámicos "crudos" (valora de 1 a 5):

a. Número de páginas vistas 1 2 3 4 5
b. Número de vídeos visualizados 1 2 3 4 5
c. Número de tareas entregadas 1 2 3 4 5
d. Número de mensajes escritos en los foros 1 2 3 4 5

4.2 De cara realizar actividades colaborativas y a establecer criterios de agrupación entre los alumnos, qué impacto crees que tendrá cada uno de estos datos dinámicos "cocinados" (valora de 1 a 5):

a. Rol emergente de participación 1 2 3 4 5

(referido a los arquetipos identificados por algunos autores en el contexto MOOC que distinguen figuras tales como *missing*, mirón, completador, participativo, mentor, etc.)

b. Nivel de participación/implicación (*engagement*) 1 2 3 4 5
c. Probabilidad de abandono 1 2 3 4 5
d. Ritmo de aprendizaje* 1 2 3 4 5
e. Capacidad de autorregulación* 1 2 3 4 5

(capacidad de autogestionar el tiempo disponible y los recursos para cumplir las expectativas iniciales respecto al curso)

f. Intereses mostrados 1 2 3 4 5
g. Afinidad con otros alumnos 1 2 3 4 5

* Si el curso es calendarizado, como es este caso, tienen menos relevancia que si el curso es self-paced

BLOQUE FINAL – UTILIDAD DEL CUESTIONARIO

En este bloque se valorará la utilidad del cuestionario como ayuda para diseñar actividades colaborativas y gestionar las agrupaciones de alumnos en entornos de escala masiva y variable

5.1 ¿El cuestionario te ha servido para comprender mejor el problema de crear agrupaciones colaborativas en un entorno de escala masiva y variable?

a. Sí
b. No

Describe brevemente por qué

El cuestionario me ha ayudado a tener en cuenta algunos aspectos en relación con las agrupaciones a los que no había prestado atención hasta el momento. En los agrupamientos que había realizado hasta el momento (sobre todo en docencia presencial) había prestado atención a la homogeneidad/heterogeneidad de los estudiantes en relación con su nivel de conocimientos, pero no había prestado atención a aspectos tales como la zona horaria o la dispersión geográfica, puesto que en la docencia presencial no desempeñan un papel muy importante.

5.2 ¿El cuestionario te ha ayudado a tomar decisiones de diseño respecto a las actividades colaborativas y las agrupaciones de alumnos?

Figure C.8: Model of questionnaire to be used with the teacher in a co-design session (Part 3)

a. Sí
b. No

Describe brevemente por qué

El cuestionario me ha hecho reflexionar sobre importancia de los criterios de composición de los agrupamientos. Aunque en algunas de las actividades, me resulta indiferente el sistema de creación de los grupos, sí que me ha llevado a tomar decisiones en relación con el diseño, por ejemplo, dejar las actividades abiertas hasta el final; así estudiantes que tengan menos disponibilidad y no puedan dedicar las horas preestablecidas a la realización del curso (que podría ser un criterio de agrupamiento), podrán llevarlas a cabo sin problema.

5.3 ¿El cuestionario ha hecho que cambies tu idea inicial respecto al diseño de las actividades colaborativas que tenías planificado y la forma de gestionar las agrupaciones?

a. Sí
b. No

Describe brevemente por qué

El cuestionario no me ha hecho cambiar, pero si reflexionar sobre las posibles implicaciones que tendrían los diferentes sistemas de agrupamiento de estudiantes.

5.4 Si el cuestionario te ha resultado útil, resume de forma explícita de qué forma el cuestionario te ha beneficiado o te ha ayudado a diseñar las actividades colaborativas y la forma de gestionar los grupos:

El cuestionario me ha permitido reflexionar sobre la repercusión (impacto) que algunos criterios (tales como la dispersión geográfica de los estudiantes o el nivel de motivación) podrían tener en el desarrollo de las diferentes tareas del MOOC. Por otra parte, me ha ayudado a tener una idea más clara de los diferentes patrones de trabajo colaborativo y de cómo puede influir la creación de los grupos de trabajo en el desarrollo (y éxito) de las tareas.

Figure C.9: Model of questionnaire to be used with the teacher in a co-design session (Part 4)

Appendix D

Pilot Satisfaction Survey and Fieldwork of the Judgment of Five Experts (STD1)

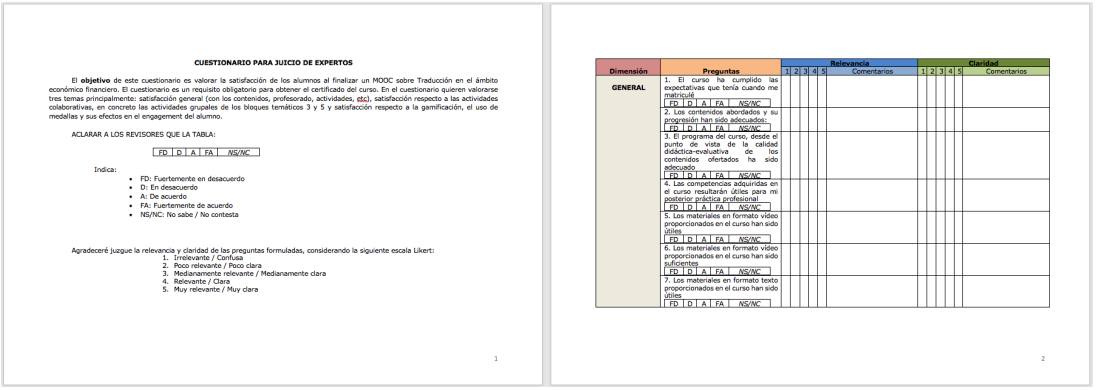
Summary: In this Appendix, we include the pilot version of the student satisfaction survey of STD1, together with the judgment of five experts which helped to generate the definitive version.

D.1 Pilot Satisfaction Survey Model

To measure the satisfaction of the students with the collaboration carried out in their group during STD1, we gathered, at the end of the course, quantitative and qualitative data about students' satisfaction regarding the collaboration carried out within their teams. We asked about and collected data from both experiments by means of open and close ended questions in a final satisfaction survey. The method used to draw up the satisfaction survey was the construction of a pilot version of the questionnaire that satisfaction survey in order to be subsequently validated by means of an experts judgment [40], [114]. The five experts selected must validate each question of the pilot questionnaire by assessing its relevance and clarity with a Likert scale of five points:

1. Irrelevant / Confusing
2. Little relevance / Little clarity
3. Medium relevance / Medium clarity
4. Relevant / Clear
5. Very relevant / Very clear

Figures D.1, D.2, D.3, D.4, D.5 and D.6 shows the pilot satisfaction survey prior to the judgment of the experts.



CUESTIONARIO PARA JUICIO DE EXPERTOS

El **objetivo** de este cuestionario es valorar la satisfacción de los alumnos al finalizar un MOOC sobre Traducción en el ámbito económico financiero. El cuestionario es un requisito obligatorio para obtener el certificado del curso. En el cuestionario quieren valorarse tres temas principalmente: satisfacción general (con los contenidos, profesorado, actividades, etc), satisfacción respecto a las actividades colaborativas, en concreto las actividades grupales de los bloques temáticos 3 y 5 y satisfacción respecto a la gamificación, el uso de medallas y sus efectos en el engagement del alumno.

ACLARAR A LOS REVISORES QUE LA TABLA:

FD	D	A	FA	NS/NC

Indica:

- FD: Fuertemente en desacuerdo
- D: En desacuerdo
- A: De acuerdo
- FA: Fuertemente de acuerdo
- NS/NC: No sabe / No contesta

Agradeceré juzgue la relevancia y claridad de las preguntas formuladas, considerando la siguiente escala Likert:

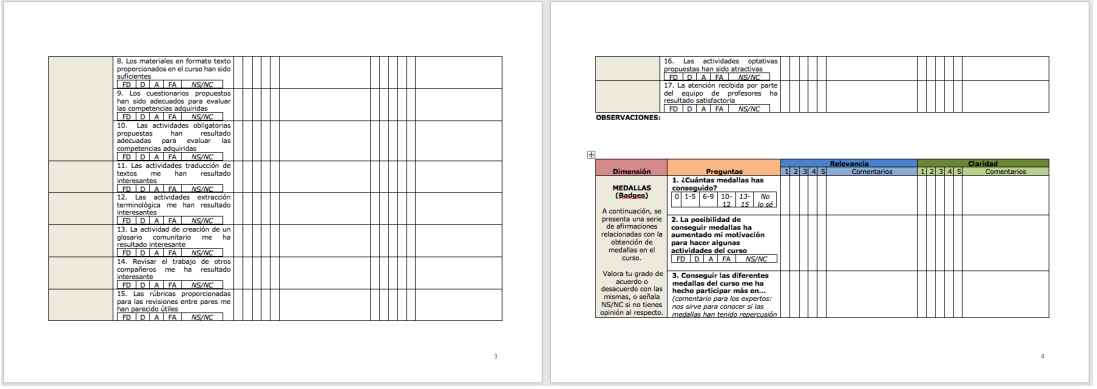
1. Irrelevante / Confusa
2. Poco relevante / Poco clara
3. Medianamente relevante / Medianamente clara
4. Relevante / Clara
5. Muy relevante / Muy clara

1

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
GENERAL	1. El curso ha cumplido las expectativas que tenía cuando me matriculé FD D A FA NS/NC												
	2. Los contenidos abordados y su progresión han sido adecuados: FD D A FA NS/NC												
	3. El programa del curso, desde el punto de vista de la calidad didáctica-evaluativa de los contenidos ofertados ha sido adecuado FD D A FA NS/NC												
	4. Las competencias adquiridas en el curso resultarán útiles para mi posterior práctica profesional FD D A FA NS/NC												
	5. Los materiales en formato vídeo proporcionados en el curso han sido útiles FD D A FA NS/NC												
	6. Los materiales en formato vídeo proporcionados en el curso han sido suficientes FD D A FA NS/NC												
	7. Los materiales en formato texto proporcionados en el curso han sido útiles FD D A FA NS/NC												

2

Figure D.1: Pilot satisfaction survey prior to the judgment of the experts (Part 1)



	8. Los materiales en formato texto proporcionados en el curso han sido suficientes FD D A FA NS/NC												
	9. Los cuestionarios propuestos han sido adecuados para evaluar las competencias adquiridas FD D A FA NS/NC												
	10. Las actividades obligatorias propuestas han resultado adecuadas para evaluar las competencias adquiridas FD D A FA NS/NC												
	11. Las actividades traducción de textos me han resultado interesantes FD D A FA NS/NC												
	12. Las actividades extracción terminológica me han resultado interesantes FD D A FA NS/NC												
	13. La actividad de creación de un glosario comunitario me ha resultado interesante FD D A FA NS/NC												
	14. Revisar el trabajo de otros compañeros me ha resultado interesante FD D A FA NS/NC												
	15. Las rúbricas proporcionadas para las revisiones entre pares me han parecido útiles FD D A FA NS/NC												

3

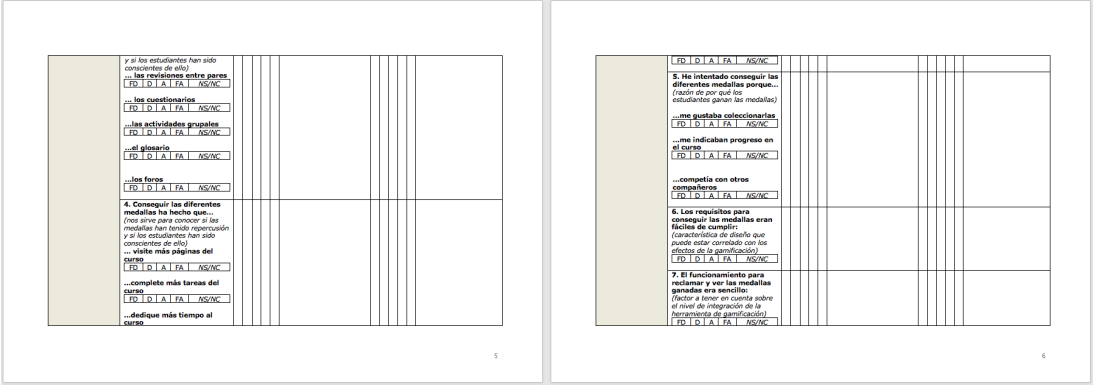
	16. Las actividades optativas propuestas han sido atractivas FD D A FA NS/NC												
	17. La atención recibida por parte del equipo de profesores ha resultado satisfactoria FD D A FA NS/NC												

OBSERVACIONES:

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
MEDALLAS (Badges)	**1. ¿Cuántas medallas has conseguido?** 0 | 1-5 | 6-9 | 10-12 | 13-15 | *No lo sé*												
A continuación, se presenta una serie de afirmaciones relacionadas con la obtención de medallas en el curso.	**2. La posibilidad de conseguir medallas ha aumentado mi motivación para hacer algunas actividades del curso** FD D A FA NS/NC												
Valora tu grado de acuerdo o desacuerdo con las mismas, o señala NS/NC si no tienes opinión al respecto.	**3. Conseguir las diferentes medallas del curso me ha hecho participar más en...** *(comentario para los expertos: nos sirve para conocer si las medallas han tenido repercusión* *y si los estudiantes han sido conscientes de ello)* **...las revisiones entre pares** FD D A FA NS/NC												
	...los cuestionarios FD D A FA NS/NC												
	...las actividades grupales FD D A FA NS/NC												
	...el glosario FD D A FA NS/NC												
	...los foros FD D A FA NS/NC												
	4. Conseguir las diferentes medallas ha hecho que... *(nos sirve para conocer si las medallas han tenido repercusión y si los estudiantes han sido conscientes de ello)* **...visite más páginas del curso** FD D A FA NS/NC												
	...complete más tareas del curso FD D A FA NS/NC												
	...dedique más tiempo al curso FD D A FA NS/NC												

4

Figure D.2: Pilot satisfaction survey prior to the judgment of the experts (Part 1)



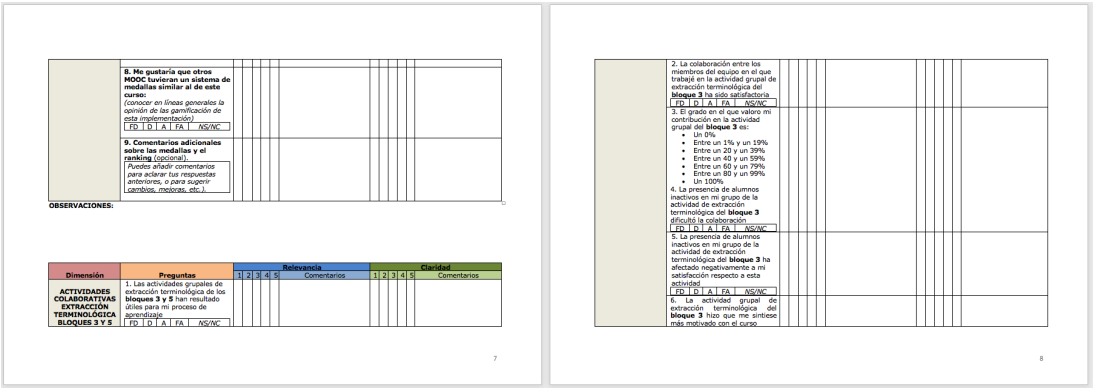
	y si los estudiantes han sido conscientes de ello) **... las revisiones entre pares** FD D A FA NS/NC												
	... los cuestionarios FD D A FA NS/NC												
	...las actividades grupales FD D A FA NS/NC												
	...el glosario FD D A FA NS/NC												
	...los foros FD D A FA NS/NC												
	4. Conseguir las diferentes medallas ha hecho que... *(nos sirve para conocer si las medallas han tenido repercusión y si los estudiantes han sido conscientes de ello)* **... visite más páginas del curso** FD D A FA NS/NC												
	...complete más tareas del curso FD D A FA NS/NC												
	...dedique más tiempo al curso FD D A FA NS/NC												

5

	FD D A FA NS/NC												
	5. He intentado conseguir las diferentes medallas porque... *(razón de por qué los estudiantes ganan las medallas)* **...me gustaba coleccionarlas** FD D A FA NS/NC												
	...me indicaban progreso en el curso FD D A FA NS/NC												
	...competía con otros compañeros FD D A FA NS/NC												
	6. Los requisitos para conseguir las medallas eran fáciles de cumplir: *(característica de diseño que puede estar correlado con los efectos de la gamificación)* FD D A FA NS/NC												
	7. El funcionamiento para reclamar y ver las medallas ganadas era sencillo: *(factor a tener en cuenta sobre el nivel de integración de la herramienta de gamificación)* FD D A FA NS/NC												

6

Figure D.3: Pilot satisfaction survey prior to the judgment of the experts (Part 1)



	8. Me gustaría que otros MOOC tuvieran un sistema de medallas similar al de este curso: *(conocer en líneas generales la opinión de las gamificación de esta implementación)* FD D A FA NS/NC															
	9. Comentarios adicionales sobre las medallas y el ranking (opcional). *Puedes añadir comentarios para aclarar tus respuestas anteriores, o para sugerir cambios, mejoras, etc.).*															

OBSERVACIONES:

Dimensión	Preguntas	Relevancia					Comentarios	Claridad					Comentarios
		1	2	3	4	5		1	2	3	4	5	
ACTIVIDADES COLABORATIVAS EXTRACCIÓN TERMINOLÓGICA BLOQUES 3 Y 5	1. Las actividades grupales de extracción terminológica de los **bloques 3 y 5** han resultado útiles para mi proceso de aprendizaje FD D A FA NS/NC												

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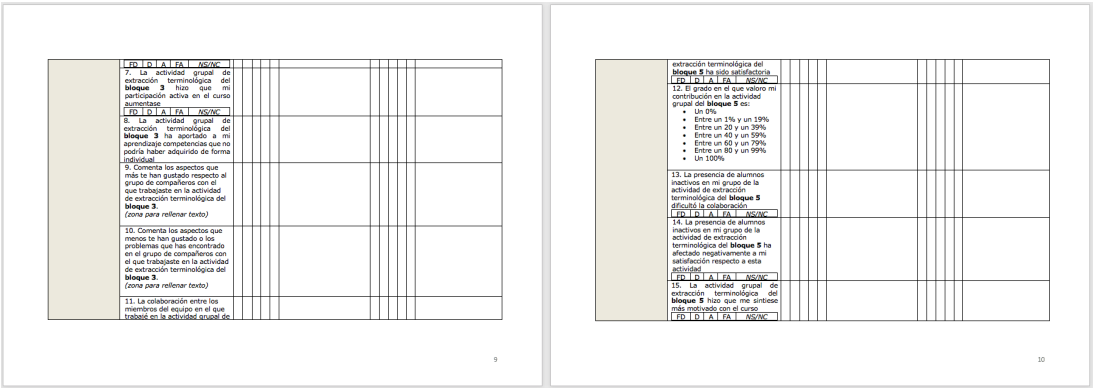
	2. La colaboración entre los miembros del equipo en el que trabajé en la actividad grupal de extracción terminológica del **bloque 3** ha sido satisfactoria FD D A FA NS/NC
	3. El grado en el que valoro mi contribución en la actividad grupal del **bloque 3** es: • Un 0% • Entre un 1% y un 19% • Entre un 20 y un 39% • Entre un 40 y un 59% • Entre un 60 y un 79% • Entre un 80 y un 99% • Un 100%
	4. La presencia de alumnos inactivos en mi grupo de la actividad de extracción terminológica del **bloque 3** dificultó la colaboración FD D A FA NS/NC
	5. La presencia de alumnos inactivos en mi grupo de la actividad de extracción terminológica del **bloque 3** ha afectado negativamente a mi satisfacción respecto a esta actividad FD D A FA NS/NC
	6. La actividad grupal de extracción terminológica del **bloque 3** hizo que me sintiese más motivado con el curso

8

Figure D.4: Pilot satisfaction survey prior to the judgment of the experts (Part 1)



	FD D A FA NS/NC
	7. La actividad grupal de extracción terminológica del **bloque 3** hizo que mi participación activa en el curso aumentase FD D A FA NS/NC
	8. La actividad grupal de extracción terminológica del **bloque 3** ha aportado a mi aprendizaje competencias que no podría haber adquirido de forma individual
	9. Comenta los aspectos que más te han gustado respecto al grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 3**. *(zona para rellenar texto)*
	10. Comenta los aspectos que menos te han gustado o los problemas que has encontrado en el grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 3**. *(zona para rellenar texto)*
	11. La colaboración entre los miembros del equipo en el que trabajé en la actividad grupal de

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	extracción terminológica del **bloque 5** ha sido satisfactoria FD D A FA NS/NC
	12. El grado en el que valoro mi contribución en la actividad grupal del **bloque 5** es: • Un 0% • Entre un 1% y un 19% • Entre un 20 y un 39% • Entre un 40 y un 59% • Entre un 60 y un 79% • Entre un 80 y un 99% • Un 100%
	13. La presencia de alumnos inactivos en mi grupo de la actividad de extracción terminológica del **bloque 5** dificultó la colaboración FD D A FA NS/NC
	14. La presencia de alumnos inactivos en mi grupo de la actividad de extracción terminológica del **bloque 5** ha afectado negativamente a mi satisfacción respecto a esta actividad FD D A FA NS/NC
	15. La actividad grupal de extracción terminológica del **bloque 5** hizo que me sintiese más motivado con el curso FD D A FA NS/NC

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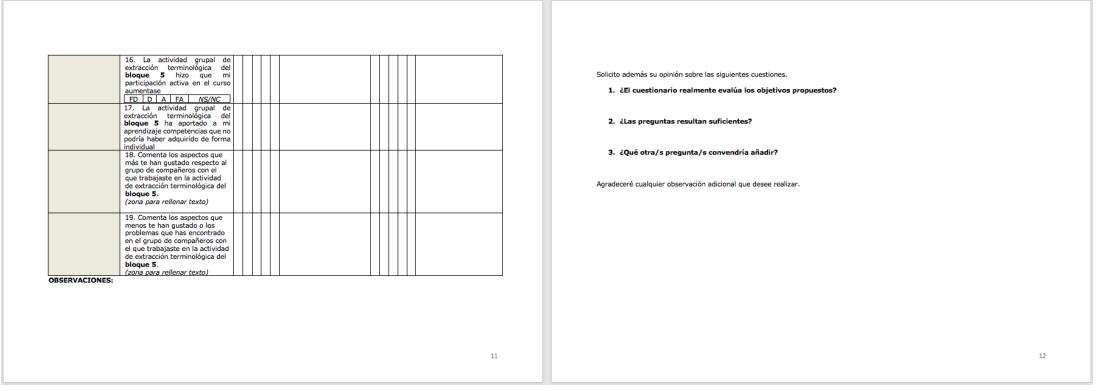
Figure D.5: Pilot satisfaction survey prior to the judgment of the experts (Part 1)



	16. La actividad grupal de extracción terminológica del **bloque 5** hizo que mi participación activa en el curso aumentase FD D A FA NS/NC
	17. La actividad grupal de extracción terminológica del **bloque 5** ha aportado a mi aprendizaje competencias que no podría haber adquirido de forma individual
	18. Comenta los aspectos que más te han gustado respecto al grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 5**. *(zona para rellenar texto)*
	19. Comenta los aspectos que menos te han gustado o los problemas que has encontrado en el grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 5**. *(zona para rellenar texto)*

OBSERVACIONES:

11

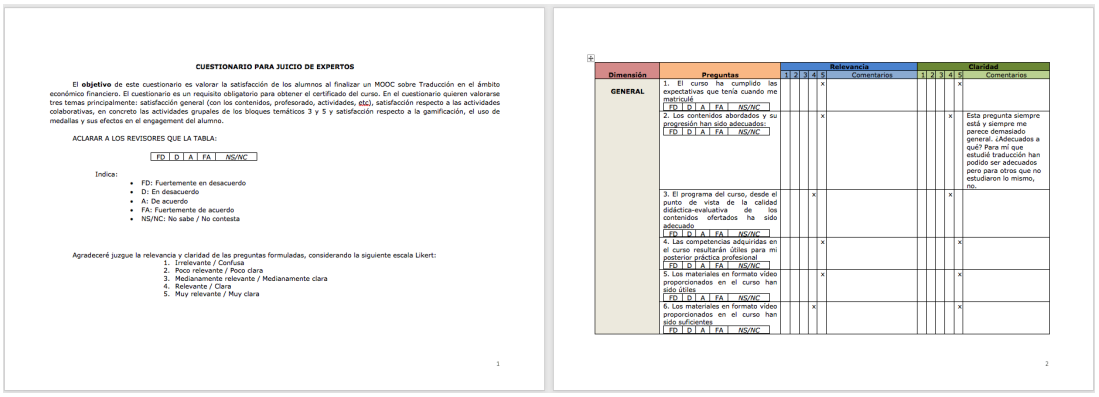
Solicito además su opinión sobre las siguientes cuestiones.

1. **¿El cuestionario realmente evalúa los objetivos propuestos?**
2. **¿Las preguntas resultan suficientes?**
3. **¿Qué otra/s pregunta/s convendría añadir?**

Agradeceré cualquier observación adicional que desee realizar.

12

Figure D.6: Pilot satisfaction survey prior to the judgment of the experts (Part 1)



CUESTIONARIO PARA JUICIO DE EXPERTOS

El **objetivo** de este cuestionario es valorar la satisfacción de los alumnos al finalizar un MOOC sobre Traducción en el ámbito económico financiero. El cuestionario es un requisito obligatorio para obtener el certificado del curso. En el cuestionario quieren valorarse tres temas principalmente: satisfacción general (con los contenidos, profesorado, actividades, etc), satisfacción respecto a las actividades colaborativas, en concreto las actividades grupales de los bloques temáticos 3 y 5 y satisfacción respecto a la gamificación, el uso de medallas y sus efectos en el engagement del alumno.

