

MOOCs pedagogical and didactical approaches

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MOOCs pedagogical and didactical approaches

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Abstract

The paper explores different issues and trends in regard to MOOCs pedagogical and didactical approaches applying the Group Concept Mapping methodology (GCM). Group Concept Mapping is a participative research methodology that identifies in an objective way the shared vision of a group of experts on a particular issue (e.g. MOOC pedagogical and didactical approaches).

Seventy-nine ideas have been generated and they were grouped in the following thematic categories: Learning design, Curriculum design, Methodologies, Learning network, Self-regulated learning, Assessment, Technology & Scaling, Participation and Organisation. The study's results provide an empirical basis for making informed suggestions as how to combine the principles and instructional design guidelines of xMOOC and cMOOC.

Keywords

MOOC pedagogies, Group Concept Mapping, Home project

1 Introduction

While the literature on pedagogical approaches in MOOCs has increased in the recent years, it remains a highly underestimated research subject and the number of dedicated studies is still relatively small.

From content point of view, the discussion on MOOCs pedagogical approaches has quite often been replaced by a debate on the affordances of technological platforms. When it comes to classifications of pedagogies they typically include three very general categories: cognitive-behaviourist, socio-constructivist and connectivist (Anderson & Dron, 2011). The debate xMOOC vs cMOOC is useful on a general level, but it is not particularly helpful on micro-level, that is how learning activities should be structured to foster effective, efficient and enjoyable learning. Research also indicates that such a dichotomous, 'either-or', categorization obscures variation and richness of the pedagogic approaches applied (Stoyanov, Sloep, De Bie & Hermans, 2014).

From research methods point of view, it seems that most of the studies apply qualitative methods for data collection and analysis (Bali, 2014; Bayne & Ross, 2014; Kop, Fournier & Sui Fai Mak, 2011). The quantitative methods used are mainly questionnaires (Margaryan, Bianco & Littlejohn, 2015). To the best of our knowledge, mixed methods research, which is supposed to deliver valid and reliable outcomes, is non-existent.

To address these issues, we apply the Group Concept Mapping (GCM) research methodology (Kane & Trochim, 2007; see also Trochim, 1989) for collecting, objectively aggregating and analysing the opinions of experts on various aspects of MOOCs pedagogical approaches. In the remaining part of the paper, we first define the GCM methodology. Then we describe the participants, procedure and the outcomes of the study. Finally we discuss the study's results and draw some conclusions.

2 Group Concept Mapping

Group Concept Mapping is a participatory mixed-research methods approach that identifies in an objective way the shared vision of a group of experts on a particular topic of interest (i.e. pedagogical approaches in MOOCs). Typically, the methodology facilitates the participants to generate ideas, to sort them on similarity of

meaning and to rate the ideas on some values (e.g. importance and easy/difficult to apply in practice). Then multivariate analyses are carried out, that include multidimensional scaling analysis (MDS) on the raw sorting data to show the relationship between the ideas on two-dimensional space (x-y) and hierarchical cluster analysis (HCA) on the MDS coordinates to partition the map into groups of similar ideas. In addition, descriptive statistics is applied to the rating data. The resulting concept map shows the relationships and values of individual ideas and clusters of ideas to support interpretation and discussion of the findings.

3 Participants and procedure

We invited all HOME project partners across Europe to participate in the study. Thirty five of them were assigned to the study web environment (Concept System Global Max, 2014) specifically created to facilitate an asynchronous online collection and analysis of the participants' contribution. The demographic characteristics of the participants are presented in Table 1.

Table 1: Demographic questions

Participant Question	Option	Frequency	%
Educational background	Engineering and computer science	5	14.29
	Social Sciences	10	28.57
	Math and Science	2	5.71
	Business & management	1	2.86
	Other	3	8.57
	did not respond	14	40
TOTAL		35	100
Experience	Less than 5 years	2	5.71
	6-10 years	2	5.71

	More than 10 years	17	48.57
	did not respond	14	40
TOTAL		35	100
Expertise	Expert	4	11.43
	High	12	34.29
	Medium	4	11.43
	Low	1	2.86
	did not respond	14	40
TOTAL		35	100
Professional involvement	More in teaching	6	17.14
	More in research	13	37.14
	Other	1	2.86
	did not respond	15	42.86
TOTAL		35	100