ACLARAR A LOS REVISORES QUE LA TABLA:

FD	D	A	FA	NS/NC

Indica:

- FD: Fuertemente en desacuerdo
- D: En desacuerdo
- A: De acuerdo
- FA: Fuertemente de acuerdo
- NS/NC: No sabe / No contesta

Agradeceré juzgue la relevancia y claridad de las preguntas formuladas, considerando la siguiente escala Likert:

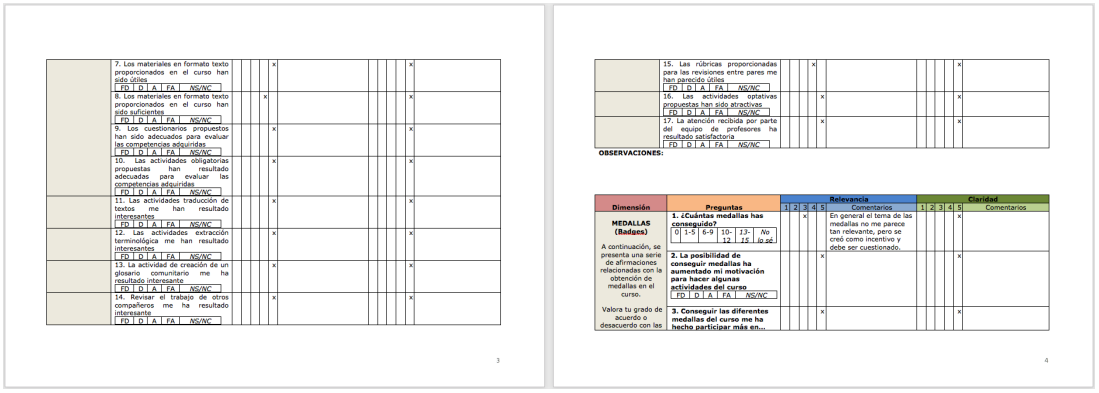
1. Irrelevante / Confusa
2. Poco relevante / Poco clara
3. Medianamente relevante / Medianamente clara
4. Relevante / Clara
5. Muy relevante / Muy clara

1

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
GENERAL	1. El curso ha cumplido las expectativas que tenía cuando me matriculé FD D A FA NS/NC					x						x	
	2. Los contenidos abordados y su progresión han sido adecuados: FD D A FA NS/NC					x						x	Esta pregunta siempre está y siempre me parece demasiado general. ¿Adecuados a qué? Para mí que estudié traducción han podido ser adecuados pero para otros que no estudiaron lo mismo, no.
	3. El programa del curso, desde el punto de vista de la calidad didáctica-evaluativa de los contenidos ofertados ha sido adecuado FD D A FA NS/NC				x						x		
	4. Las competencias adquiridas en el curso resultarán útiles para mi posterior práctica profesional FD D A FA NS/NC					x						x	
	5. Los materiales en formato vídeo proporcionados en el curso han sido útiles FD D A FA NS/NC					x						x	
	6. Los materiales en formato vídeo proporcionados en el curso han sido suficientes FD D A FA NS/NC				x							x	

2

Figure D.7: Judgment of the first expert about the pilot satisfaction survey (Part 1)



	7. Los materiales en formato texto proporcionados en el curso han sido útiles FD D A FA NS/NC				x							x	
	8. Los materiales en formato texto proporcionados en el curso han sido suficientes FD D A FA NS/NC			x								x	
	9. Los cuestionarios propuestos han sido adecuados para evaluar las competencias adquiridas FD D A FA NS/NC				x							x	
	10. Las actividades obligatorias propuestas han resultado adecuadas para evaluar las competencias adquiridas FD D A FA NS/NC				x							x	
	11. Las actividades traducción de textos me han resultado interesantes FD D A FA NS/NC				x							x	
	12. Las actividades extracción terminológica me han resultado interesantes FD D A FA NS/NC				x							x	
	13. La actividad de creación de un glosario comunitario me ha resultado interesante FD D A FA NS/NC				x							x	
	14. Revisar el trabajo de otros compañeros me ha resultado interesante FD D A FA NS/NC				x							x	

3

	15. Las rúbricas proporcionadas para las revisiones entre pares me han parecido útiles FD D A FA NS/NC					x						x	
	16. Las actividades optativas propuestas han sido atractivas FD D A FA NS/NC				x							x	
	17. La atención recibida por parte del equipo de profesores ha resultado satisfactoria FD D A FA NS/NC				x							x	

OBSERVACIONES:

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
MEDALLAS (Badges) A continuación, se presenta una serie de afirmaciones relacionadas con la obtención de medallas en el curso. Valora tu grado de acuerdo o desacuerdo con las	**1. ¿Cuántas medallas has conseguido?** 0 | 1-5 | 6-9 | 10-12 | 13-15 | No lo sé			x			En general el tema de las medallas no me parece tan relevante, pero se creó como incentivo y debe ser cuestionado.					x	
	2. La posibilidad de conseguir medallas ha aumentado mi motivación para hacer algunas actividades del curso FD D A FA NS/NC					x						x	
	3. Conseguir las diferentes medallas del curso me ha hecho participar más en...					x						x	

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Figure D.8: Judgment of the first expert about the pilot satisfaction survey (Part 2)

D.2 Judgment of Five Experts

D.2.1 Expert 1

Figures D.7, D.8, D.9, D.10, D.11 and D.12 shows the judgment of the first expert about the pilot satisfaction survey.

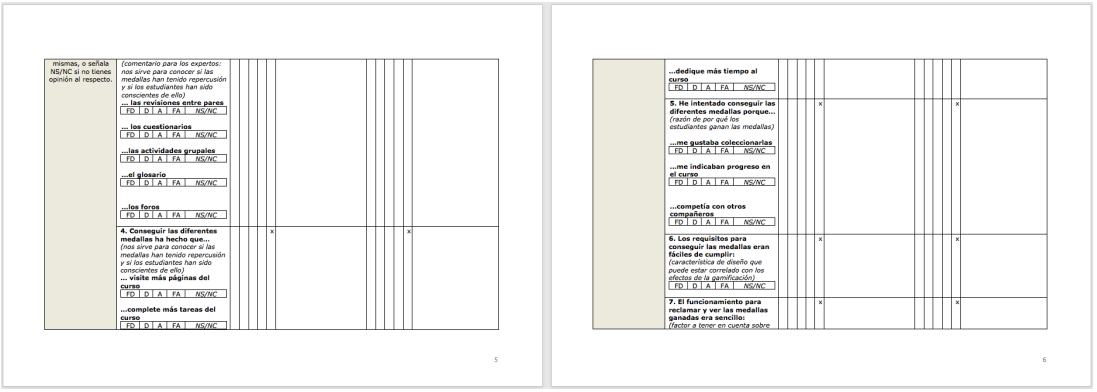


Figure D.9: Judgment of the first expert about the pilot satisfaction survey (Part 3)

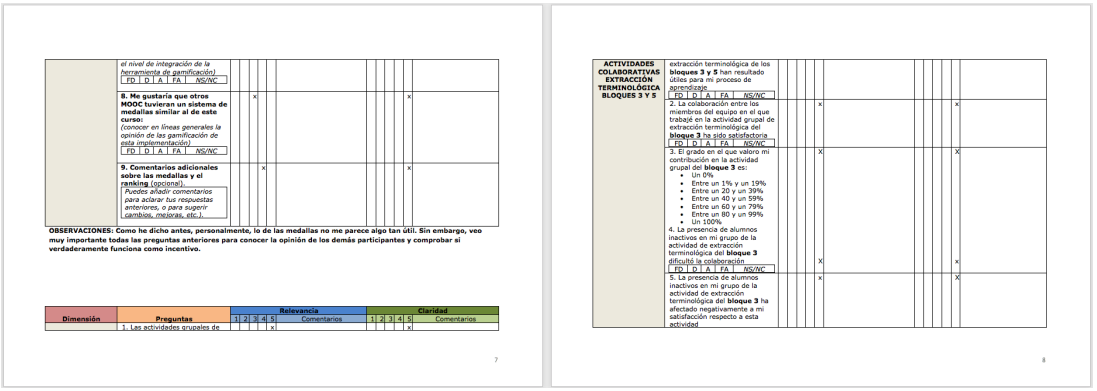


Figure D.10: Judgment of the first expert about the pilot satisfaction survey (Part 4)

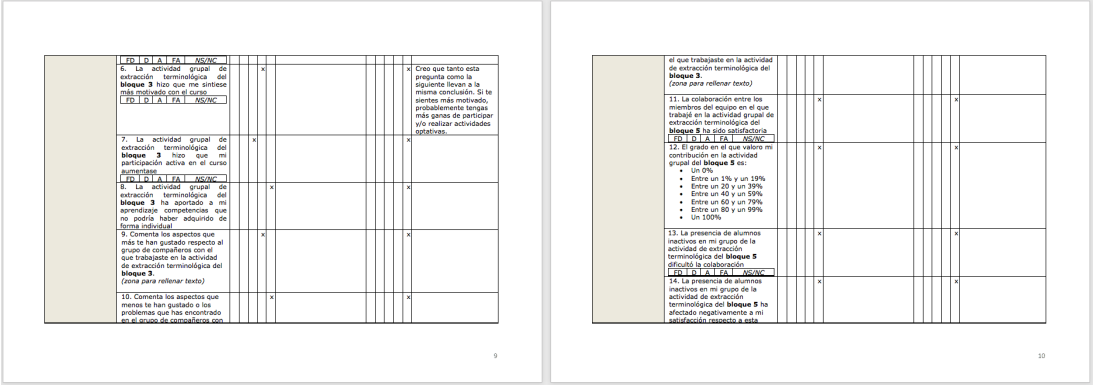
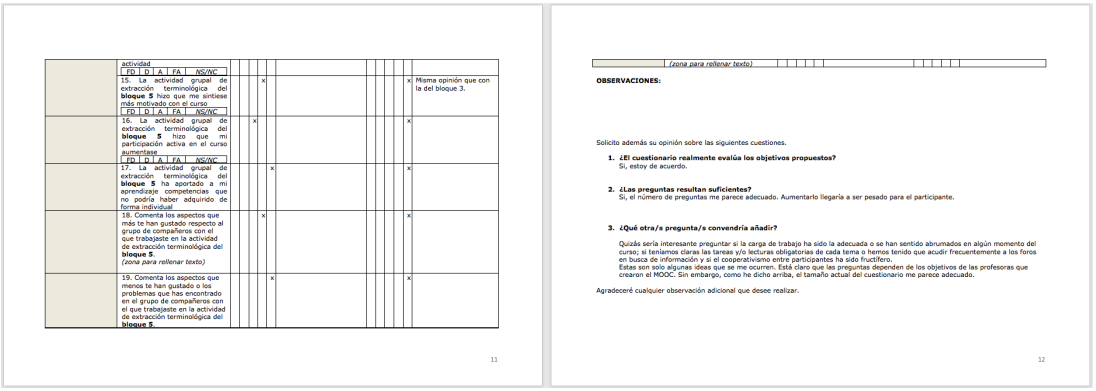


Figure D.11: Judgment of the first expert about the pilot satisfaction survey (Part 5)



	actividad FD D A FA NS/NC												
	15. La actividad grupal de extracción terminológica del **bloque 5** hizo que me sintiese más motivado con el curso FD D A FA NS/NC				x							x	Misma opinión que con la del bloque 3.
	16. La actividad grupal de extracción terminológica del **bloque 5** hizo que mi participación activa en el curso aumentase FD D A FA NS/NC			x								x	
	17. La actividad grupal de extracción terminológica del **bloque 5** ha aportado a mi aprendizaje competencias que no podría haber adquirido de forma individual					x						x	
	18. Comenta los aspectos que más te han gustado respecto al grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 5.** *(zona para rellenar texto)*				x							x	
	19. Comenta los aspectos que menos te han gustado o los problemas que has encontrado en el grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 5.**					x						x	

11

(zona para rellenar texto)

OBSERVACIONES:

Solicito además su opinión sobre las siguientes cuestiones.

1. **¿El cuestionario realmente evalúa los objetivos propuestos?**
   Si, estoy de acuerdo.

2. **¿Las preguntas resultan suficientes?**
   Si, el número de preguntas me parece adecuado. Aumentarlo llegaría a ser pesado para el participante.

3. **¿Qué otra/s pregunta/s convendría añadir?**

   Quizás sería interesante preguntar si la carga de trabajo ha sido la adecuada o se han sentido abrumados en algún momento del curso; si teníamos claras las tareas y/o lecturas obligatorias de cada tema o hemos tenido que acudir frecuentemente a los foros en busca de información y si el cooperativismo entre participantes ha sido fructífero.
   Estas son solo algunas ideas que se me ocurren. Está claro que las preguntas dependen de los objetivos de las profesoras que crearon el MOOC. Sin embargo, como he dicho arriba, el tamaño actual del cuestionario me parece adecuado.

Agradeceré cualquier observación adicional que desee realizar.

12

Figure D.12: Judgment of the first expert about the pilot satisfaction survey (Part 6)

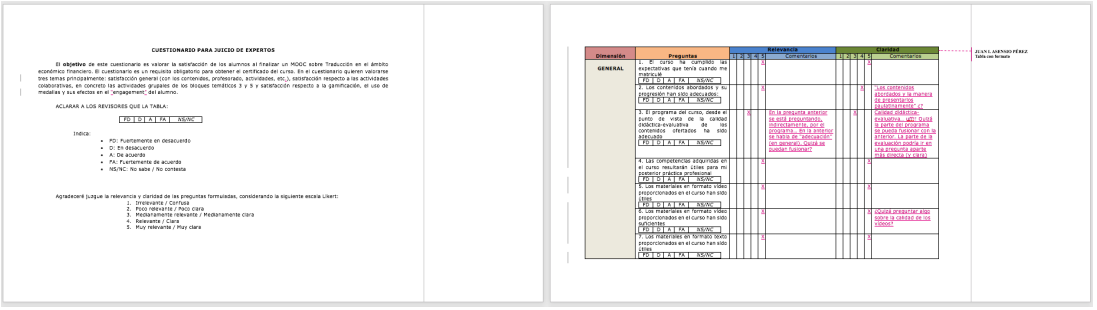


Figure D.13: Judgment of the second expert about the pilot satisfaction survey (Part 1)

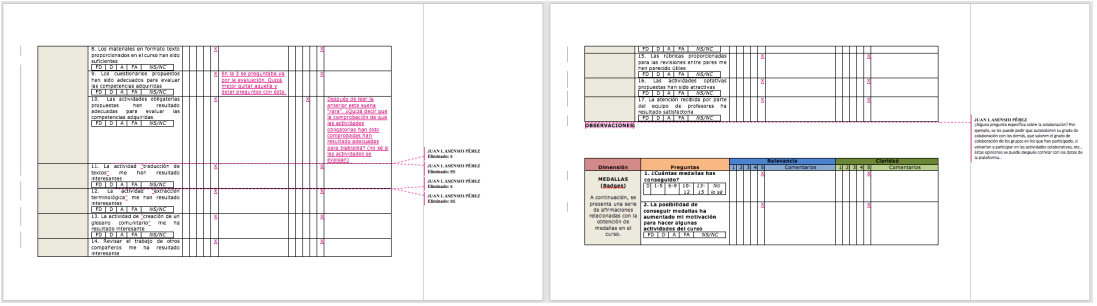


Figure D.14: Judgment of the second expert about the pilot satisfaction survey (Part 2)

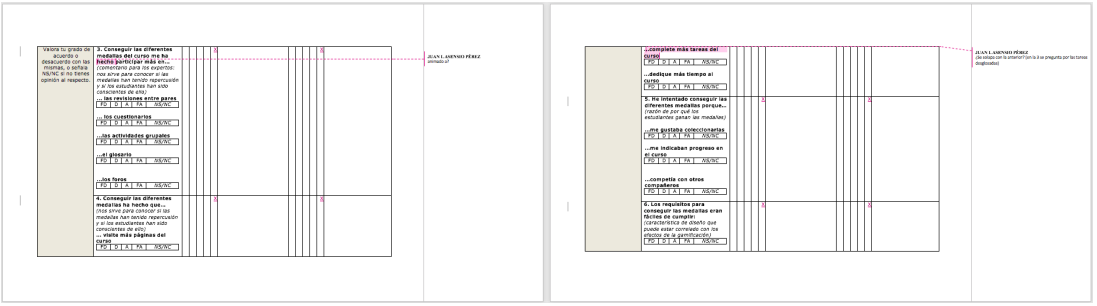


Figure D.15: Judgment of the second expert about the pilot satisfaction survey (Part 3)

D.2.2 Expert 2

Figures D.13, D.14, D.15, D.16, D.17 and D.18 shows the judgment of the second expert about the pilot satisfaction survey.

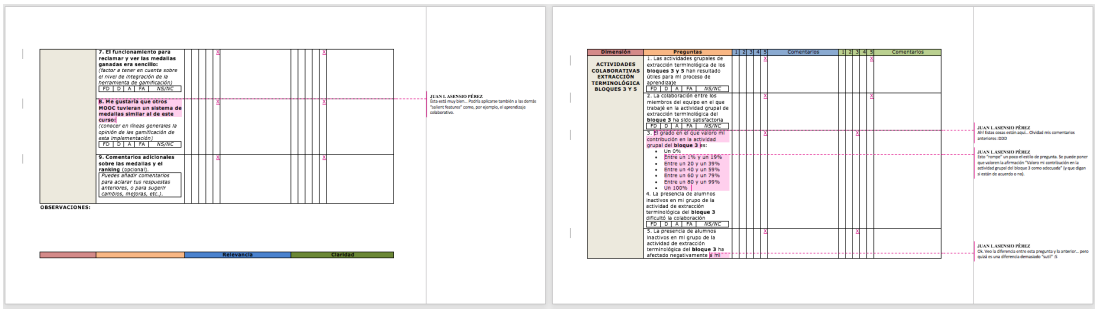


Figure D.16: Judgment of the second expert about the pilot satisfaction survey (Part 4)

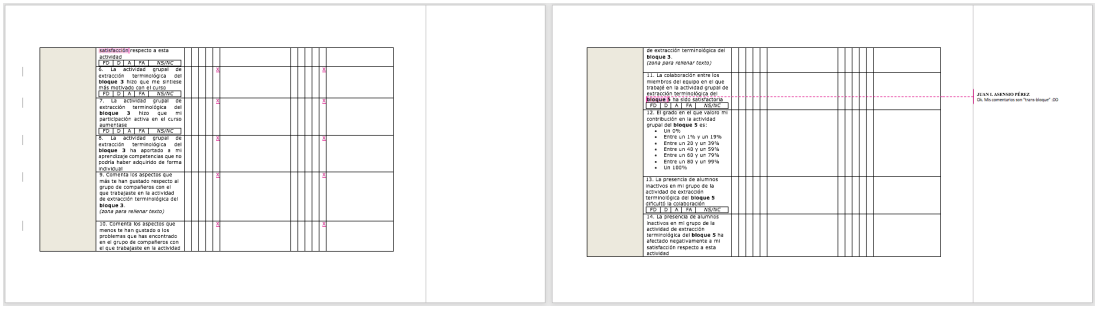


Figure D.17: Judgment of the second expert about the pilot satisfaction survey (Part 5)

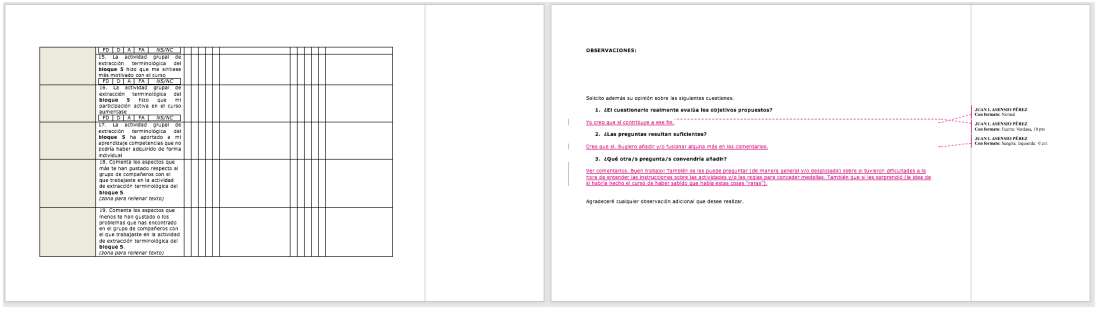
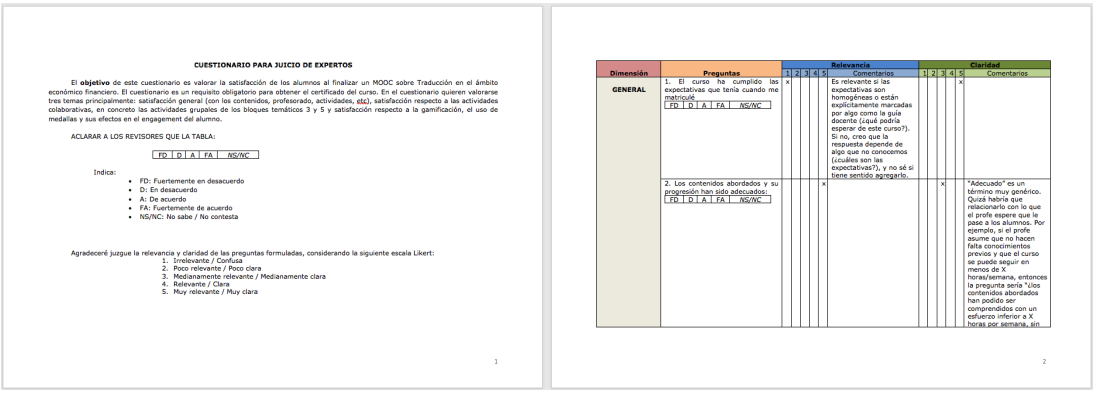


Figure D.18: Judgment of the second expert about the pilot satisfaction survey (Part 6)

D.2.3 Expert 3

Figures D.19, D.20, D.21, D.22, D.23, D.24 and D.25 shows the judgment of the third expert about the pilot satisfaction survey.



CUESTIONARIO PARA JUICIO DE EXPERTOS

El **objetivo** de este cuestionario es valorar la satisfacción de los alumnos al finalizar un MOOC sobre Traducción en el ámbito económico financiero. El cuestionario es un requisito obligatorio para obtener el certificado del curso. En el cuestionario quieren valorarse tres temas principalmente: satisfacción general (con los contenidos, profesorado, actividades, etc), satisfacción respecto a las actividades colaborativas, en concreto las actividades grupales de los bloques temáticos 3 y 5 y satisfacción respecto a la gamificación, el uso de medallas y sus efectos en el engagement del alumno.

ACLARAR A LOS REVISORES QUE LA TABLA:

| FD | D | A | FA | NS/NC |

Indica:

- FD: Fuertemente en desacuerdo
- D: En desacuerdo
- A: De acuerdo
- FA: Fuertemente de acuerdo
- NS/NC: No sabe / No contesta

Agradeceré juzgue la relevancia y claridad de las preguntas formuladas, considerando la siguiente escala Likert:

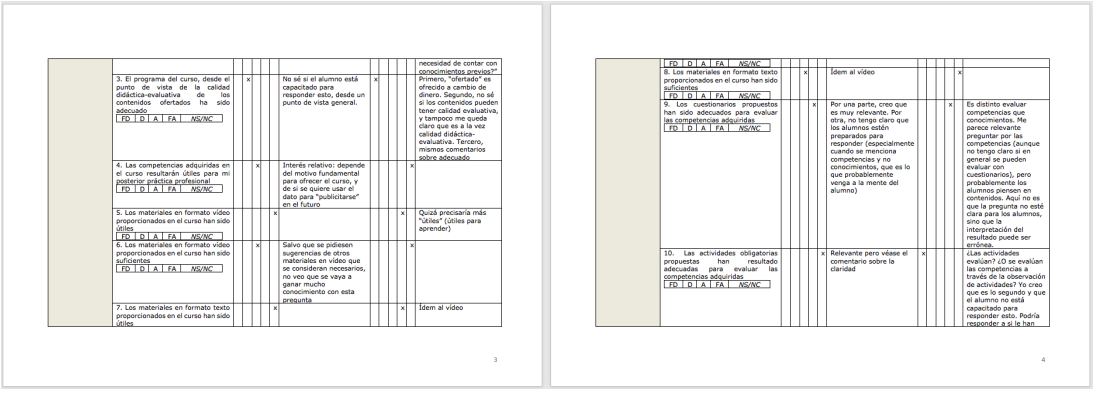
1. Irrelevante / Confusa
2. Poco relevante / Poco clara
3. Medianamente relevante / Medianamente clara
4. Relevante / Clara
5. Muy relevante / Muy clara

1

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
GENERAL	1. El curso ha cumplido las expectativas que tenía cuando me matriculé FD | D | A | FA | NS/NC	x					Es relevante si las expectativas son homogéneas o están explícitamente marcadas por algo como la guía docente (¿qué podría esperar de este curso?). Si no, creo que la respuesta depende de algo que no conocemos (¿cuáles son las expectativas?), y no sé si tiene sentido agregarlo.					x	
	2. Los contenidos abordados y su progresión han sido adecuados: FD | D | A | FA | NS/NC				x						x		"Adecuado" es un término muy genérico. Quizá habría que relacionarlo con lo que el profe espere que le pase a los alumnos. Por ejemplo, si el profe asume que no hacen falta conocimientos previos y que el curso se puede seguir en menos de X horas/semana, entonces la pregunta sería "¿los contenidos abordados han podido ser comprendidos con un esfuerzo inferior a X horas por semana, sin

2

Figure D.19: Judgment of the third expert about the pilot satisfaction survey (Part 1)



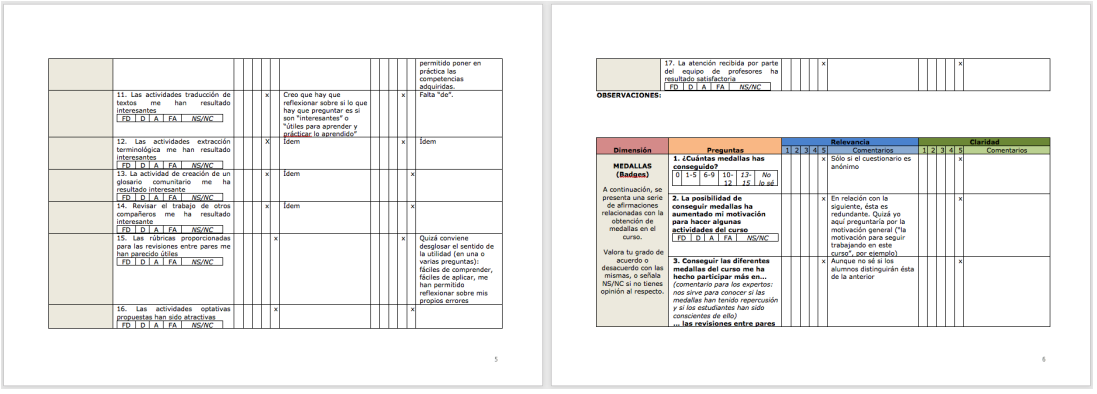
													necesidad de contar con conocimientos previos?"
	3. El programa del curso, desde el punto de vista de la calidad didáctica-evaluativa de los contenidos ofertados ha sido adecuado FD | D | A | FA | NS/NC	x					No sé si el alumno está capacitado para responder esto, desde un punto de vista general.	x					Primero, "ofertado" es ofrecido a cambio de dinero. Segundo, no sé si los contenidos pueden tener calidad evaluativa, y tampoco me queda claro que es a la vez calidad didáctica-evaluativa. Tercero, mismos comentarios sobre adecuado
	4. Las competencias adquiridas en el curso resultarán útiles para mi posterior práctica profesional FD | D | A | FA | NS/NC		x				Interés relativo: depende del motivo fundamental para ofrecer el curso, y de si se quiere usar el dato para "publicitarse" en el futuro					x	
	5. Los materiales en formato vídeo proporcionados en el curso han sido útiles FD | D | A | FA | NS/NC			x							x		Quizá precisaría más "útiles" (útiles para aprender)
	6. Los materiales en formato vídeo proporcionados en el curso han sido suficientes FD | D | A | FA | NS/NC		x				Salvo que se pidiesen sugerencias de otros materiales en vídeo que se consideran necesarios, no veo que se vaya a ganar mucho conocimiento con esta pregunta					x	
	7. Los materiales en formato texto proporcionados en el curso han sido útiles			x			Idem al vídeo				x		

3

	FD | D | A | FA | NS/NC												
	8. Los materiales en formato texto proporcionados en el curso han sido suficientes FD | D | A | FA | NS/NC			x			Idem al vídeo					x	
	9. Los cuestionarios propuestos han sido adecuados para evaluar las competencias adquiridas FD | D | A | FA | NS/NC			x			Por una parte, creo que es muy relevante. Por otra, no tengo claro que los alumnos estén preparados para responder (especialmente cuando se menciona competencias y no conocimientos, que es lo que probablemente venga a la mente del alumno)					x	Es distinto evaluar competencias que conocimientos. Me parece relevante preguntar por las competencias (aunque no tengo claro si en general se pueden evaluar con cuestionarios), pero probablemente los alumnos piensen en contenidos. Aquí no es que la pregunta no esté clara para los alumnos, sino que la interpretación del resultado puede ser errónea.
	10. Las actividades obligatorias propuestas han resultado adecuadas para evaluar las competencias adquiridas FD | D | A | FA | NS/NC				x		Relevante pero véase el comentario sobre la claridad	x					¿Las actividades evalúan? ¿O se evalúan las competencias a través de la observación de actividades? Yo creo que es lo segundo y que el alumno no está capacitado para responder esto. Podría responder a si le han

4

Figure D.20: Judgment of the third expert about the pilot satisfaction survey (Part 2)



													permitido poner en práctica las competencias adquiridas.
	11. Las actividades traducción de textos me han resultado interesantes FD | D | A | FA | NS/NC			x			Creo que hay que reflexionar sobre si lo que hay que preguntar es si son "interesantes" o "útiles para aprender y practicar lo aprendido"					x	Falta "del".
	12. Las actividades extracción terminológica me han resultado interesantes FD | D | A | FA | NS/NC			X			Idem					x	Idem
	13. La actividad de creación de un glosario comunitario me ha resultado interesante FD | D | A | FA | NS/NC			x			Idem					x	
	14. Revisar el trabajo de otros compañeros me ha resultado interesante FD | D | A | FA | NS/NC			x			Idem					x	
	15. Las rúbricas proporcionadas para las revisiones entre pares me han parecido útiles FD | D | A | FA | NS/NC				x							x	Quizá conviene desglosar el sentido de la utilidad (en una o varias preguntas): fáciles de comprender, fáciles de aplicar, me han permitido reflexionar sobre mis propios errores
	16. Las actividades optativas propuestas han sido atractivas FD | D | A | FA | NS/NC				x							x	

5

	17. La atención recibida por parte del equipo de profesores ha resultado satisfactoria FD | D | A | FA | NS/NC					x						x	

OBSERVACIONES:

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
MEDALLAS (Badges) A continuación, se presenta una serie de afirmaciones relacionadas con la obtención de medallas en el curso. Valora tu grado de acuerdo o desacuerdo con las mismas, o señala NS/NC si no tienes opinión al respecto.	**1. ¿Cuántas medallas has conseguido?** 0 | 1-5 | 6-9 | 10-12 | 13-15 | *No lo sé*					x	Sólo si el cuestionario es anónimo					x	
	2. La posibilidad de conseguir medallas ha aumentado mi motivación para hacer algunas actividades del curso FD | D | A | FA | NS/NC					x	En relación con la siguiente, ésta es redundante. Quizá yo aquí preguntaría por la motivación general ("la motivación para seguir trabajando en este curso", por ejemplo)					x	
	3. Conseguir las diferentes medallas del curso me ha hecho participar más en... *(comentario para los expertos: nos sirve para conocer si las medallas han tenido repercusión y si los estudiantes han sido conscientes de ello)* **... las revisiones entre pares**					x	Aunque no sé si los alumnos distinguirán ésta de la anterior					x	

6

Figure D.21: Judgment of the third expert about the pilot satisfaction survey (Part 3)

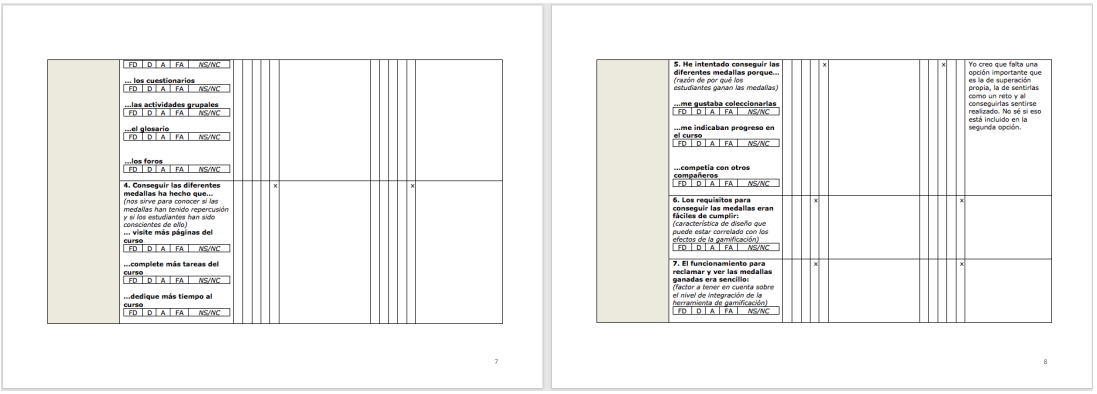


Figure D.22: Judgment of the third expert about the pilot satisfaction survey (Part 4)

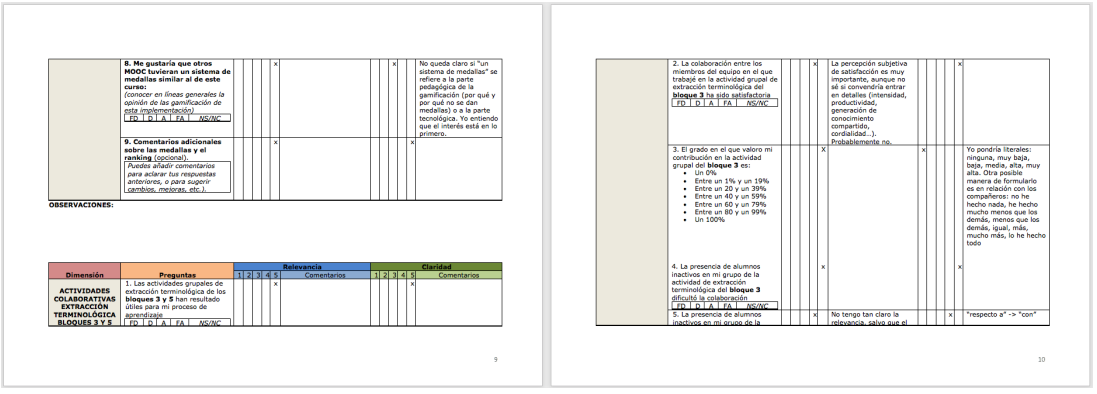


Figure D.23: Judgment of the third expert about the pilot satisfaction survey (Part 5)

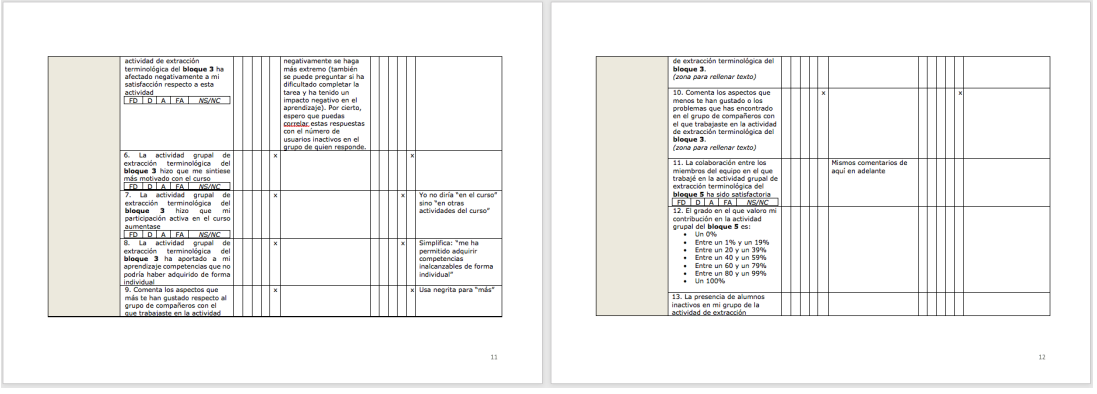
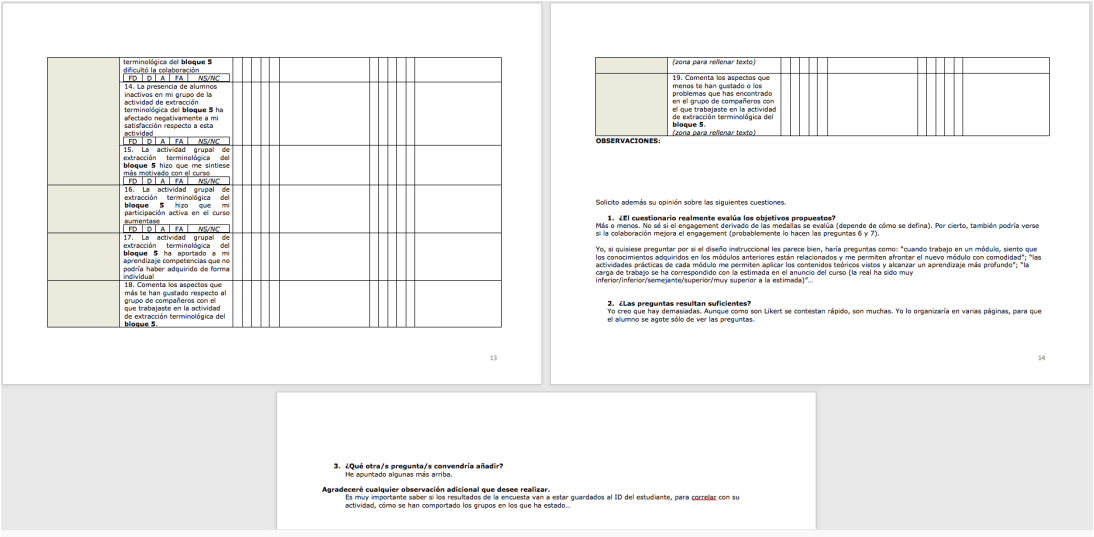


Figure D.24: Judgment of the third expert about the pilot satisfaction survey (Part 6)



terminológica del **bloque 5** dificultó la colaboración.
FD | D | A | FA | *NS/NC*

14. La presencia de alumnos inactivos en mi grupo de la actividad de extracción terminológica del **bloque 5** ha afectado negativamente a mi satisfacción respecto a esta actividad
FD | D | A | FA | *NS/NC*

15. La actividad grupal de extracción terminológica del **bloque 5** hizo que me sintiese más motivado con el curso
FD | D | A | FA | *NS/NC*

16. La actividad grupal de extracción terminológica del **bloque 5** hizo que mi participación activa en el curso aumentase
FD | D | A | FA | *NS/NC*

17. La actividad grupal de extracción terminológica del **bloque 5** ha aportado a mi aprendizaje competencias que no podría haber adquirido de forma individual

18. Comenta los aspectos que más te han gustado respecto al grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 5**.

13

(zona para rellenar texto)

19. Comenta los aspectos que menos te han gustado o los problemas que has encontrado en el grupo de compañeros con el que trabajaste en la actividad de extracción terminológica del **bloque 5**.
(zona para rellenar texto)

OBSERVACIONES:

Solicito además su opinión sobre las siguientes cuestiones.

1. ¿El cuestionario realmente evalúa los objetivos propuestos?
Más o menos. No sé si el engagement derivado de las medallas se evalúa (depende de cómo se defina). Por cierto, también podría verse si la colaboración mejora el engagement (probablemente lo hacen las preguntas 6 y 7).

Yo, si quisiese preguntar por si el diseño instruccional les parece bien, haría preguntas como: "cuando trabajo en un módulo, siento que los conocimientos adquiridos en los módulos anteriores están relacionados y me permiten afrontar el nuevo módulo con comodidad"; "las actividades prácticas de cada módulo me permiten aplicar los contenidos teóricos vistos y alcanzar un aprendizaje más profundo"; "la carga de trabajo se ha correspondido con la estimada en el anuncio del curso (la real ha sido muy inferior/inferior/semejante/superior/muy superior a la estimada)"...

2. ¿Las preguntas resultan suficientes?
Yo creo que hay demasiadas. Aunque como son Likert se contestan rápido, son muchas. Yo lo organizaría en varias páginas, para que el alumno se agote sólo de ver las preguntas.

14

3. ¿Qué otra/s pregunta/s convendría añadir?
He apuntado algunas más arriba.

Agradeceré cualquier observación adicional que desee realizar.
Es muy importante saber si los resultados de la encuesta van a estar guardados al ID del estudiante, para correlar con su actividad, cómo se han comportado los grupos en los que ha estado...

Figure D.25: Judgment of the third expert about the pilot satisfaction survey (Part 6)

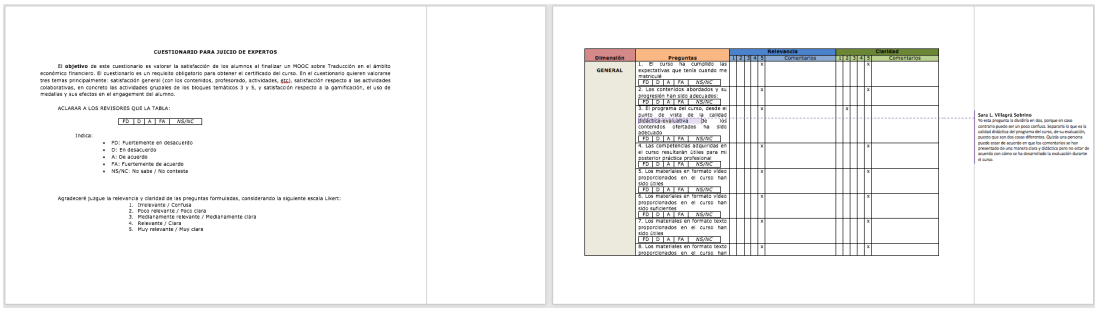


Figure D.26: Judgment of the fourth expert about the pilot satisfaction survey (Part 1)

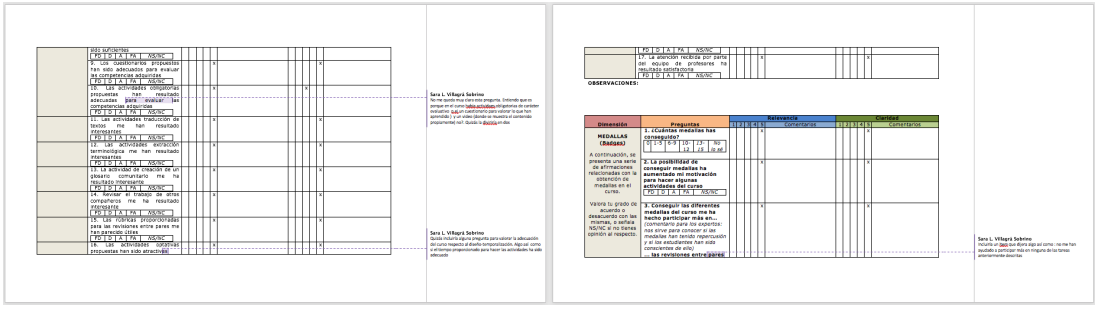


Figure D.27: Judgment of the fourth expert about the pilot satisfaction survey (Part 2)

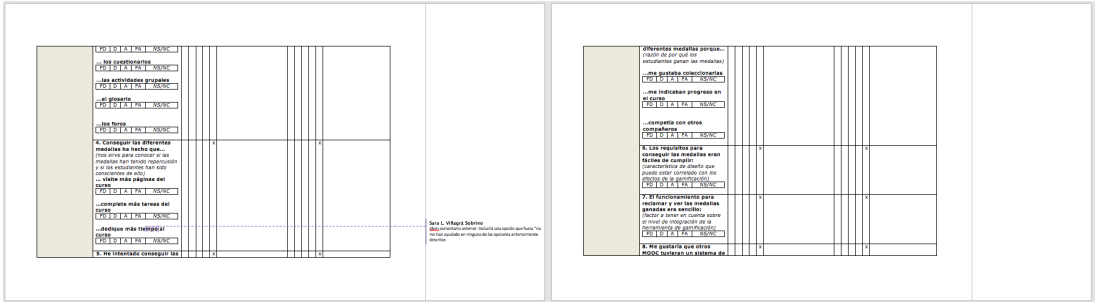


Figure D.28: Judgment of the fourth expert about the pilot satisfaction survey (Part 3)

D.2.4 Expert 4

Figures D.26, D.27, D.28, D.29, D.30 and D.31 shows the judgment of the fourth expert about the pilot satisfaction survey.

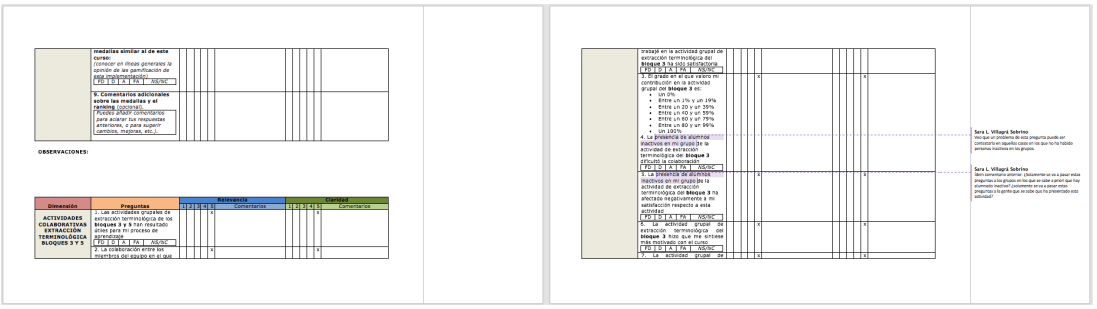


Figure D.29: Judgment of the fourth expert about the pilot satisfaction survey (Part 4)

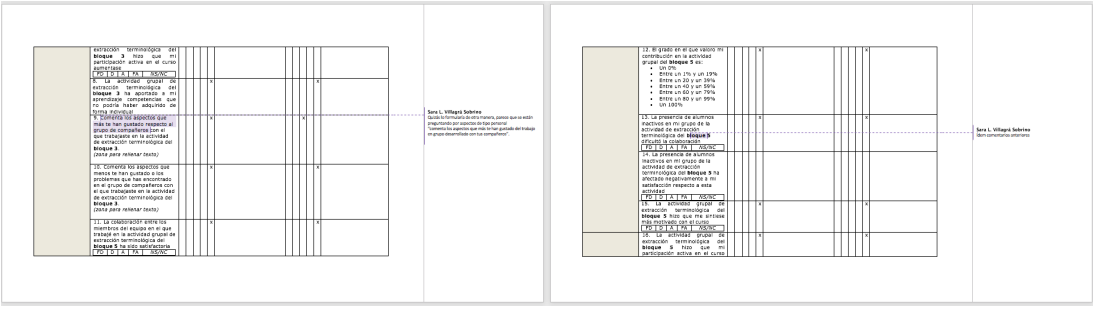


Figure D.30: Judgment of the fourth expert about the pilot satisfaction survey (Part 5)

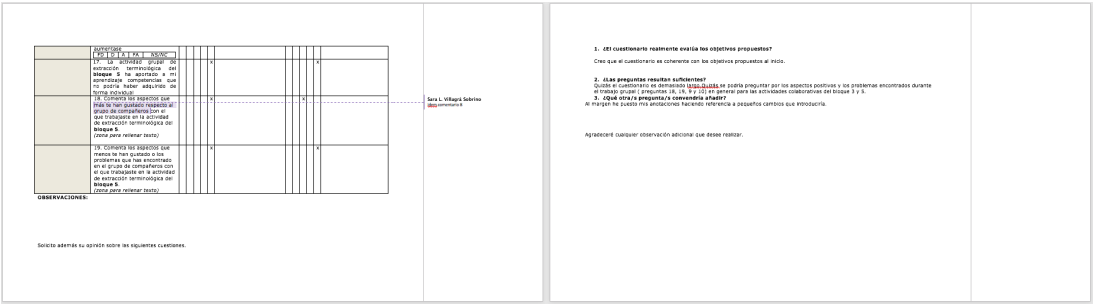
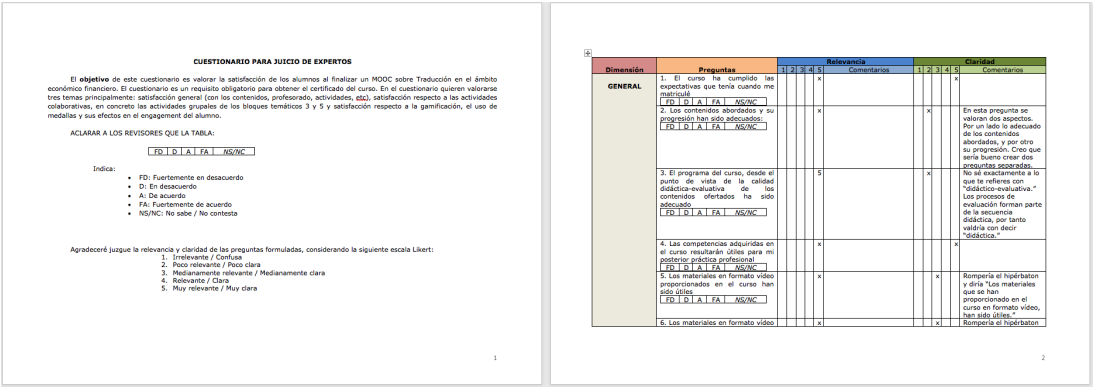


Figure D.31: Judgment of the fourth expert about the pilot satisfaction survey (Part 6)

D.2.5 Expert 5

Figures D.32, D.33, D.34, D.35, D.36 and D.37 shows the judgment of the fifth expert about the pilot satisfaction survey.



CUESTIONARIO PARA JUICIO DE EXPERTOS

El **objetivo** de este cuestionario es valorar la satisfacción de los alumnos al finalizar un MOOC sobre Traducción en el ámbito económico financiero. El cuestionario es un requisito obligatorio para obtener el certificado del curso. En el cuestionario quieren valorarse tres temas principalmente: satisfacción general (con los contenidos, profesorado, actividades, etc), satisfacción respecto a las actividades colaborativas, en concreto las actividades grupales de los bloques temáticos 3 y 5 y satisfacción respecto a la gamificación, el uso de medallas y sus efectos en el engagement del alumno.

ACLARAR A LOS REVISORES QUE LA TABLA:

| FD | D | A | FA | NS/NC |

Indica:

- FD: Fuertemente en desacuerdo
- D: En desacuerdo
- A: De acuerdo
- FA: Fuertemente de acuerdo
- NS/NC: No sabe / No contesta

Agradeceré juzgue la relevancia y claridad de las preguntas formuladas, considerando la siguiente escala Likert:

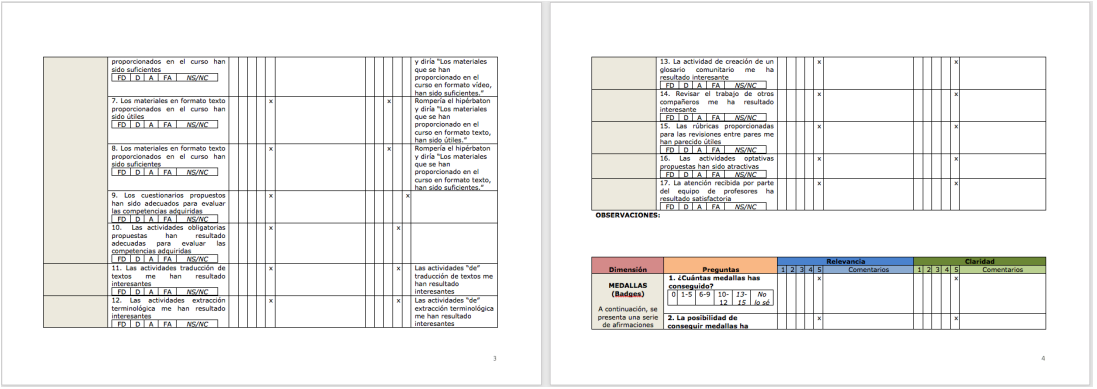
1. Irrelevante / Confusa
2. Poco relevante / Poco clara
3. Medianamente relevante / Medianamente clara
4. Relevante / Clara
5. Muy relevante / Muy clara

1

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
GENERAL	1. El curso ha cumplido las expectativas que tenía cuando me matriculé FD D A FA NS/NC					x						x	
	2. Los contenidos abordados y su progresión han sido adecuados: FD D A FA NS/NC					x				x			En esta pregunta se valoran dos aspectos. Por un lado lo adecuado de los contenidos abordados, y por otro su progresión. Creo que sería bueno crear dos preguntas separadas.
	3. El programa del curso, desde el punto de vista de la calidad didáctica-evaluativa de los contenidos ofertados ha sido adecuado FD D A FA NS/NC					5				x			No sé exactamente a lo que te refieres con "didáctico-evaluativa." Los procesos de evaluación forman parte de la secuencia didáctica, por tanto valdría con decir "didáctica."
	4. Las competencias adquiridas en el curso resultarán útiles para mi posterior práctica profesional FD D A FA NS/NC					x						x	
	5. Los materiales en formato vídeo proporcionados en el curso han sido útiles FD D A FA NS/NC					x				x			Rompería el hipérbaton y diría "Los materiales que se han proporcionado en el curso en formato vídeo, han sido útiles."
	6. Los materiales en formato vídeo					x				x			Rompería el hipérbaton

2

Figure D.32: Judgment of the fifth expert about the pilot satisfaction survey (Part 1)



	proporcionados en el curso han sido suficientes FD D A FA NS/NC												y diría "Los materiales que se han proporcionado en el curso en formato vídeo, han sido suficientes."
	7. Los materiales en formato texto proporcionados en el curso han sido útiles FD D A FA NS/NC			x				x					Rompería el hipérbaton y diría "Los materiales que se han proporcionado en el curso en formato texto, han sido útiles."
	8. Los materiales en formato texto proporcionados en el curso han sido suficientes FD D A FA NS/NC			x				x					Rompería el hipérbaton y diría "Los materiales que se han proporcionado en el curso en formato texto, han sido suficientes."
	9. Los cuestionarios propuestos han sido adecuados para evaluar las competencias adquiridas FD D A FA NS/NC			x								x	
	10. Las actividades obligatorias propuestas han resultado adecuadas para evaluar las competencias adquiridas FD D A FA NS/NC			x				x					
	11. Las actividades traducción de textos me han resultado interesantes FD D A FA NS/NC			x				x					Las actividades "de" traducción de textos me han resultado interesantes
	12. Las actividades extracción terminológica me han resultado interesantes FD D A FA NS/NC			x				x					Las actividades "de" extracción terminológica me han resultado interesantes

3

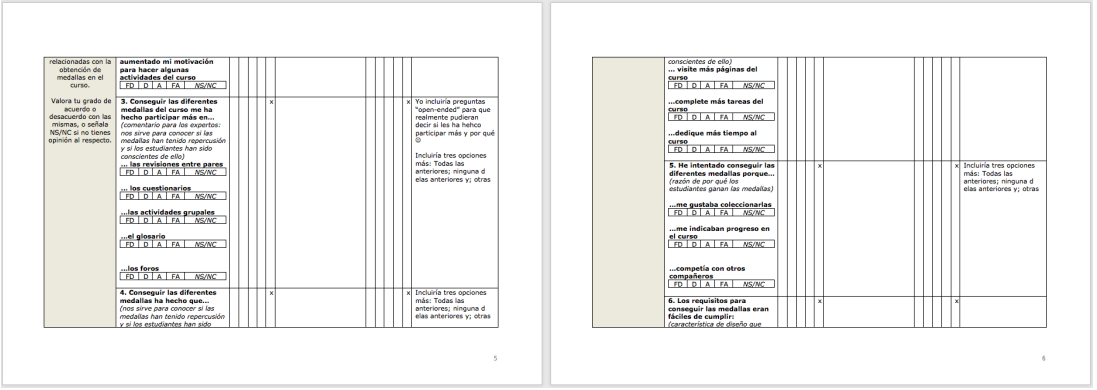
	13. La actividad de creación de un glosario comunitario me ha resultado interesante FD D A FA NS/NC					x						x	
	14. Revisar el trabajo de otros compañeros me ha resultado interesante FD D A FA NS/NC					x						x	
	15. Las rúbricas proporcionadas para las revisiones entre pares me han parecido útiles FD D A FA NS/NC					x						x	
	16. Las actividades optativas propuestas han sido atractivas FD D A FA NS/NC					x						x	
	17. La atención recibida por parte del equipo de profesores ha resultado satisfactoria FD D A FA NS/NC					x						x	

OBSERVACIONES:

Dimensión	Preguntas	Relevancia 1	2	3	4	5	Comentarios	Claridad 1	2	3	4	5	Comentarios
MEDALLAS (Badges)	**1. ¿Cuántas medallas has conseguido?** 0 | 1-5 | 6-9 | 10-12 | 13-15 | No lo sé					x						x	
A continuación, se presenta una serie de afirmaciones	**2. La posibilidad de conseguir medallas ha**					x						x	

4

Figure D.33: Judgment of the fifth expert about the pilot satisfaction survey (Part 2)



relacionadas con la obtención de medallas en el curso.	**aumentado mi motivación para hacer algunas actividades del curso** FD D A FA NS/NC												
Valora tu grado de acuerdo o desacuerdo con las mismas, o señala NS/NC si no tienes opinión al respecto.	**3. Conseguir las diferentes medallas del curso me ha hecho participar más en...** *(comentario para los expertos: nos sirve para conocer si las medallas han tenido repercusión y si los estudiantes han sido conscientes de ello)* **...las revisiones entre pares** FD D A FA NS/NC **... los cuestionarios** FD D A FA NS/NC **...las actividades grupales** FD D A FA NS/NC **...el glosario** FD D A FA NS/NC **...los foros** FD D A FA NS/NC				x							x	Yo incluiría preguntas "open-ended" para que realmente pudieran decir si les ha hehco participar más y por qué ☺ Incluiría tres opciones más: Todas las anteriores; ninguna d elas anteriores y; otras
	4. Conseguir las diferentes medallas ha hecho que... *(nos sirve para conocer si las medallas han tenido repercusión y si los estudiantes han sido*				x							x	Incluiría tres opciones más: Todas las anteriores; ninguna d elas anteriores y; otras

5

	conscientes de ello) **...visite más páginas del curso** FD D A FA NS/NC **...complete más tareas del curso** FD D A FA NS/NC **...dedique más tiempo al curso** FD D A FA NS/NC												
	5. He intentado conseguir las diferentes medallas porque... *(razón de por qué los estudiantes ganan las medallas)* **...me gustaba coleccionarlas** FD D A FA NS/NC **...me indicaban progreso en el curso** FD D A FA NS/NC **...competía con otros compañeros** FD D A FA NS/NC					x						x	Incluiría tres opciones más: Todas las anteriores; ninguna d elas anteriores y; otras
	6. Los requisitos para conseguir las medallas eran fáciles de cumplir: *(característica de diseño que*					x						x	

6

Figure D.34: Judgment of the fifth expert about the pilot satisfaction survey (Part 3)

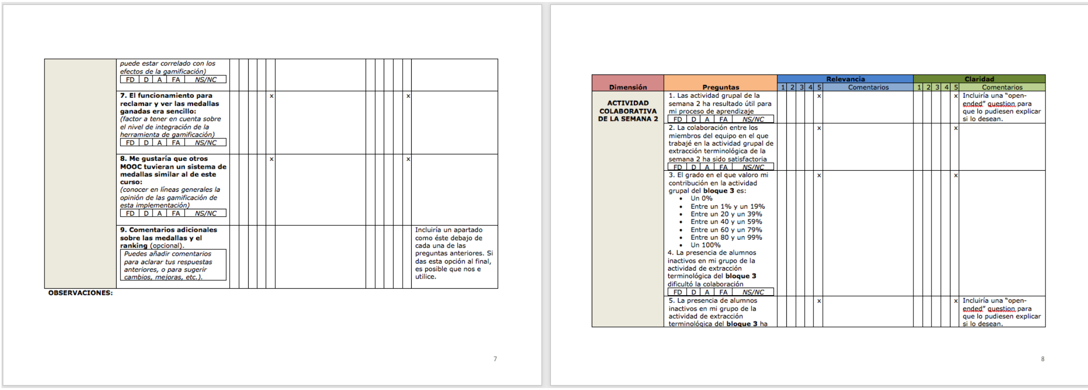


Figure D.35: Judgment of the fifth expert about the pilot satisfaction survey (Part 4)

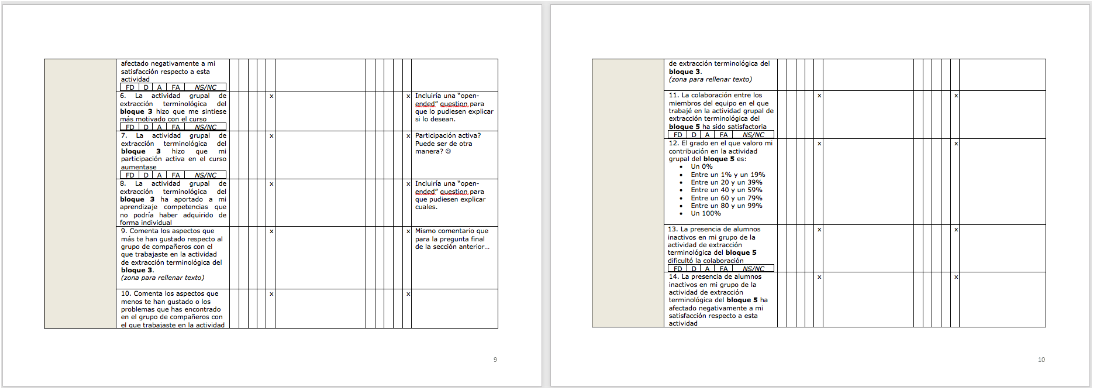
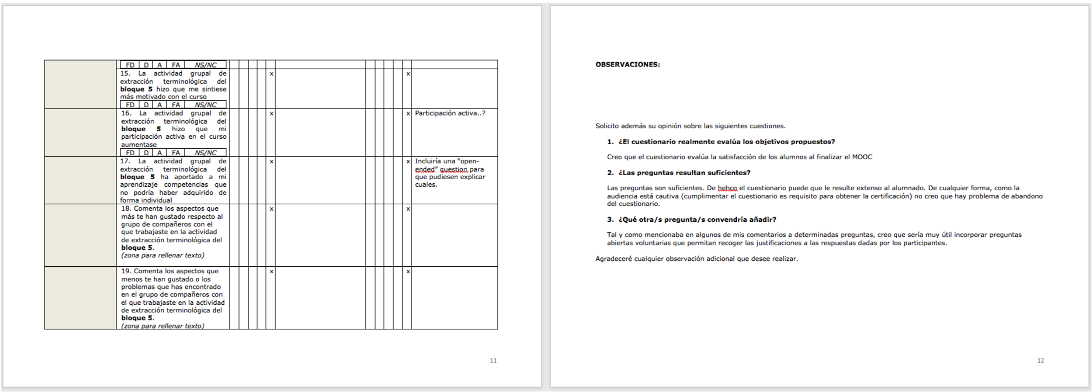


Figure D.36: Judgment of the fifth expert about the pilot satisfaction survey (Part 5)



OBSERVACIONES:

Solicito además su opinión sobre las siguientes cuestiones.

1. **¿El cuestionario realmente evalúa los objetivos propuestos?**

   Creo que el cuestionario evalúa la satisfacción de los alumnos al finalizar el MOOC

2. **¿Las preguntas resultan suficientes?**

   Las preguntas son suficientes. De hehco el cuestionario puede que le resulte extenso al alumnado. De cualquier forma, como la audiencia está cautiva (cumplimentar el cuestionario es requisito para obtener la certificación) no creo que hay problema de abandono del cuestionario.

3. **¿Qué otra/s pregunta/s convendría añadir?**

   Tal y como mencionaba en algunos de mis comentarios a determinadas preguntas, creo que sería muy útil incorporar preguntas abiertas voluntarias que permitan recoger las justificaciones a las respuestas dadas por los participantes.

Agradeceré cualquier observación adicional que desee realizar.

12

Figure D.37: Judgment of the fifth expert about the pilot satisfaction survey (Part 6)

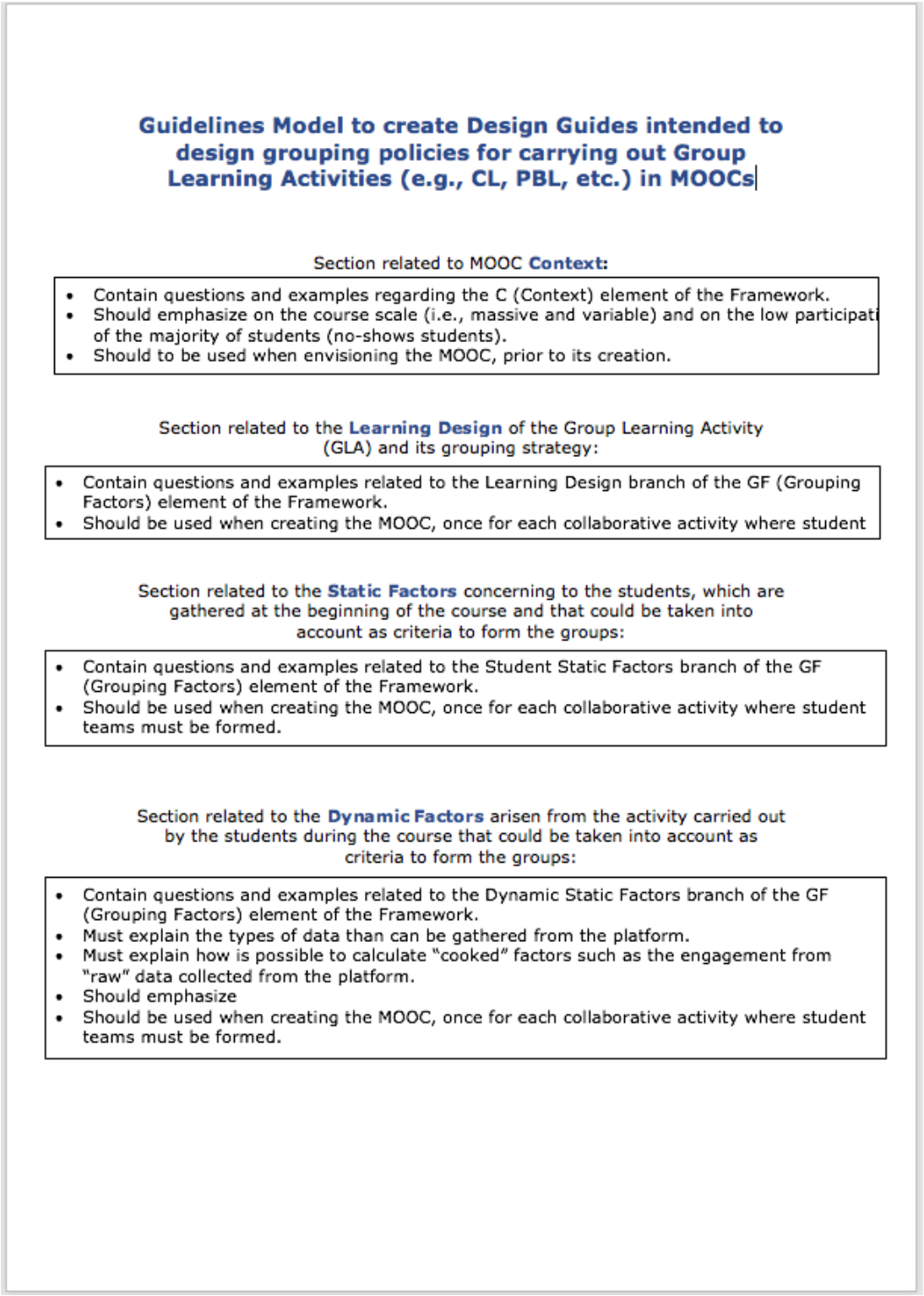
Appendix E

Guidelines Model, Design Guide template and fieldwork of the two teachers of the STD2

Summary: In this Appendix, we include the Guidelines Model, as well as its proof of concept, a template of a possible Design Guide. Furthermore, we include in this Appendix the fieldwork carried out by the two teachers who tutored the MOOC subject of our second study (STD2) to fulfill such a Design Guide.

E.1 Guidelines Model

Figure E.1 depicts the structure and content of the model schema taking part of the Framework artifact, we created to serve as a reference to the stakeholders interested in creating Design Guides adapted to their environmental characteristics, such as their learning platform.



Guidelines Model to create Design Guides intended to design grouping policies for carrying out Group Learning Activities (e.g., CL, PBL, etc.) in MOOCs

Section related to MOOC **Context:**

- Contain questions and examples regarding the C (Context) element of the Framework.
- Should emphasize on the course scale (i.e., massive and variable) and on the low participati of the majority of students (no-shows students).
- Should to be used when envisioning the MOOC, prior to its creation.

Section related to the **Learning Design** of the Group Learning Activity (GLA) and its grouping strategy:

- Contain questions and examples related to the Learning Design branch of the GF (Grouping Factors) element of the Framework.
- Should be used when creating the MOOC, once for each collaborative activity where student

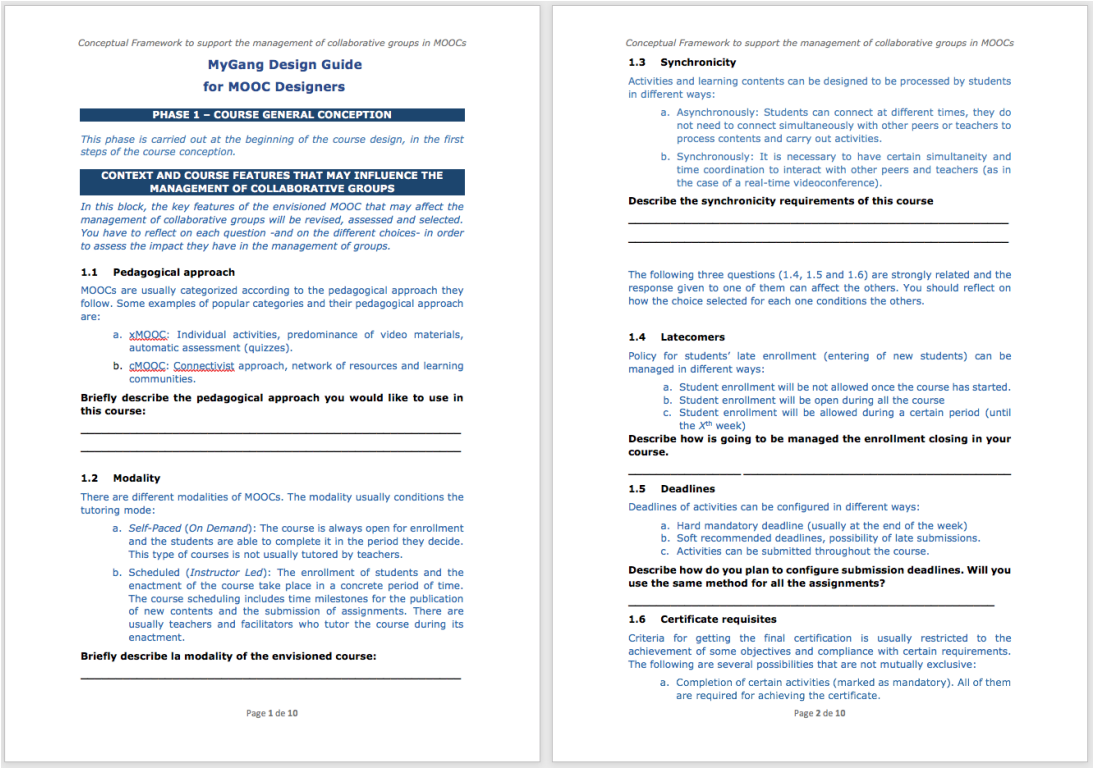
Section related to the **Static Factors** concerning to the students, which are gathered at the beginning of the course and that could be taken into account as criteria to form the groups:

- Contain questions and examples related to the Student Static Factors branch of the GF (Grouping Factors) element of the Framework.
- Should be used when creating the MOOC, once for each collaborative activity where student teams must be formed.

Section related to the **Dynamic Factors** arisen from the activity carried out by the students during the course that could be taken into account as criteria to form the groups:

- Contain questions and examples related to the Dynamic Static Factors branch of the GF (Grouping Factors) element of the Framework.
- Must explain the types of data than can be gathered from the platform.
- Must explain how is possible to calculate "cooked" factors such as the engagement from "raw" data collected from the platform.
- Should emphasize
- Should be used when creating the MOOC, once for each collaborative activity where student teams must be formed.

Figure E.1: Guidelines Model element of the Framework artifact



Conceptual Framework to support the management of collaborative groups in MOOCs

MyGang Design Guide
for MOOC Designers

PHASE 1 – COURSE GENERAL CONCEPTION

This phase is carried out at the beginning of the course design, in the first steps of the course conception.

CONTEXT AND COURSE FEATURES THAT MAY INFLUENCE THE MANAGEMENT OF COLLABORATIVE GROUPS

In this block, the key features of the envisioned MOOC that may affect the management of collaborative groups will be revised, assessed and selected. You have to reflect on each question -and on the different choices- in order to assess the impact they have in the management of groups.

1.1 Pedagogical approach

MOOCs are usually categorized according to the pedagogical approach they follow. Some examples of popular categories and their pedagogical approach are:

a. xMOOC: Individual activities, predominance of video materials, automatic assessment (quizzes).
b. cMOOC: Connectivist approach, network of resources and learning communities.

Briefly describe the pedagogical approach you would like to use in this course:

1.2 Modality

There are different modalities of MOOCs. The modality usually conditions the tutoring mode:

a. *Self-Paced* (*On Demand*): The course is always open for enrollment and the students are able to complete it in the period they decide. This type of courses is not usually tutored by teachers.
b. Scheduled (*Instructor Led*): The enrollment of students and the enactment of the course take place in a concrete period of time. The course scheduling includes time milestones for the publication of new contents and the submission of assignments. There are usually teachers and facilitators who tutor the course during its enactment.

Briefly describe la modality of the envisioned course:

Page 1 de 10

Conceptual Framework to support the management of collaborative groups in MOOCs

1.3 Synchronicity

Activities and learning contents can be designed to be processed by students in different ways:

a. Asynchronously: Students can connect at different times, they do not need to connect simultaneously with other peers or teachers to process contents and carry out activities.
b. Synchronously: It is necessary to have certain simultaneity and time coordination to interact with other peers and teachers (as in the case of a real-time videoconference).

Describe the synchronicity requirements of this course

The following three questions (1.4, 1.5 and 1.6) are strongly related and the response given to one of them can affect the others. You should reflect on how the choice selected for each one conditions the others.

1.4 Latecomers

Policy for students' late enrollment (entering of new students) can be managed in different ways:

a. Student enrollment will be not allowed once the course has started.
b. Student enrollment will be open during all the course
c. Student enrollment will be allowed during a certain period (until the X^{th} week)

Describe how is going to be managed the enrollment closing in your course.

1.5 Deadlines

Deadlines of activities can be configured in different ways:

a. Hard mandatory deadline (usually at the end of the week)
b. Soft recommended deadlines, possibility of late submissions.
c. Activities can be submitted throughout the course.

Describe how do you plan to configure submission deadlines. Will you use the same method for all the assignments?

1.6 Certificate requisites

Criteria for getting the final certification is usually restricted to the achievement of some objectives and compliance with certain requirements. The following are several possibilities that are not mutually exclusive:

a. Completion of certain activities (marked as mandatory). All of them are required for achieving the certificate.

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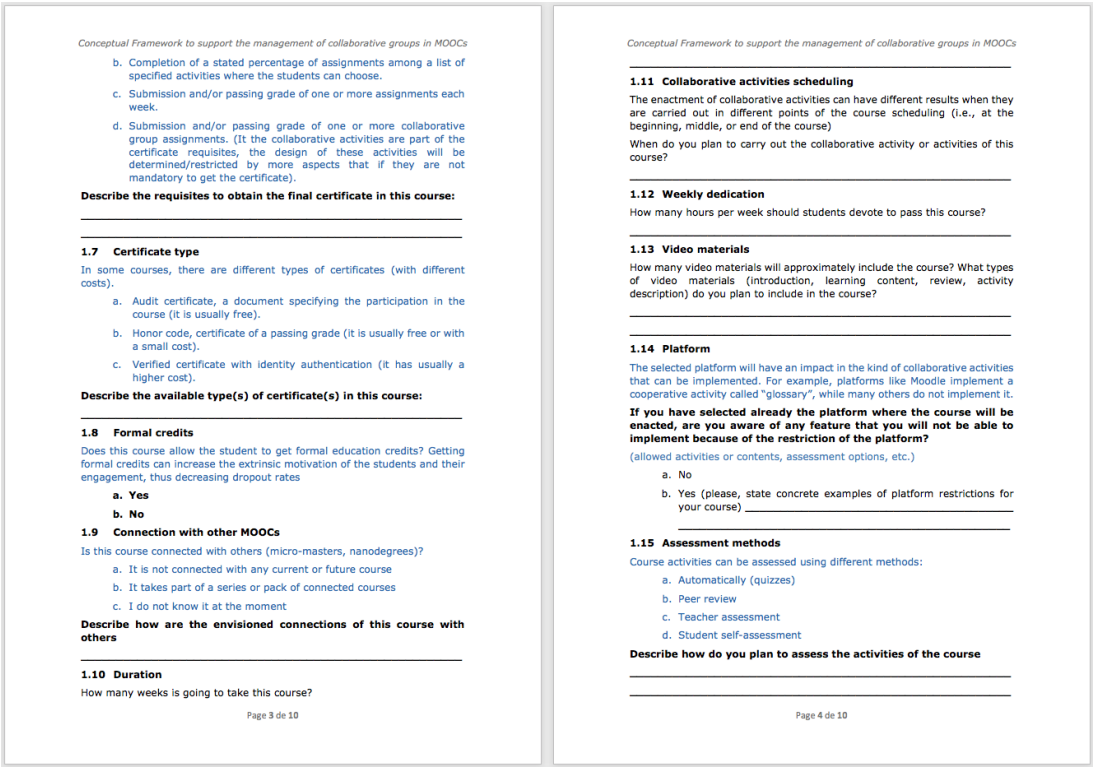
Figure E.2: Design Guide, proof of concept of the Guidelines Model (Part 1)

E.2 Design Guide Model and Fieldwork

Figures E.2, E.3, E.4, E.5 and E.6 show the content of the ten pages of our Design Guide, created as a proof of concept of the Guidelines Model adapted to our environmental characteristics.



Conceptual Framework to support the management of collaborative groups in MOOCs

b. Completion of a stated percentage of assignments among a list of specified activities where the students can choose.

c. Submission and/or passing grade of one or more assignments each week.

d. Submission and/or passing grade of one or more collaborative group assignments. (It the collaborative activities are part of the certificate requisites, the design of these activities will be determined/restricted by more aspects that if they are not mandatory to get the certificate).

Describe the requisites to obtain the final certificate in this course:

1.7 Certificate type

In some courses, there are different types of certificates (with different costs).

a. Audit certificate, a document specifying the participation in the course (it is usually free).

b. Honor code, certificate of a passing grade (it is usually free or with a small cost).

c. Verified certificate with identity authentication (it has usually a higher cost).

Describe the available type(s) of certificate(s) in this course:

1.8 Formal credits

Does this course allow the student to get formal education credits? Getting formal credits can increase the extrinsic motivation of the students and their engagement, thus decreasing dropout rates

a. Yes

b. No

1.9 Connection with other MOOCs

Is this course connected with others (micro-masters, nanodegrees)?

a. It is not connected with any current or future course

b. It takes part of a series or pack of connected courses

c. I do not know it at the moment

Describe how are the envisioned connections of this course with others

1.10 Duration

How many weeks is going to take this course?

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Conceptual Framework to support the management of collaborative groups in MOOCs

1.11 Collaborative activities scheduling

The enactment of collaborative activities can have different results when they are carried out in different points of the course scheduling (i.e., at the beginning, middle, or end of the course)

When do you plan to carry out the collaborative activity or activities of this course?

1.12 Weekly dedication

How many hours per week should students devote to pass this course?

1.13 Video materials

How many video materials will approximately include the course? What types of video materials (introduction, learning content, review, activity description) do you plan to include in the course?

1.14 Platform

The selected platform will have an impact in the kind of collaborative activities that can be implemented. For example, platforms like Moodle implement a cooperative activity called "glossary", while many others do not implement it.

If you have selected already the platform where the course will be enacted, are you aware of any feature that you will not be able to implement because of the restriction of the platform?

(allowed activities or contents, assessment options, etc.)

a. No

b. Yes (please, state concrete examples of platform restrictions for your course)

1.15 Assessment methods

Course activities can be assessed using different methods:

a. Automatically (quizzes)

b. Peer review

c. Teacher assessment

d. Student self-assessment

Describe how do you plan to assess the activities of the course

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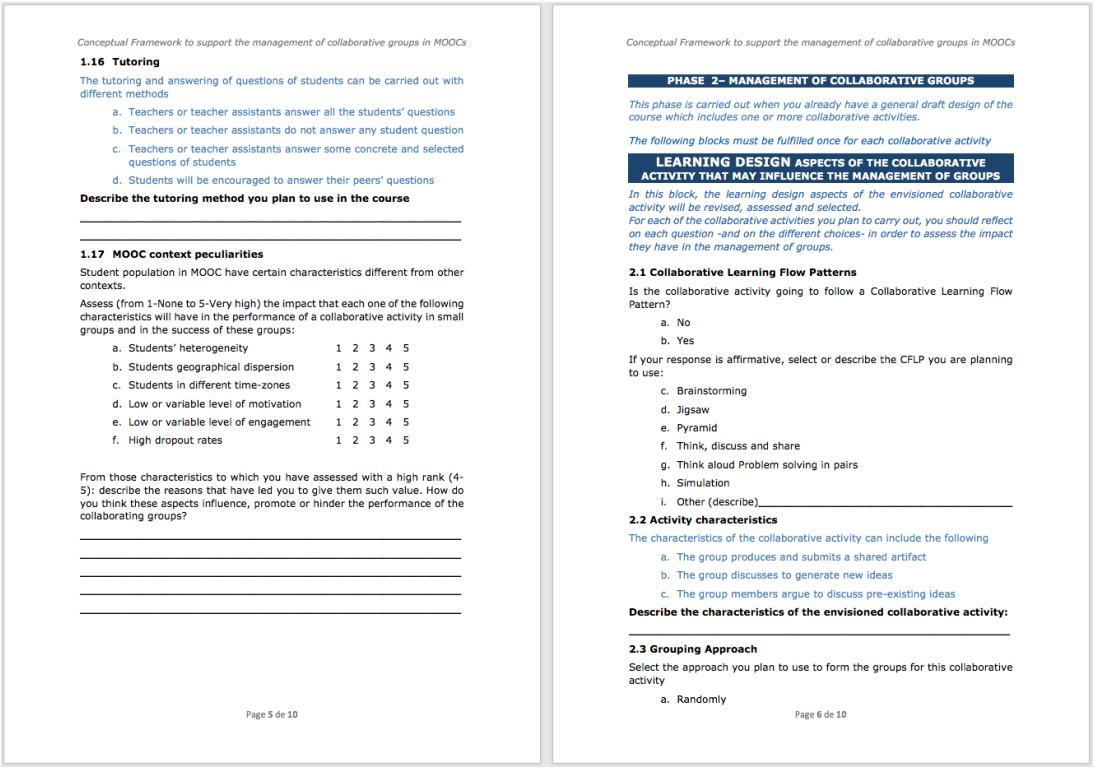
Figure E.3: Design Guide, proof of concept of the Guidelines Model (Part 2)



Conceptual Framework to support the management of collaborative groups in MOOCs

1.16 Tutoring

The tutoring and answering of questions of students can be carried out with different methods

a. Teachers or teacher assistants answer all the students' questions
b. Teachers or teacher assistants do not answer any student question
c. Teachers or teacher assistants answer some concrete and selected questions of students
d. Students will be encouraged to answer their peers' questions

Describe the tutoring method you plan to use in the course

_____

_____

1.17 MOOC context peculiarities

Student population in MOOC have certain characteristics different from other contexts.

Assess (from 1-None to 5-Very high) the impact that each one of the following characteristics will have in the performance of a collaborative activity in small groups and in the success of these groups:

a. Students' heterogeneity	1	2	3	4	5
b. Students geographical dispersion	1	2	3	4	5
c. Students in different time-zones	1	2	3	4	5
d. Low or variable level of motivation	1	2	3	4	5
e. Low or variable level of engagement	1	2	3	4	5
f. High dropout rates	1	2	3	4	5

From those characteristics to which you have assessed with a high rank (4-5): describe the reasons that have led you to give them such value. How do you think these aspects influence, promote or hinder the performance of the collaborating groups?

_____

_____

_____

_____

_____

Conceptual Framework to support the management of collaborative groups in MOOCs

PHASE 2– MANAGEMENT OF COLLABORATIVE GROUPS

This phase is carried out when you already have a general draft design of the course which includes one or more collaborative activities.

The following blocks must be fulfilled once for each collaborative activity

LEARNING DESIGN ASPECTS OF THE COLLABORATIVE ACTIVITY THAT MAY INFLUENCE THE MANAGEMENT OF GROUPS

In this block, the learning design aspects of the envisioned collaborative activity will be revised, assessed and selected.
For each of the collaborative activities you plan to carry out, you should reflect on each question -and on the different choices- in order to assess the impact they have in the management of groups.

2.1 Collaborative Learning Flow Patterns

Is the collaborative activity going to follow a Collaborative Learning Flow Pattern?

a. No
b. Yes

If your response is affirmative, select or describe the CFLP you are planning to use:

c. Brainstorming
d. Jigsaw
e. Pyramid
f. Think, discuss and share
g. Think aloud Problem solving in pairs
h. Simulation
i. Other (describe)_____

2.2 Activity characteristics

The characteristics of the collaborative activity can include the following

a. The group produces and submits a shared artifact
b. The group discusses to generate new ideas
c. The group members argue to discuss pre-existing ideas

Describe the characteristics of the envisioned collaborative activity:

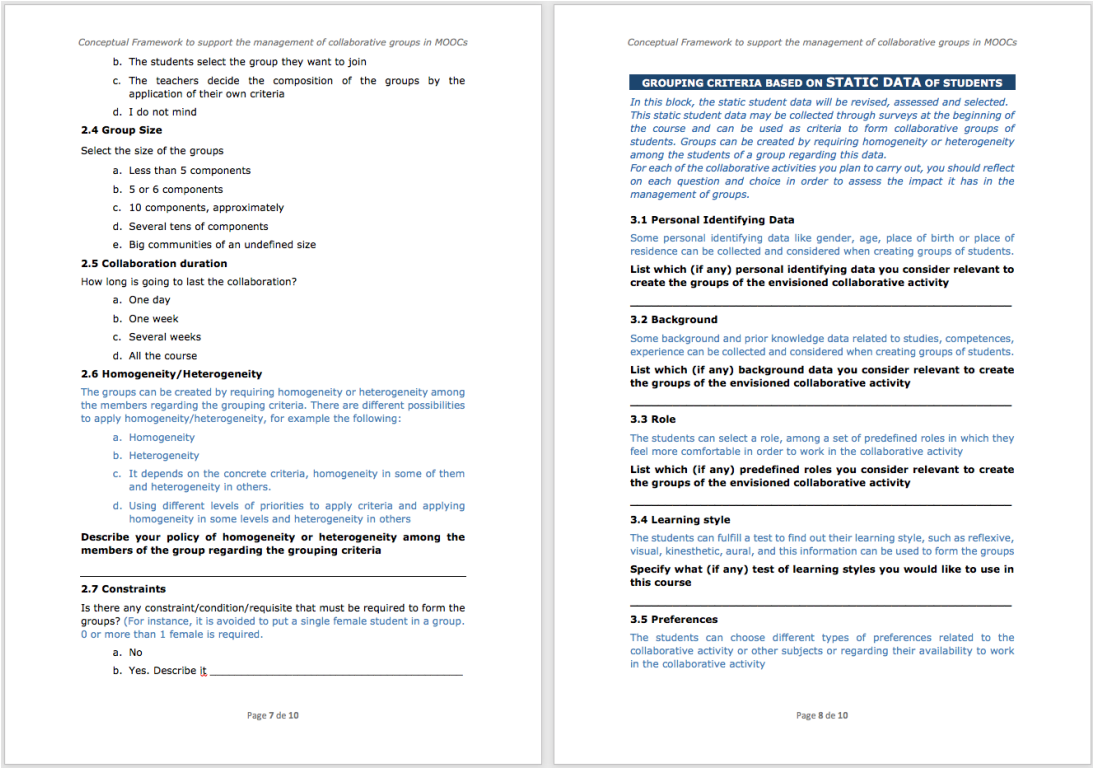
_____

2.3 Grouping Approach

Select the approach you plan to use to form the groups for this collaborative activity

a. Randomly

Figure E.4: Design Guide, proof of concept of the Guidelines Model (Part 3)



Conceptual Framework to support the management of collaborative groups in MOOCs

b. The students select the group they want to join
c. The teachers decide the composition of the groups by the application of their own criteria
d. I do not mind

2.4 Group Size

Select the size of the groups

a. Less than 5 components
b. 5 or 6 components
c. 10 components, approximately
d. Several tens of components
e. Big communities of an undefined size

2.5 Collaboration duration

How long is going to last the collaboration?

a. One day
b. One week
c. Several weeks
d. All the course

2.6 Homogeneity/Heterogeneity

The groups can be created by requiring homogeneity or heterogeneity among the members regarding the grouping criteria. There are different possibilities to apply homogeneity/heterogeneity, for example the following:

a. Homogeneity
b. Heterogeneity
c. It depends on the concrete criteria, homogeneity in some of them and heterogeneity in others.
d. Using different levels of priorities to apply criteria and applying homogeneity in some levels and heterogeneity in others

Describe your policy of homogeneity or heterogeneity among the members of the group regarding the grouping criteria

_____

2.7 Constraints

Is there any constraint/condition/requisite that must be required to form the groups? (For instance, it is avoided to put a single female student in a group. 0 or more than 1 female is required.

a. No
b. Yes. Describe it _____

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Conceptual Framework to support the management of collaborative groups in MOOCs

GROUPING CRITERIA BASED ON STATIC DATA OF STUDENTS

In this block, the static student data will be revised, assessed and selected. This static student data may be collected through surveys at the beginning of the course and can be used as criteria to form collaborative groups of students. Groups can be created by requiring homogeneity or heterogeneity among the students of a group regarding this data.
For each of the collaborative activities you plan to carry out, you should reflect on each question and choice in order to assess the impact it has in the management of groups.

3.1 Personal Identifying Data

Some personal identifying data like gender, age, place of birth or place of residence can be collected and considered when creating groups of students.

List which (if any) personal identifying data you consider relevant to create the groups of the envisioned collaborative activity

_____

3.2 Background

Some background and prior knowledge data related to studies, competences, experience can be collected and considered when creating groups of students.

List which (if any) background data you consider relevant to create the groups of the envisioned collaborative activity

_____

3.3 Role

The students can select a role, among a set of predefined roles in which they feel more comfortable in order to work in the collaborative activity

List which (if any) predefined roles you consider relevant to create the groups of the envisioned collaborative activity

_____

3.4 Learning style

The students can fulfill a test to find out their learning style, such as reflexive, visual, kinesthetic, aural, and this information can be used to form the groups

Specify what (if any) test of learning styles you would like to use in this course

_____

3.5 Preferences

The students can choose different types of preferences related to the collaborative activity or other subjects or regarding their availability to work in the collaborative activity

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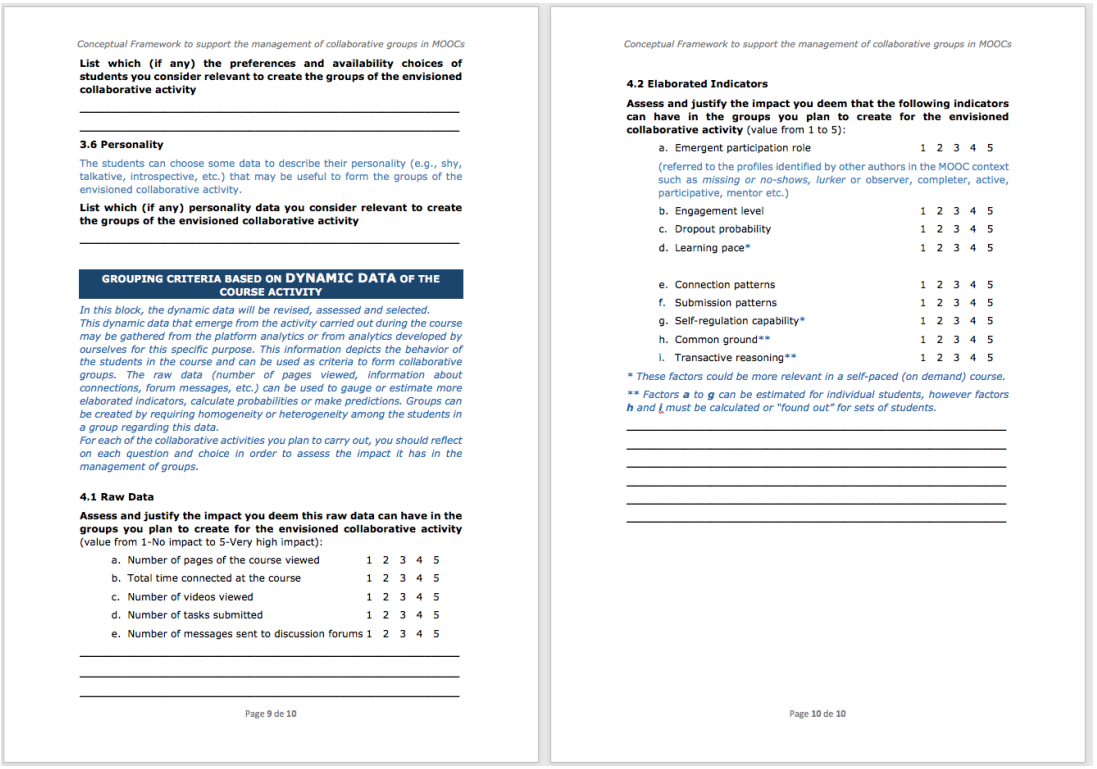
Figure E.5: Design Guide, proof of concept of the Guidelines Model (Part 4)



Conceptual Framework to support the management of collaborative groups in MOOCs

List which (if any) the preferences and availability choices of students you consider relevant to create the groups of the envisioned collaborative activity

3.6 Personality

The students can choose some data to describe their personality (e.g., shy, talkative, introspective, etc.) that may be useful to form the groups of the envisioned collaborative activity.

List which (if any) personality data you consider relevant to create the groups of the envisioned collaborative activity

GROUPING CRITERIA BASED ON DYNAMIC DATA OF THE COURSE ACTIVITY

In this block, the dynamic data will be revised, assessed and selected.
This dynamic data that emerge from the activity carried out during the course may be gathered from the platform analytics or from analytics developed by ourselves for this specific purpose. This information depicts the behavior of the students in the course and can be used as criteria to form collaborative groups. The raw data (number of pages viewed, information about connections, forum messages, etc.) can be used to gauge or estimate more elaborated indicators, calculate probabilities or make predictions. Groups can be created by requiring homogeneity or heterogeneity among the students in a group regarding this data.
For each of the collaborative activities you plan to carry out, you should reflect on each question and choice in order to assess the impact it has in the management of groups.

4.1 Raw Data

Assess and justify the impact you deem this raw data can have in the groups you plan to create for the envisioned collaborative activity (value from 1-No impact to 5-Very high impact):

a. Number of pages of the course viewed 1 2 3 4 5
b. Total time connected at the course 1 2 3 4 5
c. Number of videos viewed 1 2 3 4 5
d. Number of tasks submitted 1 2 3 4 5
e. Number of messages sent to discussion forums 1 2 3 4 5

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Conceptual Framework to support the management of collaborative groups in MOOCs

4.2 Elaborated Indicators

Assess and justify the impact you deem that the following indicators can have in the groups you plan to create for the envisioned collaborative activity (value from 1 to 5):

a. Emergent participation role 1 2 3 4 5
(referred to the profiles identified by other authors in the MOOC context such as *missing or no-shows, lurker* or observer, completer, active, participative, mentor etc.)
b. Engagement level 1 2 3 4 5
c. Dropout probability 1 2 3 4 5
d. Learning pace* 1 2 3 4 5

e. Connection patterns 1 2 3 4 5
f. Submission patterns 1 2 3 4 5
g. Self-regulation capability* 1 2 3 4 5
h. Common ground** 1 2 3 4 5
i. Transactive reasoning** 1 2 3 4 5

** These factors could be more relevant in a self-paced (on demand) course.*

*** Factors **a** to **g** can be estimated for individual students, however factors **h** and **i** must be calculated or "found out" for sets of students.*

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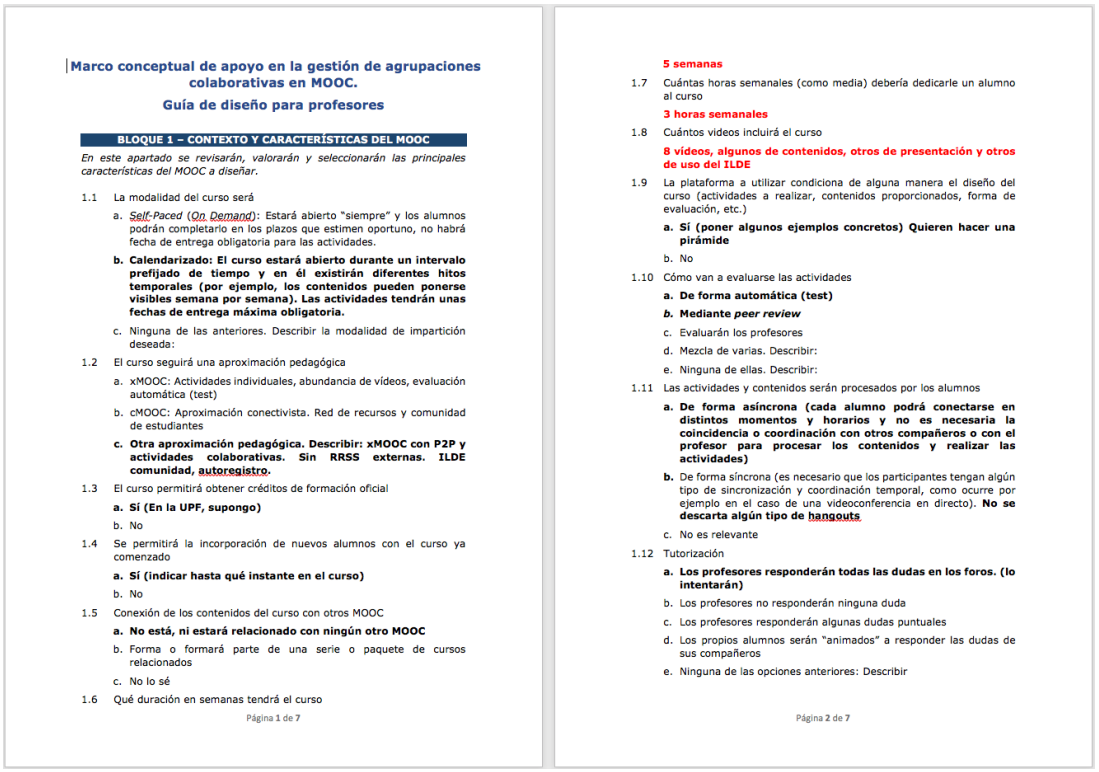
Figure E.6: Design Guide, proof of concept of the Guidelines Model (Part 5)



Marco conceptual de apoyo en la gestión de agrupaciones colaborativas en MOOC.

Guía de diseño para profesores

BLOQUE 1 – CONTEXTO Y CARACTERÍSTICAS DEL MOOC

En este apartado se revisarán, valorarán y seleccionarán las principales características del MOOC a diseñar.

1.1 La modalidad del curso será

a. *Self-Paced* (*On Demand*): Estará abierto "siempre" y los alumnos podrán completarlo en los plazos que estimen oportuno, no habrá fecha de entrega obligatoria para las actividades.

b. Calendarizado: El curso estará abierto durante un intervalo prefijado de tiempo y en él existirán diferentes hitos temporales (por ejemplo, los contenidos pueden ponerse visibles semana por semana). Las actividades tendrán unas fechas de entrega máxima obligatoria.

c. Ninguna de las anteriores. Describir la modalidad de impartición deseada:

1.2 El curso seguirá una aproximación pedagógica

a. xMOOC: Actividades individuales, abundancia de vídeos, evaluación automática (test)

b. cMOOC: Aproximación conectivista. Red de recursos y comunidad de estudiantes

c. Otra aproximación pedagógica. Describir: xMOOC con P2P y actividades colaborativas. Sin RRSS externas. ILDE comunidad, autoregistro.

1.3 El curso permitirá obtener créditos de formación oficial

a. Sí (En la UPF, supongo)

b. No

1.4 Se permitirá la incorporación de nuevos alumnos con el curso ya comenzado

a. Sí (indicar hasta qué instante en el curso)

b. No

1.5 Conexión de los contenidos del curso con otros MOOC

a. No está, ni estará relacionado con ningún otro MOOC

b. Forma o formará parte de una serie o paquete de cursos relacionados

c. No lo sé

1.6 Qué duración en semanas tendrá el curso

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5 semanas

1.7 Cuántas horas semanales (como media) debería dedicarle un alumno al curso

3 horas semanales

1.8 Cuántos videos incluirá el curso

8 vídeos, algunos de contenidos, otros de presentación y otros de uso del ILDE

1.9 La plataforma a utilizar condiciona de alguna manera el diseño del curso (actividades a realizar, contenidos proporcionados, forma de evaluación, etc.)

a. Sí (poner algunos ejemplos concretos) Quieren hacer una pirámide

b. No

1.10 Cómo van a evaluarse las actividades

a. De forma automática (test)

b.* Mediante *peer review

c. Evaluarán los profesores

d. Mezcla de varias. Describir:

e. Ninguna de ellas. Describir:

1.11 Las actividades y contenidos serán procesados por los alumnos

a. De forma asíncrona (cada alumno podrá conectarse en distintos momentos y horarios y no es necesaria la coincidencia o coordinación con otros compañeros o con el profesor para procesar los contenidos y realizar las actividades)

b. De forma síncrona (es necesario que los participantes tengan algún tipo de sincronización y coordinación temporal, como ocurre por ejemplo en el caso de una videoconferencia en directo). **No se descarta algún tipo de hangouts**

c. No es relevante

1.12 Tutorización

a. Los profesores responderán todas las dudas en los foros. (lo intentarán)

b. Los profesores no responderán ninguna duda

c. Los profesores responderán algunas dudas puntuales

d. Los propios alumnos serán "animados" a responder las dudas de sus compañeros

e. Ninguna de las opciones anteriores: Describir

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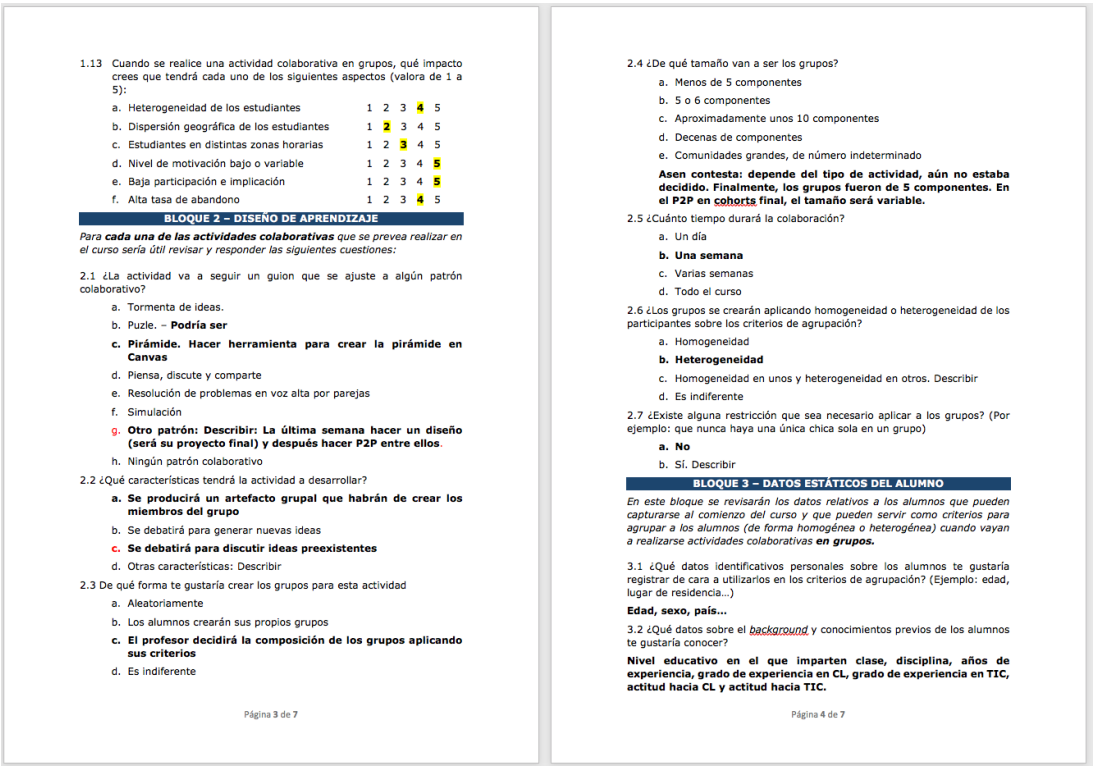
Figure E.7: Fieldwork resulting of the fulfillment of the Design Guide by Teacher 1 (Part 1)

E.2.1 Fieldwork of Teacher 1

Figures E.7, E.8 and E.9 show the fieldwork resulting of the fulfillment of the Design Guide by the Teacher 1 of our second study (STD2).



1.13 Cuando se realice una actividad colaborativa en grupos, qué impacto crees que tendrá cada uno de los siguientes aspectos (valora de 1 a 5):

a. Heterogeneidad de los estudiantes	1	2	3	**4**	5
b. Dispersión geográfica de los estudiantes	1	**2**	3	4	5
c. Estudiantes en distintas zonas horarias	1	2	**3**	4	5
d. Nivel de motivación bajo o variable	1	2	3	4	**5**
e. Baja participación e implicación	1	2	3	4	**5**
f. Alta tasa de abandono	1	2	3	**4**	5

BLOQUE 2 – DISEÑO DE APRENDIZAJE

*Para **cada una de las actividades colaborativas** que se prevea realizar en el curso sería útil revisar y responder las siguientes cuestiones:*

2.1 ¿La actividad va a seguir un guion que se ajuste a algún patrón colaborativo?

a. Tormenta de ideas.
b. Puzle. – **Podría ser**
c. Pirámide. Hacer herramienta para crear la pirámide en Canvas
d. Piensa, discute y comparte
e. Resolución de problemas en voz alta por parejas
f. Simulación
g. **Otro patrón: Describir: La última semana hacer un diseño (será su proyecto final) y después hacer P2P entre ellos**.
h. Ningún patrón colaborativo

2.2 ¿Qué características tendrá la actividad a desarrollar?

a. Se producirá un artefacto grupal que habrán de crear los miembros del grupo
b. Se debatirá para generar nuevas ideas
c. Se debatirá para discutir ideas preexistentes
d. Otras características: Describir

2.3 De qué forma te gustaría crear los grupos para esta actividad

a. Aleatoriamente
b. Los alumnos crearán sus propios grupos
c. El profesor decidirá la composición de los grupos aplicando sus criterios
d. Es indiferente

2.4 ¿De qué tamaño van a ser los grupos?

a. Menos de 5 componentes
b. 5 o 6 componentes
c. Aproximadamente unos 10 componentes
d. Decenas de componentes
e. Comunidades grandes, de número indeterminado

Asen contesta: depende del tipo de actividad, aún no estaba decidido. Finalmente, los grupos fueron de 5 componentes. En el P2P en cohorts final, el tamaño será variable.

2.5 ¿Cuánto tiempo durará la colaboración?

a. Un día
b. Una semana
c. Varias semanas
d. Todo el curso

2.6 ¿Los grupos se crearán aplicando homogeneidad o heterogeneidad de los participantes sobre los criterios de agrupación?

a. Homogeneidad
b. Heterogeneidad
c. Homogeneidad en unos y heterogeneidad en otros. Describir
d. Es indiferente

2.7 ¿Existe alguna restricción que sea necesario aplicar a los grupos? (Por ejemplo: que nunca haya una única chica sola en un grupo)

a. No
b. Sí. Describir

BLOQUE 3 – DATOS ESTÁTICOS DEL ALUMNO

*En este bloque se revisarán los datos relativos a los alumnos que pueden capturarse al comienzo del curso y que pueden servir como criterios para agrupar a los alumnos (de forma homogénea o heterogénea) cuando vayan a realizarse actividades colaborativas **en grupos.***

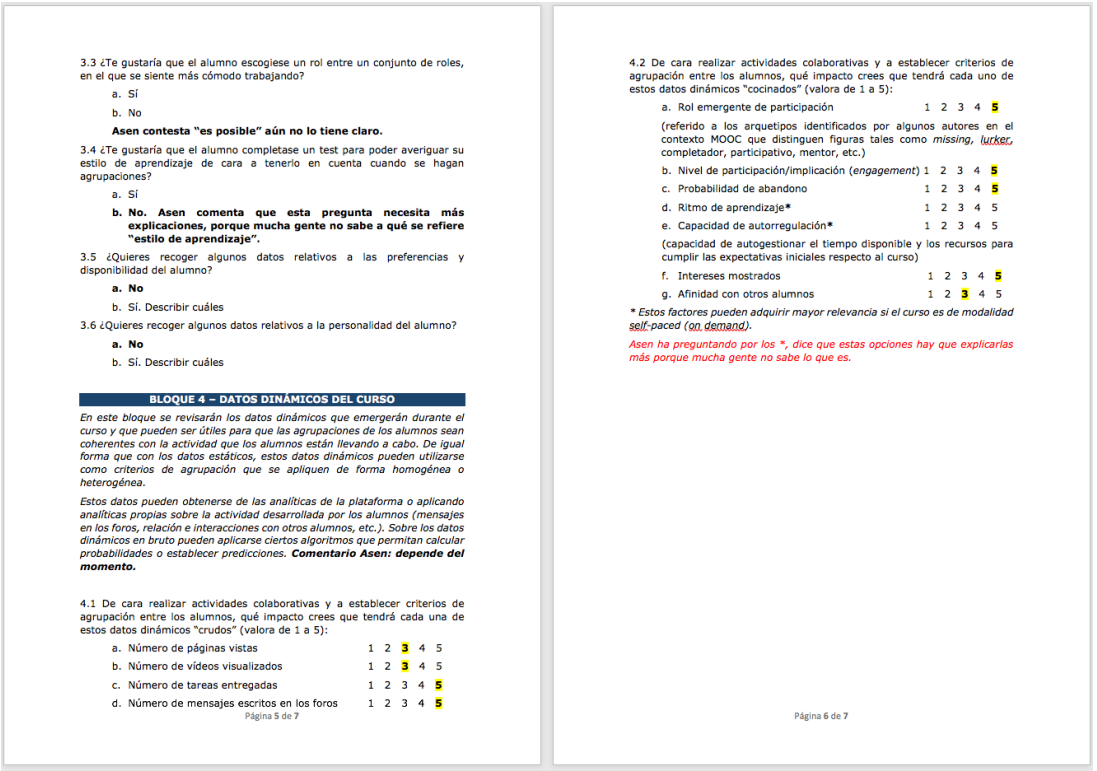
3.1 ¿Qué datos identificativos personales sobre los alumnos te gustaría registrar de cara a utilizarlos en los criterios de agrupación? (Ejemplo: edad, lugar de residencia…)

Edad, sexo, país…

3.2 ¿Qué datos sobre el *background* y conocimientos previos de los alumnos te gustaría conocer?

Nivel educativo en el que imparten clase, disciplina, años de experiencia, grado de experiencia en CL, grado de experiencia en TIC, actitud hacia CL y actitud hacia TIC.

Figure E.8: Fieldwork resulting of the fulfillment of the Design Guide by Teacher 1 (Part 2)



3.3 ¿Te gustaría que el alumno escogiese un rol entre un conjunto de roles, en el que se siente más cómodo trabajando?

a. Sí

b. No

Asen contesta "es posible" aún no lo tiene claro.

3.4 ¿Te gustaría que el alumno completase un test para poder averiguar su estilo de aprendizaje de cara a tenerlo en cuenta cuando se hagan agrupaciones?

a. Sí

b. No. Asen comenta que esta pregunta necesita más explicaciones, porque mucha gente no sabe a qué se refiere "estilo de aprendizaje".

3.5 ¿Quieres recoger algunos datos relativos a las preferencias y disponibilidad del alumno?

a. No

b. Sí. Describir cuáles

3.6 ¿Quieres recoger algunos datos relativos a la personalidad del alumno?

a. No

b. Sí. Describir cuáles

BLOQUE 4 – DATOS DINÁMICOS DEL CURSO

En este bloque se revisarán los datos dinámicos que emergerán durante el curso y que pueden ser útiles para que las agrupaciones de los alumnos sean coherentes con la actividad que los alumnos están llevando a cabo. De igual forma que con los datos estáticos, estos datos dinámicos pueden utilizarse como criterios de agrupación que se apliquen de forma homogénea o heterogénea.

Estos datos pueden obtenerse de las analíticas de la plataforma o aplicando analíticas propias sobre la actividad desarrollada por los alumnos (mensajes en los foros, relación e interacciones con otros alumnos, etc.). Sobre los datos dinámicos en bruto pueden aplicarse ciertos algoritmos que permitan calcular probabilidades o establecer predicciones. ***Comentario Asen: depende del momento.***

4.1 De cara realizar actividades colaborativas y a establecer criterios de agrupación entre los alumnos, qué impacto crees que tendrá cada una de estos datos dinámicos "crudos" (valora de 1 a 5):

a. Número de páginas vistas 1 2 **3** 4 5

b. Número de vídeos visualizados 1 2 **3** 4 5

c. Número de tareas entregadas 1 2 3 4 **5**

d. Número de mensajes escritos en los foros 1 2 3 4 **5**

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4.2 De cara realizar actividades colaborativas y a establecer criterios de agrupación entre los alumnos, qué impacto crees que tendrá cada uno de estos datos dinámicos "cocinados" (valora de 1 a 5):

a. Rol emergente de participación 1 2 3 4 **5**

(referido a los arquetipos identificados por algunos autores en el contexto MOOC que distinguen figuras tales como *missing*, *lurker*, completador, participativo, mentor, etc.)

b. Nivel de participación/implicación (*engagement*) 1 2 3 4 **5**

c. Probabilidad de abandono 1 2 3 4 **5**

d. Ritmo de aprendizaje* 1 2 3 4 5

e. Capacidad de autorregulación* 1 2 3 4 5

(capacidad de autogestionar el tiempo disponible y los recursos para cumplir las expectativas iniciales respecto al curso)

f. Intereses mostrados 1 2 3 4 **5**

g. Afinidad con otros alumnos 1 2 **3** 4 5

** Estos factores pueden adquirir mayor relevancia si el curso es de modalidad self-paced (on demand).*

*Asen ha preguntando por los *, dice que estas opciones hay que explicarlas más porque mucha gente no sabe lo que es.*

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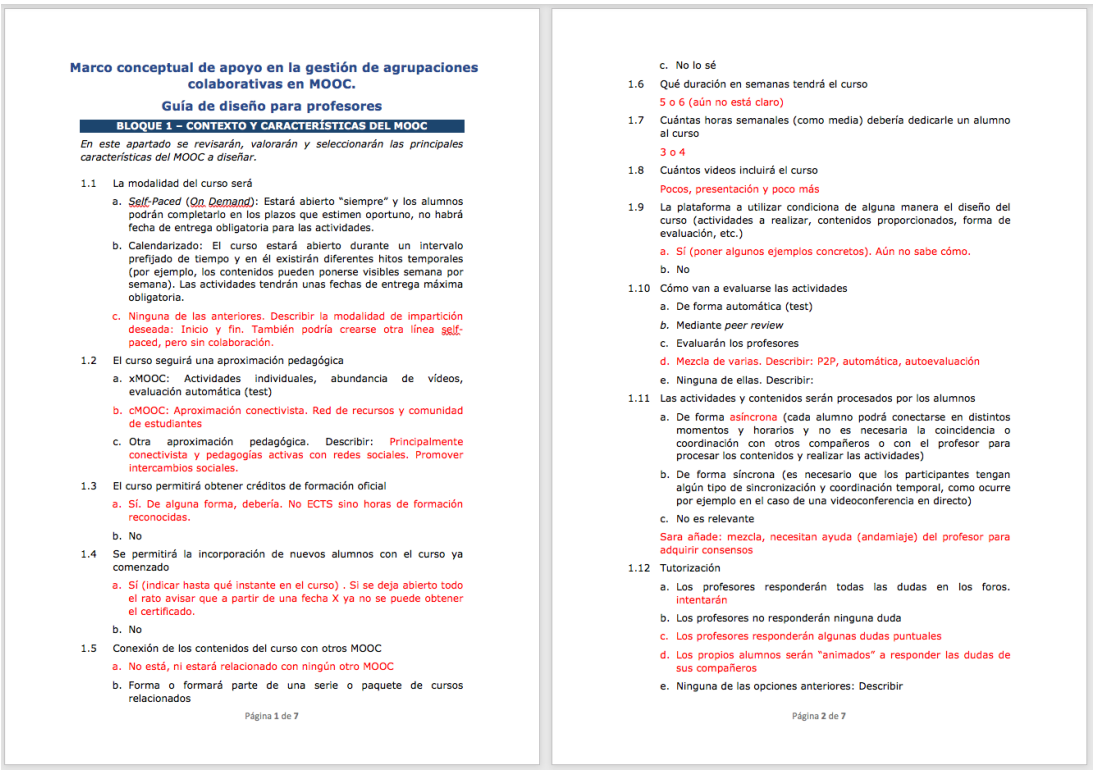
Figure E.9: Fieldwork resulting of the fulfillment of the Design Guide by Teacher 1 (Part 3)



Marco conceptual de apoyo en la gestión de agrupaciones colaborativas en MOOC.

Guía de diseño para profesores

BLOQUE 1 – CONTEXTO Y CARACTERÍSTICAS DEL MOOC

En este apartado se revisarán, valorarán y seleccionarán las principales características del MOOC a diseñar.

1.1 La modalidad del curso será

a. *Self-Paced* (*On Demand*): Estará abierto "siempre" y los alumnos podrán completarlo en los plazos que estimen oportuno, no habrá fecha de entrega obligatoria para las actividades.

b. Calendarizado: El curso estará abierto durante un intervalo prefijado de tiempo y en él existirán diferentes hitos temporales (por ejemplo, los contenidos pueden ponerse visibles semana por semana). Las actividades tendrán unas fechas de entrega máxima obligatoria.

c. Ninguna de las anteriores. Describir la modalidad de impartición deseada: Inicio y fin. También podría crearse otra línea self-paced, pero sin colaboración.

1.2 El curso seguirá una aproximación pedagógica

a. xMOOC: Actividades individuales, abundancia de vídeos, evaluación automática (test)

b. cMOOC: Aproximación conectivista. Red de recursos y comunidad de estudiantes

c. Otra aproximación pedagógica. Describir: Principalmente conectivista y pedagogías activas con redes sociales. Promover intercambios sociales.

1.3 El curso permitirá obtener créditos de formación oficial

a. Sí. De alguna forma, debería. No ECTS sino horas de formación reconocidas.

b. No

1.4 Se permitirá la incorporación de nuevos alumnos con el curso ya comenzado

a. Sí (indicar hasta qué instante en el curso) . Si se deja abierto todo el rato avisar que a partir de una fecha X ya no se puede obtener el certificado.

b. No

1.5 Conexión de los contenidos del curso con otros MOOC

a. No está, ni estará relacionado con ningún otro MOOC

b. Forma o formará parte de una serie o paquete de cursos relacionados

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c. No lo sé

1.6 Qué duración en semanas tendrá el curso

5 o 6 (aún no está claro)

1.7 Cuántas horas semanales (como media) debería dedicarle un alumno al curso

3 o 4

1.8 Cuántos videos incluirá el curso

Pocos, presentación y poco más

1.9 La plataforma a utilizar condiciona de alguna manera el diseño del curso (actividades a realizar, contenidos proporcionados, forma de evaluación, etc.)

a. Sí (poner algunos ejemplos concretos). Aún no sabe cómo.

b. No

1.10 Cómo van a evaluarse las actividades

a. De forma automática (test)

b. Mediante *peer review*

c. Evaluarán los profesores

d. Mezcla de varias. Describir: P2P, automática, autoevaluación

e. Ninguna de ellas. Describir:

1.11 Las actividades y contenidos serán procesados por los alumnos

a. De forma asíncrona (cada alumno podrá conectarse en distintos momentos y horarios y no es necesaria la coincidencia o coordinación con otros compañeros o con el profesor para procesar los contenidos y realizar las actividades)

b. De forma síncrona (es necesario que los participantes tengan algún tipo de sincronización y coordinación temporal, como ocurre por ejemplo en el caso de una videoconferencia en directo)

c. No es relevante

Sara añade: mezcla, necesitan ayuda (andamiaje) del profesor para adquirir consensos

1.12 Tutorización

a. Los profesores responderán todas las dudas en los foros. intentarán

b. Los profesores no responderán ninguna duda

c. Los profesores responderán algunas dudas puntuales

d. Los propios alumnos serán "animados" a responder las dudas de sus compañeros

e. Ninguna de las opciones anteriores: Describir

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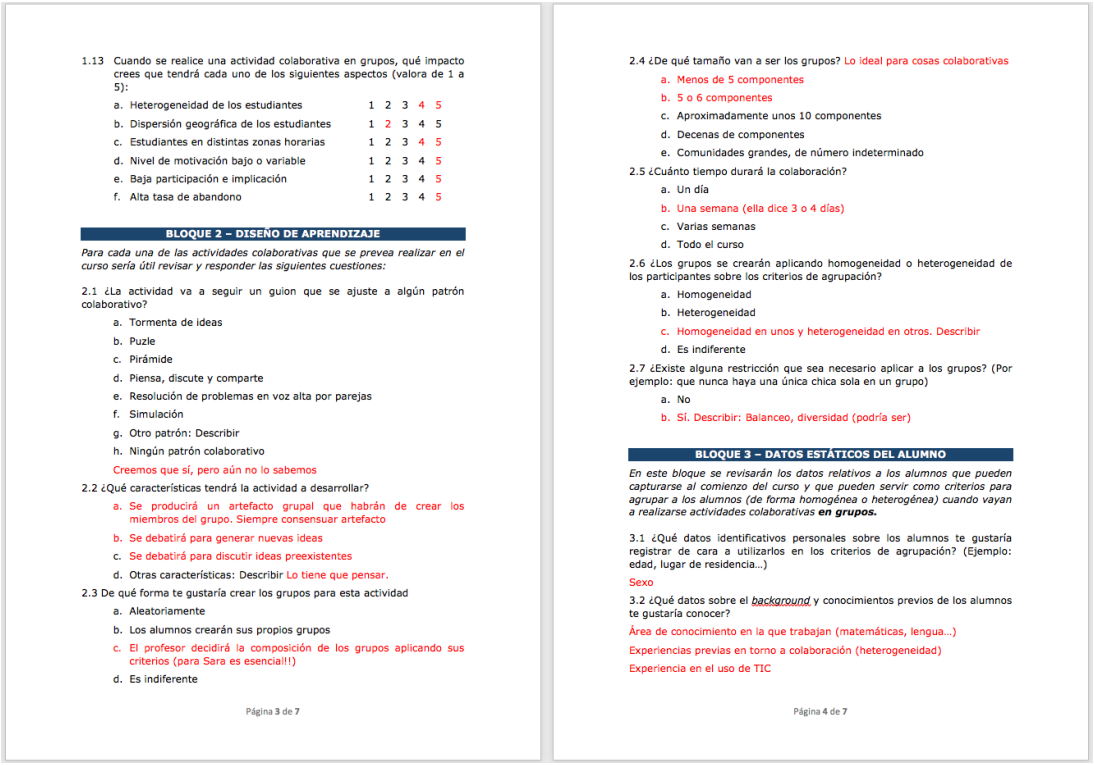
Figure E.10: Fieldwork resulting of the fulfillment of the Design Guide by Teacher 2 (Part 1)

E.2.2 Fieldwork of Teacher 2

Figures E.10, E.8 and E.12 show the fieldwork resulting of the fulfillment of the Design Guide by the Teacher 2 of our second study (STD2).



1.13 Cuando se realice una actividad colaborativa en grupos, qué impacto crees que tendrá cada uno de los siguientes aspectos (valora de 1 a 5):

a. Heterogeneidad de los estudiantes 1 2 3 4 5
b. Dispersión geográfica de los estudiantes 1 2 3 4 5
c. Estudiantes en distintas zonas horarias 1 2 3 4 5
d. Nivel de motivación bajo o variable 1 2 3 4 5
e. Baja participación e implicación 1 2 3 4 5
f. Alta tasa de abandono 1 2 3 4 5

BLOQUE 2 – DISEÑO DE APRENDIZAJE

Para cada una de las actividades colaborativas que se prevea realizar en el curso sería útil revisar y responder las siguientes cuestiones:

2.1 ¿La actividad va a seguir un guion que se ajuste a algún patrón colaborativo?

a. Tormenta de ideas
b. Puzle
c. Pirámide
d. Piensa, discute y comparte
e. Resolución de problemas en voz alta por parejas
f. Simulación
g. Otro patrón: Describir
h. Ningún patrón colaborativo

Creemos que sí, pero aún no lo sabemos

2.2 ¿Qué características tendrá la actividad a desarrollar?

a. Se producirá un artefacto grupal que habrán de crear los miembros del grupo. Siempre consensuar artefacto
b. Se debatirá para generar nuevas ideas
c. Se debatirá para discutir ideas preexistentes
d. Otras características: Describir Lo tiene que pensar.

2.3 De qué forma te gustaría crear los grupos para esta actividad

a. Aleatoriamente
b. Los alumnos crearán sus propios grupos
c. El profesor decidirá la composición de los grupos aplicando sus criterios (para Sara es esencial!!)
d. Es indiferente

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2.4 ¿De qué tamaño van a ser los grupos? Lo ideal para cosas colaborativas

a. Menos de 5 componentes
b. 5 o 6 componentes
c. Aproximadamente unos 10 componentes
d. Decenas de componentes
e. Comunidades grandes, de número indeterminado

2.5 ¿Cuánto tiempo durará la colaboración?

a. Un día
b. Una semana (ella dice 3 o 4 días)
c. Varias semanas
d. Todo el curso

2.6 ¿Los grupos se crearán aplicando homogeneidad o heterogeneidad de los participantes sobre los criterios de agrupación?

a. Homogeneidad
b. Heterogeneidad
c. Homogeneidad en unos y heterogeneidad en otros. Describir
d. Es indiferente

2.7 ¿Existe alguna restricción que sea necesario aplicar a los grupos? (Por ejemplo: que nunca haya una única chica sola en un grupo)

a. No
b. Sí. Describir: Balanceo, diversidad (podría ser)

BLOQUE 3 – DATOS ESTÁTICOS DEL ALUMNO

En este bloque se revisarán los datos relativos a los alumnos que pueden capturarse al comienzo del curso y que pueden servir como criterios para agrupar a los alumnos (de forma homogénea o heterogénea) cuando vayan a realizarse actividades colaborativas ***en grupos.***

3.1 ¿Qué datos identificativos personales sobre los alumnos te gustaría registrar de cara a utilizarlos en los criterios de agrupación? (Ejemplo: edad, lugar de residencia…)

Sexo

3.2 ¿Qué datos sobre el *background* y conocimientos previos de los alumnos te gustaría conocer?

Área de conocimiento en la que trabajan (matemáticas, lengua…)
Experiencias previas en torno a colaboración (heterogeneidad)
Experiencia en el uso de TIC

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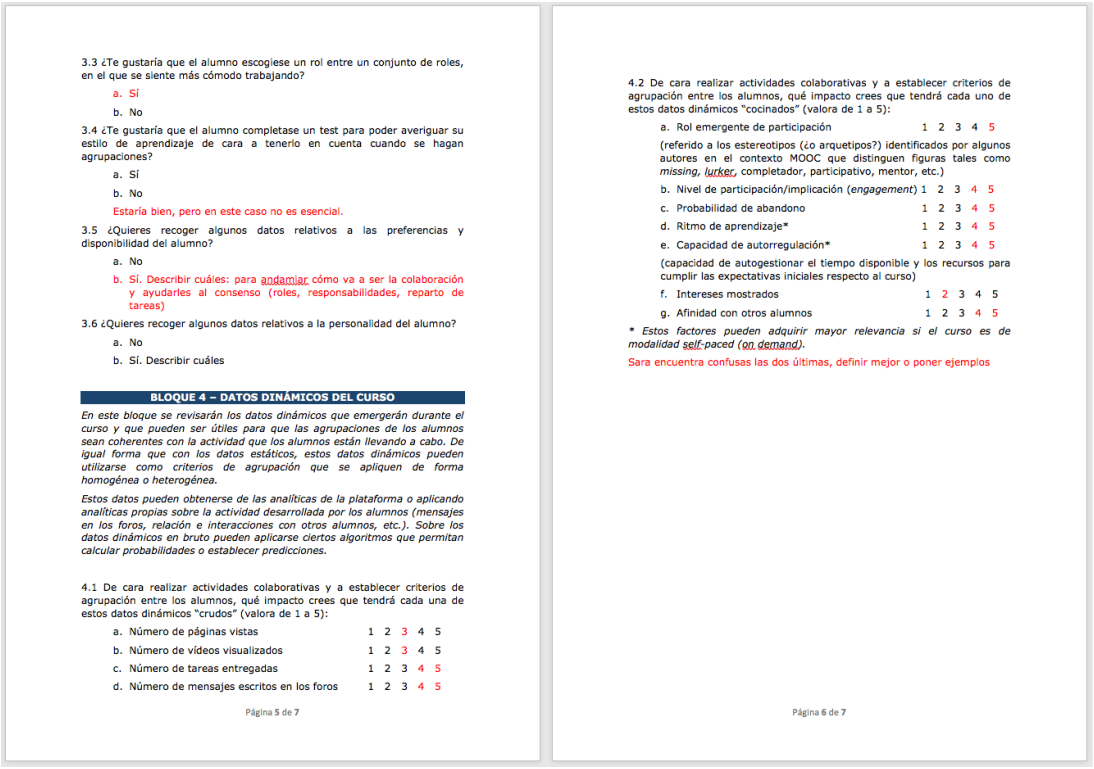
Figure E.11: Fieldwork resulting of the fulfillment of the Design Guide by Teacher 2 (Part 2)



3.3 ¿Te gustaría que el alumno escogiese un rol entre un conjunto de roles, en el que se siente más cómodo trabajando?

a. Sí

b. No

3.4 ¿Te gustaría que el alumno completase un test para poder averiguar su estilo de aprendizaje de cara a tenerlo en cuenta cuando se hagan agrupaciones?

a. Sí

b. No

Estaría bien, pero en este caso no es esencial.

3.5 ¿Quieres recoger algunos datos relativos a las preferencias y disponibilidad del alumno?

a. No

b. Sí. Describir cuáles: para andamiar cómo va a ser la colaboración y ayudarles al consenso (roles, responsabilidades, reparto de tareas)

3.6 ¿Quieres recoger algunos datos relativos a la personalidad del alumno?

a. No

b. Sí. Describir cuáles

BLOQUE 4 – DATOS DINÁMICOS DEL CURSO

En este bloque se revisarán los datos dinámicos que emergerán durante el curso y que pueden ser útiles para que las agrupaciones de los alumnos sean coherentes con la actividad que los alumnos están llevando a cabo. De igual forma que con los datos estáticos, estos datos dinámicos pueden utilizarse como criterios de agrupación que se apliquen de forma homogénea o heterogénea.

Estos datos pueden obtenerse de las analíticas de la plataforma o aplicando analíticas propias sobre la actividad desarrollada por los alumnos (mensajes en los foros, relación e interacciones con otros alumnos, etc.). Sobre los datos dinámicos en bruto pueden aplicarse ciertos algoritmos que permitan calcular probabilidades o establecer predicciones.

4.1 De cara realizar actividades colaborativas y a establecer criterios de agrupación entre los alumnos, qué impacto crees que tendrá cada una de estos datos dinámicos "crudos" (valora de 1 a 5):

a. Número de páginas vistas 1 2 3 4 5

b. Número de vídeos visualizados 1 2 3 4 5

c. Número de tareas entregadas 1 2 3 4 5

d. Número de mensajes escritos en los foros 1 2 3 4 5

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4.2 De cara realizar actividades colaborativas y a establecer criterios de agrupación entre los alumnos, qué impacto crees que tendrá cada uno de estos datos dinámicos "cocinados" (valora de 1 a 5):

a. Rol emergente de participación 1 2 3 4 5

(referido a los estereotipos (¿o arquetipos?) identificados por algunos autores en el contexto MOOC que distinguen figuras tales como *missing*, *lurker*, completador, participativo, mentor, etc.)

b. Nivel de participación/implicación (*engagement*) 1 2 3 4 5

c. Probabilidad de abandono 1 2 3 4 5

d. Ritmo de aprendizaje* 1 2 3 4 5

e. Capacidad de autorregulación* 1 2 3 4 5

(capacidad de autogestionar el tiempo disponible y los recursos para cumplir las expectativas iniciales respecto al curso)

f. Intereses mostrados 1 2 3 4 5

g. Afinidad con otros alumnos 1 2 3 4 5

** Estos factores pueden adquirir mayor relevancia si el curso es de modalidad self-paced (on demand).*

Sara encuentra confusas las dos últimas, definir mejor o poner ejemplos

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Figure E.12: Fieldwork resulting of the fulfillment of the Design Guide by Teacher 2 (Part 3)

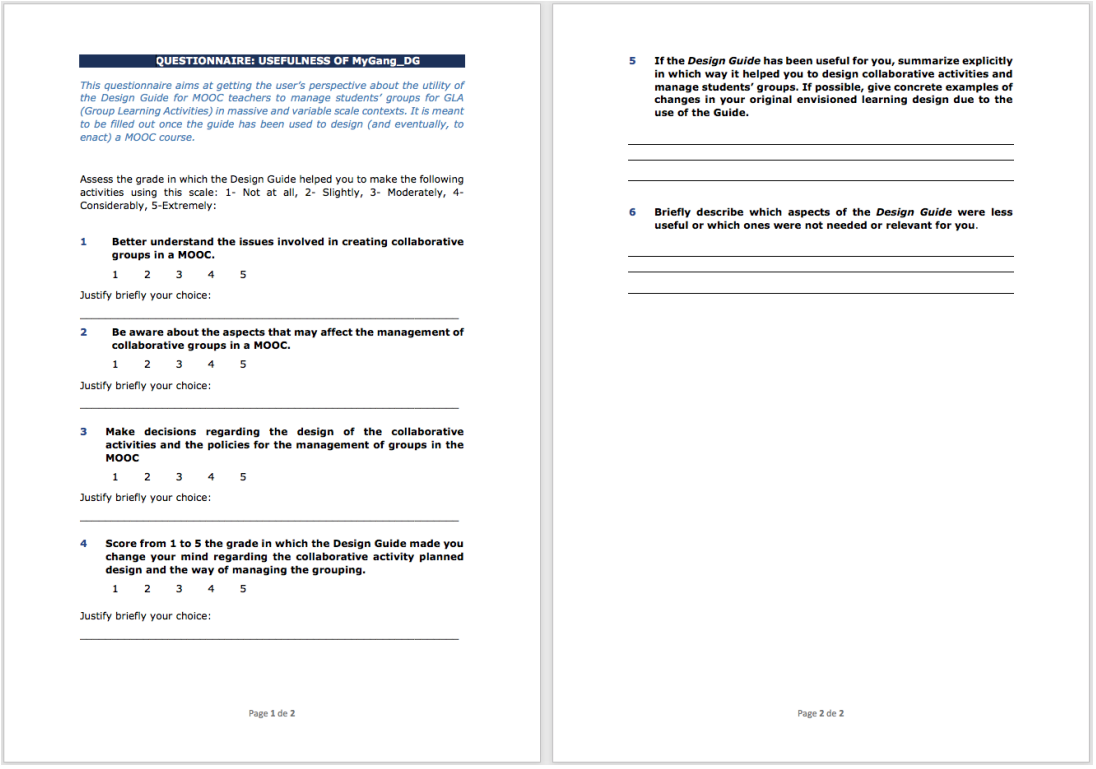
Appendix F

Fieldwork corresponding to EO2: questionnaires and design guides fulfilled by the teachers

Summary: In this Appendix, we include the fieldwork corresponding to the experiment we named EO2 (second round of gathering expert opinions).

F.1 Evaluative Questionnaire Model and Fieldwork

Figure F.1 depicts the structure and content of the model schema taking part of the Framework artifact, we created to serve as a reference to the stakeholders interested in creating Design Guides adapted to their environmental characteristics, such as their learning platform.



QUESTIONNAIRE: USEFULNESS OF MyGang_DG

This questionnaire aims at getting the user's perspective about the utility of the Design Guide for MOOC teachers to manage students' groups for GLA (Group Learning Activities) in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which the Design Guide helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 3 4 5

Justify briefly your choice:

4 **Score from 1 to 5 the grade in which the Design Guide made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 4 5

Justify briefly your choice:

Page 1 de 2

5 **If the *Design Guide* has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

6 **Briefly describe which aspects of the *Design Guide* were less useful or which ones were not needed or relevant for you.**

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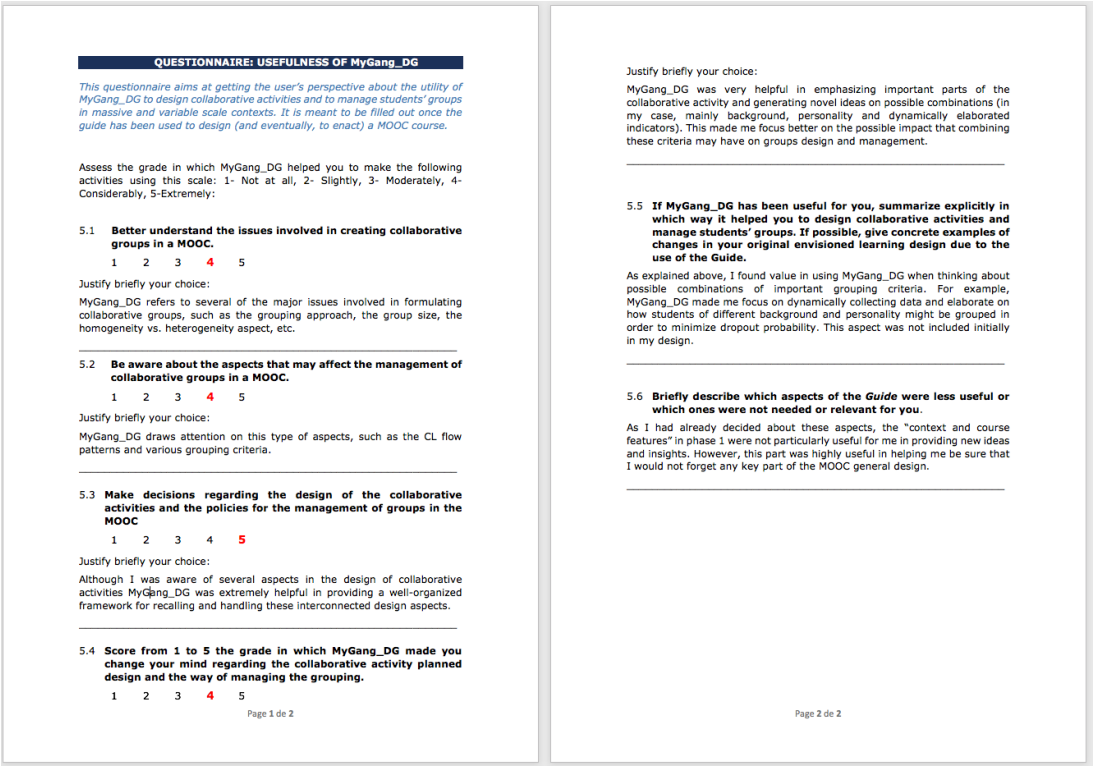
Figure F.1: Model of the Evaluative Questionnaire aimed at validating our Design Guide

F.1.1 Fieldwork corresponding to the teachers using the Design Guide in the Tutored (Supervised) Mode (TM)

Figures F.2, F.3 and F.4 show the fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teachers TM1, TM2 and TM3 respectively.



QUESTIONNAIRE: USEFULNESS OF MyGang_DG

This questionnaire aims at getting the user's perspective about the utility of MyGang_DG to design collaborative activities and to manage students' groups in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which MyGang_DG helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

5.1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 **4** 5

Justify briefly your choice:

MyGang_DG refers to several of the major issues involved in formulating collaborative groups, such as the grouping approach, the group size, the homogeneity vs. heterogeneity aspect, etc.

5.2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 **4** 5

Justify briefly your choice:

MyGang_DG draws attention on this type of aspects, such as the CL flow patterns and various grouping criteria.

5.3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 3 4 **5**

Justify briefly your choice:

Although I was aware of several aspects in the design of collaborative activities MyGang_DG was extremely helpful in providing a well-organized framework for recalling and handling these interconnected design aspects.

5.4 **Score from 1 to 5 the grade in which MyGang_DG made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 **4** 5

Page 1 de 2

Justify briefly your choice:

MyGang_DG was very helpful in emphasizing important parts of the collaborative activity and generating novel ideas on possible combinations (in my case, mainly background, personality and dynamically elaborated indicators). This made me focus better on the possible impact that combining these criteria may have on groups design and management.

5.5 **If MyGang_DG has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

As explained above, I found value in using MyGang_DG when thinking about possible combinations of important grouping criteria. For example, MyGang_DG made me focus on dynamically collecting data and elaborate on how students of different background and personality might be grouped in order to minimize dropout probability. This aspect was not included initially in my design.

5.6 **Briefly describe which aspects of the *Guide* were less useful or which ones were not needed or relevant for you.**

As I had already decided about these aspects, the "context and course features" in phase 1 were not particularly useful for me in providing new ideas and insights. However, this part was highly useful in helping me be sure that I would not forget any key part of the MOOC general design.

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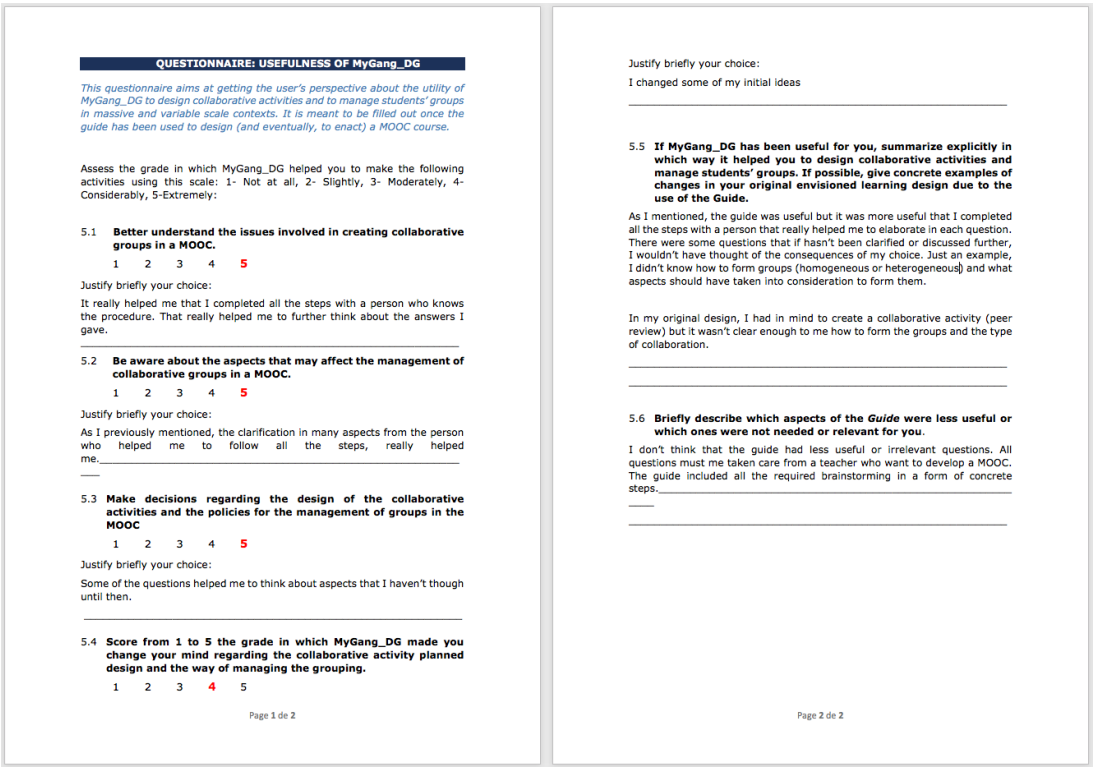
Figure F.2: Fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teacher TM1



QUESTIONNAIRE: USEFULNESS OF MyGang_DG

This questionnaire aims at getting the user's perspective about the utility of MyGang_DG to design collaborative activities and to manage students' groups in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which MyGang_DG helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

5.1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 4 **5**

Justify briefly your choice:

It really helped me that I completed all the steps with a person who knows the procedure. That really helped me to further think about the answers I gave.

5.2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 4 **5**

Justify briefly your choice:

As I previously mentioned, the clarification in many aspects from the person who helped me to follow all the steps, really helped me.

5.3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 3 4 **5**

Justify briefly your choice:

Some of the questions helped me to think about aspects that I haven't though until then.

5.4 **Score from 1 to 5 the grade in which MyGang_DG made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 **4** 5

Page **1** de **2**

Justify briefly your choice:

I changed some of my initial ideas

5.5 **If MyGang_DG has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

As I mentioned, the guide was useful but it was more useful that I completed all the steps with a person that really helped me to elaborate in each question. There were some questions that if hasn't been clarified or discussed further, I wouldn't have thought of the consequences of my choice. Just an example, I didn't know how to form groups (homogeneous or heterogeneous) and what aspects should have taken into consideration to form them.

In my original design, I had in mind to create a collaborative activity (peer review) but it wasn't clear enough to me how to form the groups and the type of collaboration.

5.6 **Briefly describe which aspects of the *Guide* were less useful or which ones were not needed or relevant for you.**

I don't think that the guide had less useful or irrelevant questions. All questions must me taken care from a teacher who want to develop a MOOC. The guide included all the required brainstorming in a form of concrete steps.

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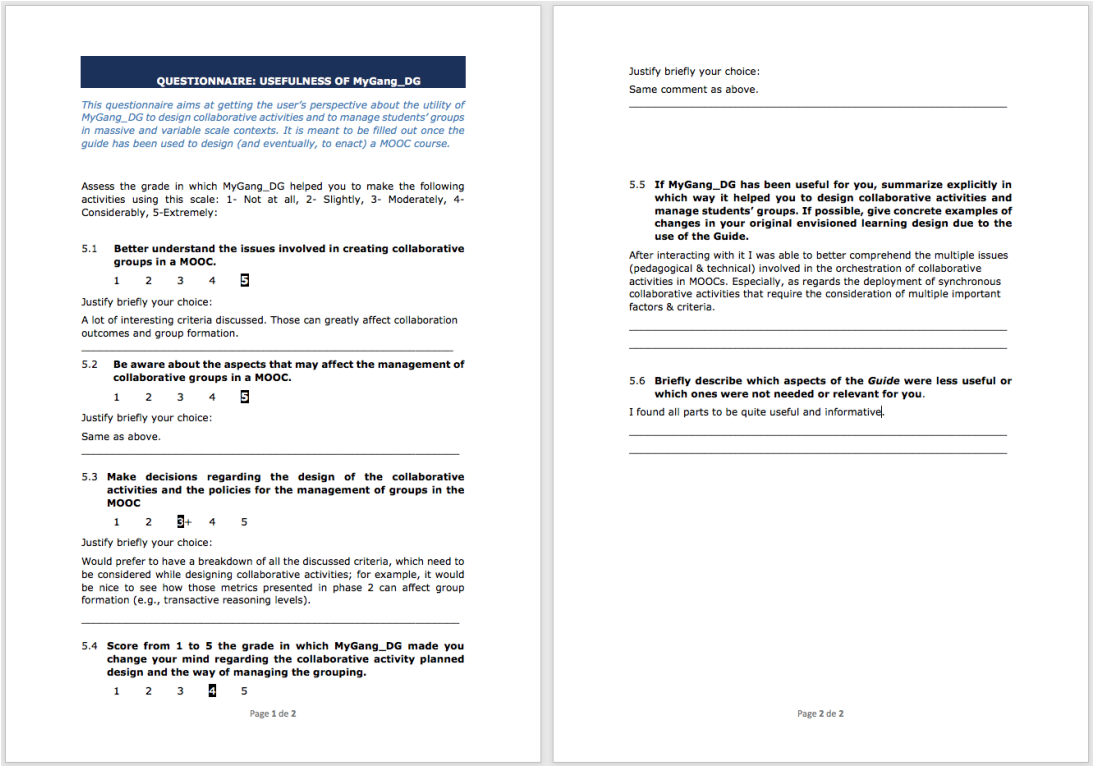
Figure F.3: Fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teacher TM2



QUESTIONNAIRE: USEFULNESS OF MyGang_DG

This questionnaire aims at getting the user's perspective about the utility of MyGang_DG to design collaborative activities and to manage students' groups in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which MyGang_DG helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

5.1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

A lot of interesting criteria discussed. Those can greatly affect collaboration outcomes and group formation.

5.2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

Same as above.

5.3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 5+ 4 5

Justify briefly your choice:

Would prefer to have a breakdown of all the discussed criteria, which need to be considered while designing collaborative activities; for example, it would be nice to see how those metrics presented in phase 2 can affect group formation (e.g., transactive reasoning levels).

5.4 **Score from 1 to 5 the grade in which MyGang_DG made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 4 5

Page 1 de 2

Justify briefly your choice:

Same comment as above.

5.5 **If MyGang_DG has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

After interacting with it I was able to better comprehend the multiple issues (pedagogical & technical) involved in the orchestration of collaborative activities in MOOCs. Especially, as regards the deployment of synchronous collaborative activities that require the consideration of multiple important factors & criteria.

5.6 **Briefly describe which aspects of the *Guide* were less useful or which ones were not needed or relevant for you.**

I found all parts to be quite useful and informative.

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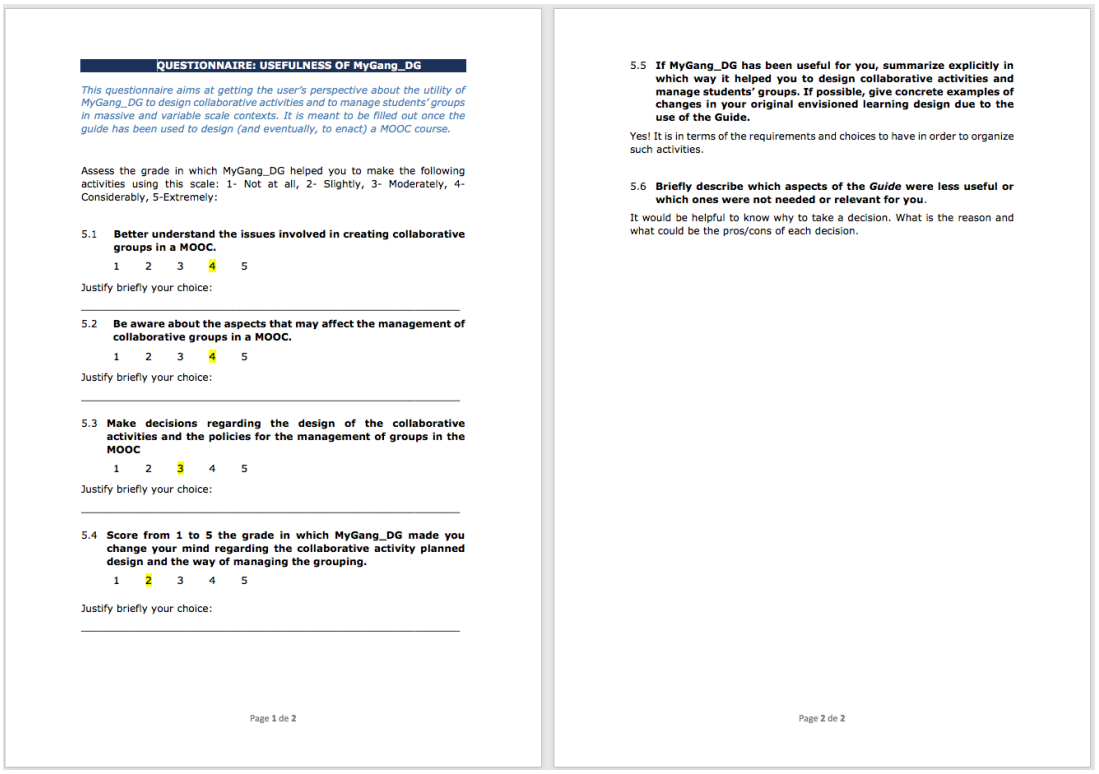
Figure F.4: Fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teacher TM3



QUESTIONNAIRE: USEFULNESS OF MyGang_DG

This questionnaire aims at getting the user's perspective about the utility of MyGang_DG to design collaborative activities and to manage students' groups in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which MyGang_DG helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

5.1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

5.2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

5.3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 3 4 5

Justify briefly your choice:

5.4 **Score from 1 to 5 the grade in which MyGang_DG made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 4 5

Justify briefly your choice:

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5.5 **If MyGang_DG has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

Yes! It is in terms of the requirements and choices to have in order to organize such activities.

5.6 **Briefly describe which aspects of the *Guide* were less useful or which ones were not needed or relevant for you.**

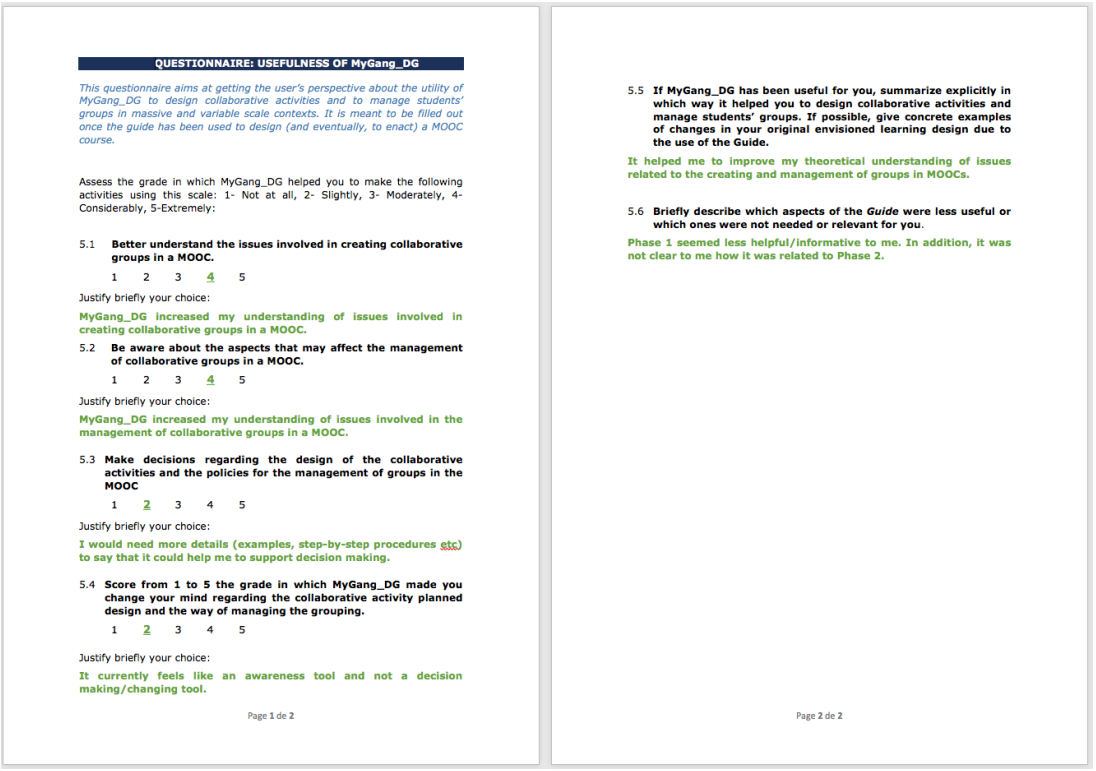
It would be helpful to know why to take a decision. What is the reason and what could be the pros/cons of each decision.

Page 2 de 2

Figure F.5: Fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teacher SAM1

F.1.2 Fieldwork corresponding to the teachers using the Design Guide in the Standalone Mode (SAM)

Figures F.5, F.6 and F.7 show the fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teachers SAM1, SAM2 and SAM3 respectively.



QUESTIONNAIRE: USEFULNESS OF MyGang_DG

This questionnaire aims at getting the user's perspective about the utility of MyGang_DG to design collaborative activities and to manage students' groups in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which MyGang_DG helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

5.1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

MyGang_DG increased my understanding of issues involved in creating collaborative groups in a MOOC.

5.2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 4 5

Justify briefly your choice:

MyGang_DG increased my understanding of issues involved in the management of collaborative groups in a MOOC.

5.3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 3 4 5

Justify briefly your choice:

I would need more details (examples, step-by-step procedures etc) to say that it could help me to support decision making.

5.4 **Score from 1 to 5 the grade in which MyGang_DG made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 4 5

Justify briefly your choice:

It currently feels like an awareness tool and not a decision making/changing tool.

Page 1 de 2

5.5 **If MyGang_DG has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

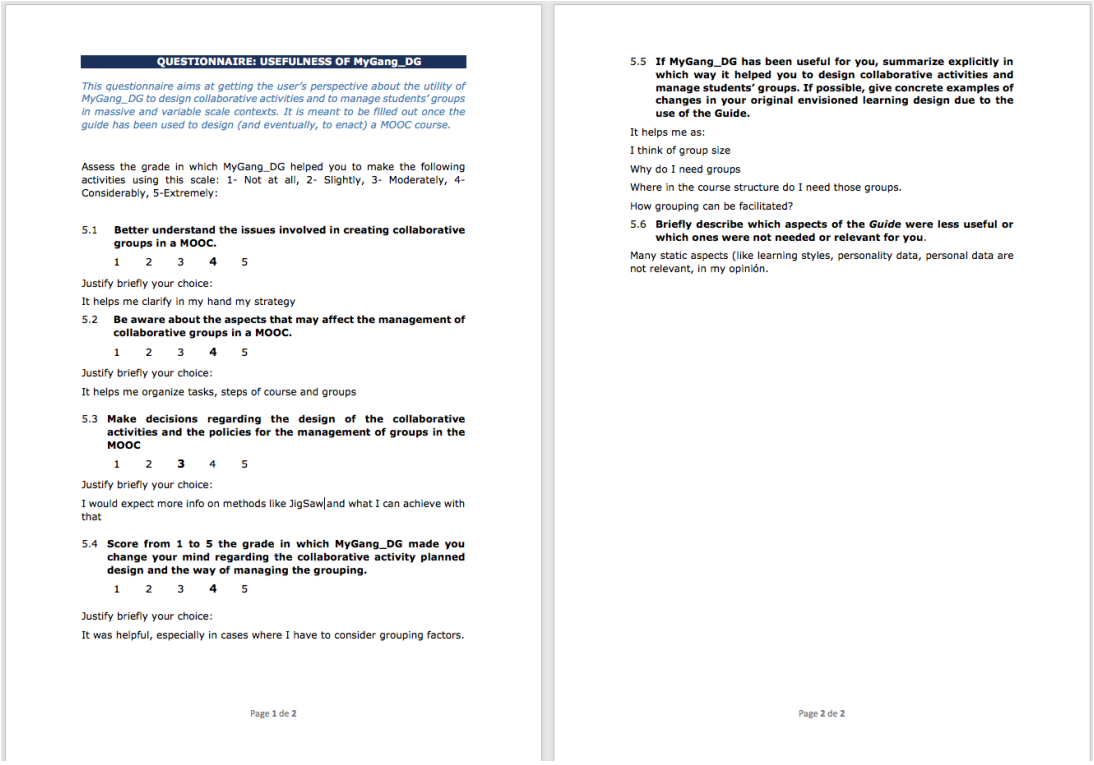
It helped me to improve my theoretical understanding of issues related to the creating and management of groups in MOOCs.

5.6 **Briefly describe which aspects of the *Guide* were less useful or which ones were not needed or relevant for you.**

Phase 1 seemed less helpful/informative to me. In addition, it was not clear to me how it was related to Phase 2.

Page 2 de 2

Figure F.6: Fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teacher SAM2



QUESTIONNAIRE: USEFULNESS OF MyGang_DG

This questionnaire aims at getting the user's perspective about the utility of MyGang_DG to design collaborative activities and to manage students' groups in massive and variable scale contexts. It is meant to be filled out once the guide has been used to design (and eventually, to enact) a MOOC course.

Assess the grade in which MyGang_DG helped you to make the following activities using this scale: 1- Not at all, 2- Slightly, 3- Moderately, 4- Considerably, 5-Extremely:

5.1 **Better understand the issues involved in creating collaborative groups in a MOOC.**

1 2 3 **4** 5

Justify briefly your choice:

It helps me clarify in my hand my strategy

5.2 **Be aware about the aspects that may affect the management of collaborative groups in a MOOC.**

1 2 3 **4** 5

Justify briefly your choice:

It helps me organize tasks, steps of course and groups

5.3 **Make decisions regarding the design of the collaborative activities and the policies for the management of groups in the MOOC**

1 2 **3** 4 5

Justify briefly your choice:

I would expect more info on methods like JigSaw and what I can achieve with that

5.4 **Score from 1 to 5 the grade in which MyGang_DG made you change your mind regarding the collaborative activity planned design and the way of managing the grouping.**

1 2 3 **4** 5

Justify briefly your choice:

It was helpful, especially in cases where I have to consider grouping factors.

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5.5 **If MyGang_DG has been useful for you, summarize explicitly in which way it helped you to design collaborative activities and manage students' groups. If possible, give concrete examples of changes in your original envisioned learning design due to the use of the Guide.**

It helps me as:

I think of group size

Why do I need groups

Where in the course structure do I need those groups.

How grouping can be facilitated?

5.6 **Briefly describe which aspects of the *Guide* were less useful or which ones were not needed or relevant for you**.

Many static aspects (like learning styles, personality data, personal data are not relevant, in my opinión.

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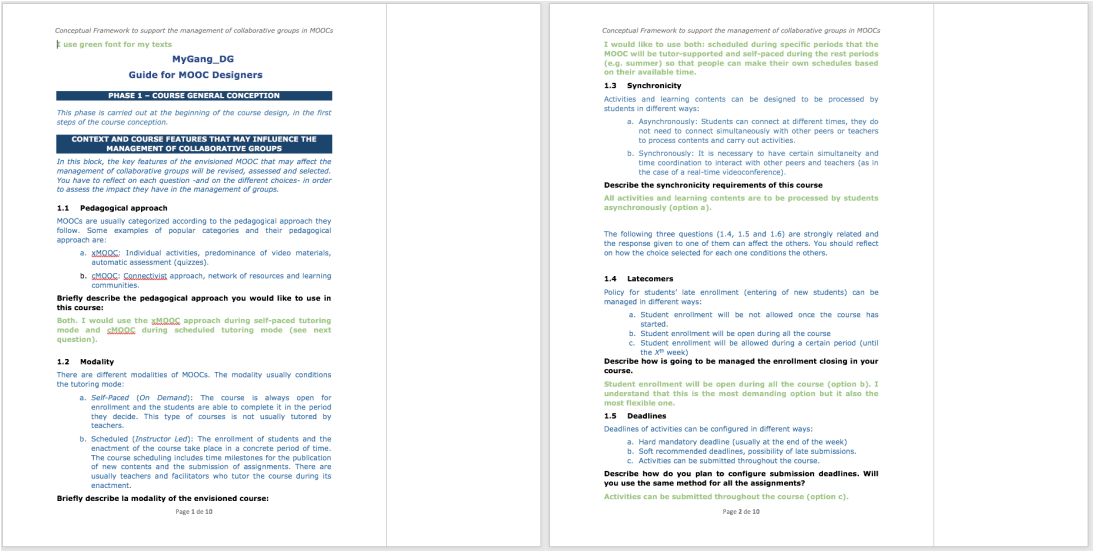
Figure F.7: Fieldwork resulting of the fulfillment of the Evaluative Questionnaire by the teacher SAM3



Conceptual Framework to support the management of collaborative groups in MOOCs

I use green font for my texts

MyGang_DG

Guide for MOOC Designers

PHASE 1 – COURSE GENERAL CONCEPTION

This phase is carried out at the beginning of the course design, in the first steps of the course conception.

CONTEXT AND COURSE FEATURES THAT MAY INFLUENCE THE MANAGEMENT OF COLLABORATIVE GROUPS

In this block, the key features of the envisioned MOOC that may affect the management of collaborative groups will be revised, assessed and selected. You have to reflect on each question -and on the different choices- in order to assess the impact they have in the management of groups.

1.1 Pedagogical approach

MOOCs are usually categorized according to the pedagogical approach they follow. Some examples of popular categories and their pedagogical approach are:

a. xMOOC: Individual activities, predominance of video materials, automatic assessment (quizzes).
b. cMOOC: Connectivist approach, network of resources and learning communities.

Briefly describe the pedagogical approach you would like to use in this course:

Both. I would use the xMOOC approach during self-paced tutoring mode and cMOOC during scheduled tutoring mode (see next question).

1.2 Modality

There are different modalities of MOOCs. The modality usually conditions the tutoring mode:

a. *Self-Paced* (*On Demand*): The course is always open for enrollment and the students are able to complete it in the period they decide. This type of courses is not usually tutored by teachers.
b. Scheduled (*Instructor Led*): The enrollment of students and the enactment of the course take place in a concrete period of time. The course scheduling includes time milestones for the publication of new contents and the submission of assignments. There are usually teachers and facilitators who tutor the course during its enactment.

Briefly describe la modality of the envisioned course:

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Conceptual Framework to support the management of collaborative groups in MOOCs

I would like to use both: scheduled during specific periods that the MOOC will be tutor-supported and self-paced during the rest periods (e.g. summer) so that people can make their own schedules based on their available time.

1.3 Synchronicity

Activities and learning contents can be designed to be processed by students in different ways:

a. Asynchronously: Students can connect at different times, they do not need to connect simultaneously with other peers or teachers to process contents and carry out activities.
b. Synchronously: It is necessary to have certain simultaneity and time coordination to interact with other peers and teachers (as in the case of a real-time videoconference).

Describe the synchronicity requirements of this course

All activities and learning contents are to be processed by students asynchronously (option a).

The following three questions (1.4, 1.5 and 1.6) are strongly related and the response given to one of them can affect the others. You should reflect on how the choice selected for each one conditions the others.

1.4 Latecomers

Policy for students' late enrollment (entering of new students) can be managed in different ways:

a. Student enrollment will be not allowed once the course has started.
b. Student enrollment will be open during all the course
c. Student enrollment will be allowed during a certain period (until the X^{th} week)

Describe how is going to be managed the enrollment closing in your course.

Student enrollment will be open during all the course (option b). I understand that this is the most demanding option but it also the most flexible one.

1.5 Deadlines

Deadlines of activities can be configured in different ways:

a. Hard mandatory deadline (usually at the end of the week)
b. Soft recommended deadlines, possibility of late submissions.
c. Activities can be submitted throughout the course.

Describe how do you plan to configure submission deadlines. Will you use the same method for all the assignments?

Activities can be submitted throughout the course (option c).

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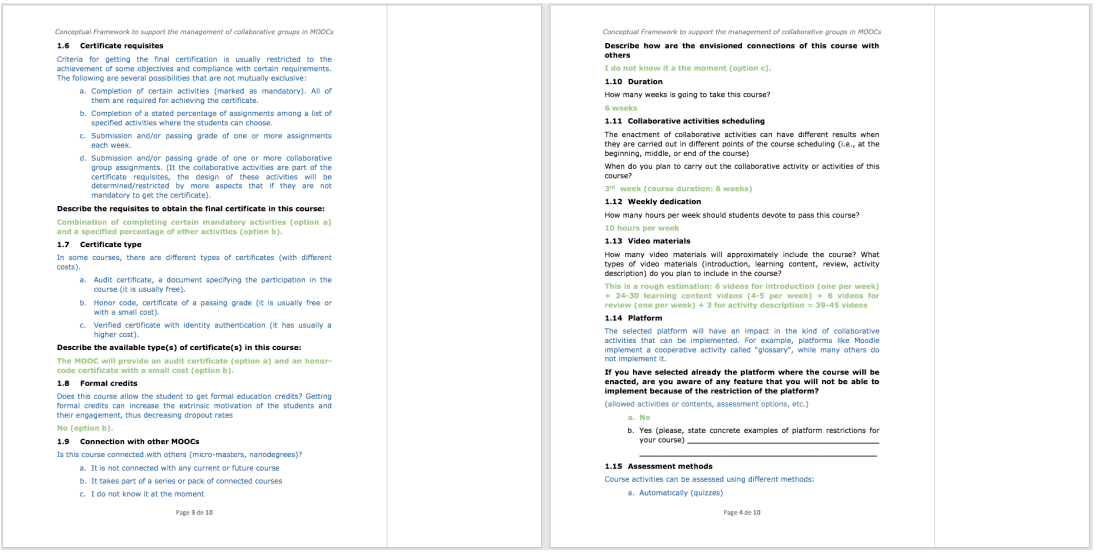
Figure F.8: Fieldwork resulting of the fulfillment of the Design Guide by the teacher SAM2 (Part1)



Conceptual Framework to support the management of collaborative groups in MOOCs

1.6 Certificate requisites

Criteria for getting the final certification is usually restricted to the achievement of some objectives and compliance with certain requirements. The following are several possibilities that are not mutually exclusive:

a. Completion of certain activities (marked as mandatory). All of them are required for achieving the certificate.
b. Completion of a stated percentage of assignments among a list of specified activities where the students can choose.
c. Submission and/or passing grade of one or more assignments each week.
d. Submission and/or passing grade of one or more collaborative group assignments. (It the collaborative activities are part of the certificate requisites, the design of these activities will be determined/restricted by more aspects that if they are not mandatory to get the certificate).

Describe the requisites to obtain the final certificate in this course:

Combination of completing certain mandatory activities (option a) and a specified percentage of other activities (option b).

1.7 Certificate type

In some courses, there are different types of certificates (with different costs).

a. Audit certificate, a document specifying the participation in the course (it is usually free).
b. Honor code, certificate of a passing grade (it is usually free or with a small cost).
c. Verified certificate with identity authentication (it has usually a higher cost).

Describe the available type(s) of certificate(s) in this course:

The MOOC will provide an audit certificate (option a) and an honor-code certificate with a small cost (option b).

1.8 Formal credits

Does this course allow the student to get formal education credits? Getting formal credits can increase the extrinsic motivation of the students and their engagement, thus decreasing dropout rates

No (option b).

1.9 Connection with other MOOCs

Is this course connected with others (micro-masters, nanodegrees)?

a. It is not connected with any current or future course
b. It takes part of a series or pack of connected courses
c. I do not know it at the moment

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Conceptual Framework to support the management of collaborative groups in MOOCs

Describe how are the envisioned connections of this course with others

I do not know it a the moment (option c).

1.10 Duration

How many weeks is going to take this course?

6 weeks

1.11 Collaborative activities scheduling

The enactment of collaborative activities can have different results when they are carried out in different points of the course scheduling (i.e., at the beginning, middle, or end of the course)

When do you plan to carry out the collaborative activity or activities of this course?

3rd week (course duration: 6 weeks)

1.12 Weekly dedication

How many hours per week should students devote to pass this course?

10 hours per week

1.13 Video materials

How many video materials will approximately include the course? What types of video materials (introduction, learning content, review, activity description) do you plan to include in the course?

This is a rough estimation: 6 videos for introduction (one per week) + 24-30 learning content videos (4-5 per week) + 6 videos for review (one per week) + 3 for activity description = 39-45 videos

1.14 Platform

The selected platform will have an impact in the kind of collaborative activities that can be implemented. For example, platforms like Moodle implement a cooperative activity called "glossary", while many others do not implement it.

If you have selected already the platform where the course will be enacted, are you aware of any feature that you will not be able to implement because of the restriction of the platform?

(allowed activities or contents, assessment options, etc.)

a. No
b. Yes (please, state concrete examples of platform restrictions for your course) _____

1.15 Assessment methods

Course activities can be assessed using different methods:

a. Automatically (quizzes)

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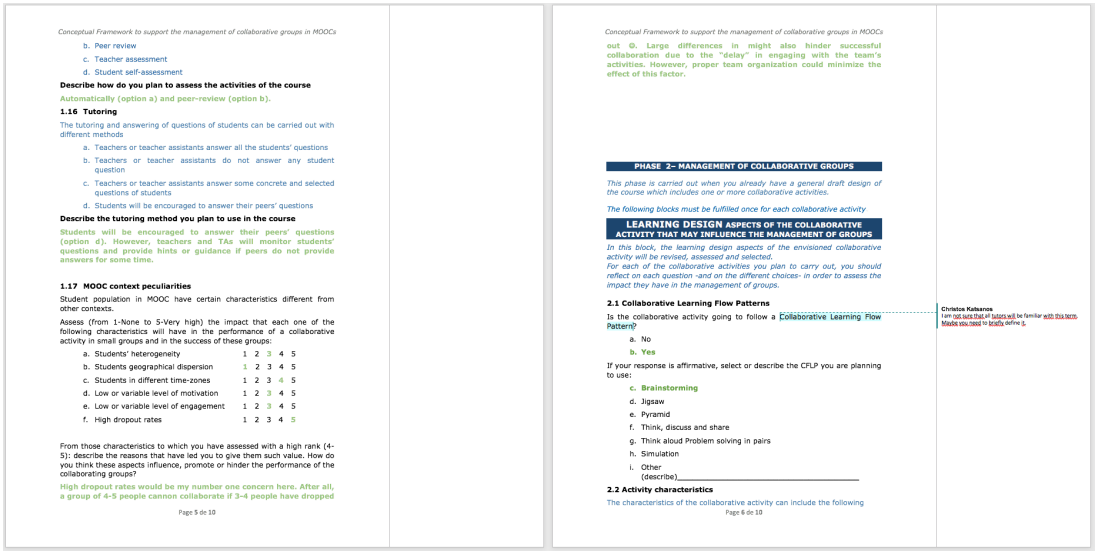
Figure F.9: Fieldwork resulting of the fulfillment of the Design Guide by the teacher TM2

F.2 Sample of Fieldwork resulting of the fulfillment of the Design Guide

Figures F.8, F.9, F.10, F.11 and F.12 show the fieldwork resulting of the fulfillment of the Design Guide by the teachers SAM2.



Conceptual Framework to support the management of collaborative groups in MOOCs

b. Peer review
c. Teacher assessment
d. Student self-assessment

Describe how do you plan to assess the activities of the course

Automatically (option a) and peer-review (option b).

1.16 Tutoring

The tutoring and answering of questions of students can be carried out with different methods

a. Teachers or teacher assistants answer all the students' questions
b. Teachers or teacher assistants do not answer any student question
c. Teachers or teacher assistants answer some concrete and selected questions of students
d. Students will be encouraged to answer their peers' questions

Describe the tutoring method you plan to use in the course

Students will be encouraged to answer their peers' questions (option d). However, teachers and TAs will monitor students' questions and provide hints or guidance if peers do not provide answers for some time.

1.17 MOOC context peculiarities

Student population in MOOC have certain characteristics different from other contexts.

Assess (from 1-None to 5-Very high) the impact that each one of the following characteristics will have in the performance of a collaborative activity in small groups and in the success of these groups:

a. Students' heterogeneity	1	2	3	4	5
b. Students geographical dispersion	1	2	3	4	5
c. Students in different time-zones	1	2	3	4	5
d. Low or variable level of motivation	1	2	3	4	5
e. Low or variable level of engagement	1	2	3	4	5
f. High dropout rates	1	2	3	4	5

From those characteristics to which you have assessed with a high rank (4-5): describe the reasons that have led you to give them such value. How do you think these aspects influence, promote or hinder the performance of the collaborating groups?

High dropout rates would be my number one concern here. After all, a group of 4-5 people cannon collaborate if 3-4 people have dropped

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Conceptual Framework to support the management of collaborative groups in MOOCs

out ☹. Large differences in might also hinder successful collaboration due to the "delay" in engaging with the team's activities. However, proper team organization could minimize the effect of this factor.

PHASE 2– MANAGEMENT OF COLLABORATIVE GROUPS

This phase is carried out when you already have a general draft design of the course which includes one or more collaborative activities.

The following blocks must be fulfilled once for each collaborative activity

LEARNING DESIGN ASPECTS OF THE COLLABORATIVE ACTIVITY THAT MAY INFLUENCE THE MANAGEMENT OF GROUPS

In this block, the learning design aspects of the envisioned collaborative activity will be revised, assessed and selected.
For each of the collaborative activities you plan to carry out, you should reflect on each question -and on the different choices- in order to assess the impact they have in the management of groups.

2.1 Collaborative Learning Flow Patterns

Is the collaborative activity going to follow a Collaborative Learning Flow Pattern?

a. No
b. Yes

If your response is affirmative, select or describe the CFLP you are planning to use:

c. Brainstorming
d. Jigsaw
e. Pyramid
f. Think, discuss and share
g. Think aloud Problem solving in pairs
h. Simulation
i. Other (describe)_____

2.2 Activity characteristics

The characteristics of the collaborative activity can include the following

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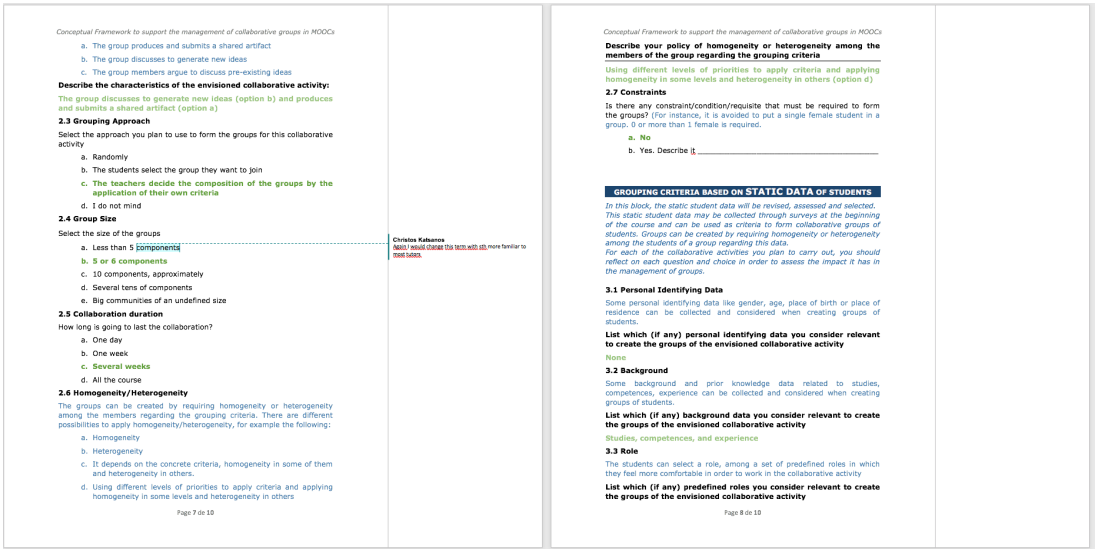
Christos Kaltsanos
I am not sure that all tutors will be familiar with this term. Maybe you need to briefly define it.

Figure F.10: Fieldwork resulting of the fulfillment of the Design Guide by the teacher TM3



Conceptual Framework to support the management of collaborative groups in MOOCs

a. The group produces and submits a shared artifact
b. The group discusses to generate new ideas
c. The group members argue to discuss pre-existing ideas

Describe the characteristics of the envisioned collaborative activity:

The group discusses to generate new ideas (option b) and produces and submits a shared artifact (option a)

2.3 Grouping Approach

Select the approach you plan to use to form the groups for this collaborative activity

a. Randomly
b. The students select the group they want to join
c. **The teachers decide the composition of the groups by the application of their own criteria**
d. I do not mind

2.4 Group Size

Select the size of the groups

a. Less than 5 components
b. **5 or 6 components**
c. 10 components, approximately
d. Several tens of components
e. Big communities of an undefined size

2.5 Collaboration duration

How long is going to last the collaboration?

a. One day
b. One week
c. **Several weeks**
d. All the course

2.6 Homogeneity/Heterogeneity

The groups can be created by requiring homogeneity or heterogeneity among the members regarding the grouping criteria. There are different possibilities to apply homogeneity/heterogeneity, for example the following:

a. Homogeneity
b. Heterogeneity
c. It depends on the concrete criteria, homogeneity in some of them and heterogeneity in others.
d. Using different levels of priorities to apply criteria and applying homogeneity in some levels and heterogeneity in others

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Christos Kaltsanos
Again I would change this term with sth more familiar to most tutors.

Conceptual Framework to support the management of collaborative groups in MOOCs

Describe your policy of homogeneity or heterogeneity among the members of the group regarding the grouping criteria

Using different levels of priorities to apply criteria and applying homogeneity in some levels and heterogeneity in others (option d)

2.7 Constraints

Is there any constraint/condition/requisite that must be required to form the groups? (For instance, it is avoided to put a single female student in a group. 0 or more than 1 female is required.

a. **No**
b. Yes. Describe it _____

GROUPING CRITERIA BASED ON STATIC DATA OF STUDENTS

In this block, the static student data will be revised, assessed and selected.
This static student data may be collected through surveys at the beginning of the course and can be used as criteria to form collaborative groups of students. Groups can be created by requiring homogeneity or heterogeneity among the students of a group regarding this data.
For each of the collaborative activities you plan to carry out, you should reflect on each question and choice in order to assess the impact it has in the management of groups.

3.1 Personal Identifying Data

Some personal identifying data like gender, age, place of birth or place of residence can be collected and considered when creating groups of students.

List which (if any) personal identifying data you consider relevant to create the groups of the envisioned collaborative activity

None

3.2 Background

Some background and prior knowledge data related to studies, competences, experience can be collected and considered when creating groups of students.

List which (if any) background data you consider relevant to create the groups of the envisioned collaborative activity

Studies, competences, and experience

3.3 Role

The students can select a role, among a set of predefined roles in which they feel more comfortable in order to work in the collaborative activity

List which (if any) predefined roles you consider relevant to create the groups of the envisioned collaborative activity

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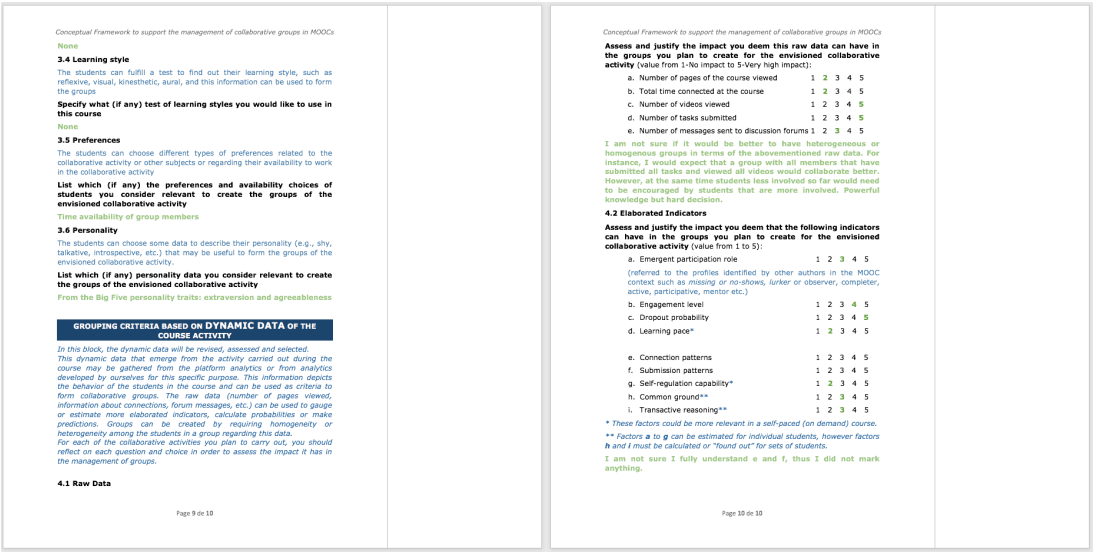
Figure F.11: Fieldwork resulting of the fulfillment of the Design Guide by the teacher SAM2



Conceptual Framework to support the management of collaborative groups in MOOCs

None

3.4 Learning style

The students can fulfill a test to find out their learning style, such as reflexive, visual, kinesthetic, aural, and this information can be used to form the groups

Specify what (if any) test of learning styles you would like to use in this course

None

3.5 Preferences

The students can choose different types of preferences related to the collaborative activity or other subjects or regarding their availability to work in the collaborative activity

List which (if any) the preferences and availability choices of students you consider relevant to create the groups of the envisioned collaborative activity

Time availability of group members

3.6 Personality

The students can choose some data to describe their personality (e.g., shy, talkative, introspective, etc.) that may be useful to form the groups of the envisioned collaborative activity.

List which (if any) personality data you consider relevant to create the groups of the envisioned collaborative activity

From the Big Five personality traits: extraversion and agreeableness

GROUPING CRITERIA BASED ON DYNAMIC DATA OF THE COURSE ACTIVITY

In this block, the dynamic data will be revised, assessed and selected.
This dynamic data that emerge from the activity carried out during the course may be gathered from the platform analytics or from analytics developed by ourselves for this specific purpose. This information depicts the behavior of the students in the course and can be used as criteria to form collaborative groups. The raw data (number of pages viewed, information about connections, forum messages, etc.) can be used to gauge or estimate more elaborated indicators, calculate probabilities or make predictions. Groups can be created by requiring homogeneity or heterogeneity among the students in a group regarding this data.
For each of the collaborative activities you plan to carry out, you should reflect on each question and choice in order to assess the impact it has in the management of groups.

4.1 Raw Data

Conceptual Framework to support the management of collaborative groups in MOOCs

Assess and justify the impact you deem this raw data can have in the groups you plan to create for the envisioned collaborative activity (value from 1-No impact to 5-Very high impact):

a. Number of pages of the course viewed 1 **2** 3 4 5
b. Total time connected at the course 1 **2** 3 4 5
c. Number of videos viewed 1 2 3 4 **5**
d. Number of tasks submitted 1 2 3 4 **5**
e. Number of messages sent to discussion forums 1 2 **3** 4 5

I am not sure if it would be better to have heterogeneous or homogenous groups in terms of the abovementioned raw data. For instance, I would expect that a group with all members that have submitted all tasks and viewed all videos would collaborate better. However, at the same time students less involved so far would need to be encouraged by students that are more involved. Powerful knowledge but hard decision.

4.2 Elaborated Indicators

Assess and justify the impact you deem that the following indicators can have in the groups you plan to create for the envisioned collaborative activity (value from 1 to 5):

a. Emergent participation role 1 2 **3** 4 5

(referred to the profiles identified by other authors in the MOOC context such as *missing or no-shows, lurker* or observer, completer, active, participative, mentor etc.)

b. Engagement level 1 2 3 **4** 5
c. Dropout probability 1 2 3 4 **5**
d. Learning pace* 1 2 3 4 5

e. Connection patterns 1 2 3 4 5
f. Submission patterns 1 2 3 4 5
g. Self-regulation capability* 1 2 **3** 4 5
h. Common ground** 1 2 **3** 4 5
i. Transactive reasoning** 1 2 **3** 4 5

** These factors could be more relevant in a self-paced (on demand) course.*

*** Factors **a** to **g** can be estimated for individual students, however factors **h** and **i** must be calculated or "found out" for sets of students.*

I am not sure I fully understand e and f, thus I did not mark anything.

Figure F.12: Fieldwork resulting of the fulfillment of the Design Guide by the teacher SAM3

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