25 out of 35 project's partners took part in the idea generation phase. They were instructed to brainstorm ideas about specific instructional guidelines that should be taken into account when designing a MOOC. The participants got 2 weeks for this activity. The idea generation phase resulted in 113 ideas. In the next stage, 'Idea Synthesis', two researchers cleaned and edited the data respecting the following rules:

- a) Obtain a list of unique ideas, with only one idea represented in each statement;
- b) Ensure that each statement is relevant to the focus of the project;
- c) Reduce the statements to a manageable number for sorting and rating;
- d) Ensure that statements are clear and understandable across the entire stakeholder group;

- e) Do not prioritize, select on perceived value, or delete unpopular ideas.

The number of the ideas was reduced to 79, which were send back to the participants to first sort them on similarity of meaning, giving the groups names and then using a 1-5 scale to rate the ideas on two values: importance (1 = relatively unimportant; 5 = extremely important) and difficulty/easy to apply in practice (1 = very difficult; 5 = very easy). The participants were given 3 weeks for the sorting and rating with a reminder after 2 weeks. As the number of sorters was low after 3 weeks, we extended the time for sorting and rating over two months. Thirteen experts participated in the sorting and twelve in the rating.

4 Results

The first outcome of the GCM, which is a result of the MDS analysis, is a point map (See Figure 1). It shows all the 79 ideas and how they are related with more similar ideas proximally located in the two-dimensional space. MDS scaling assigns each idea a bridging value (between 0 and 1). A lower bridging value means more participants have grouped the statements with ideas around it. A higher bridging value indicates that the idea has been sorted together with statements further apart. MDS scaling produces also a statistic, called stress index (a value between 0 and 1) to indicate the extent to which the concept map reflects the raw sorting as represented by a similarity matrix. In this study the stress index is 0.3, which is in the accepted range (Rosas & Kane, 2012).

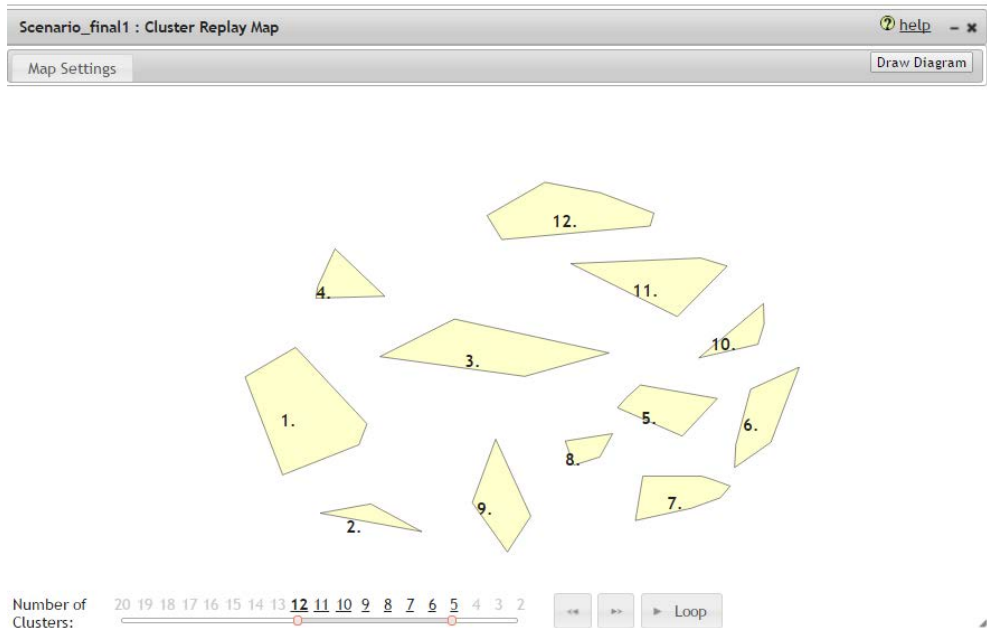


Figure 2: Replay map 12-cluster solution

It has been found that less than 5 clusters does not provide sufficient details to make meaningful interpretations (Rosas & Kane, 2012).

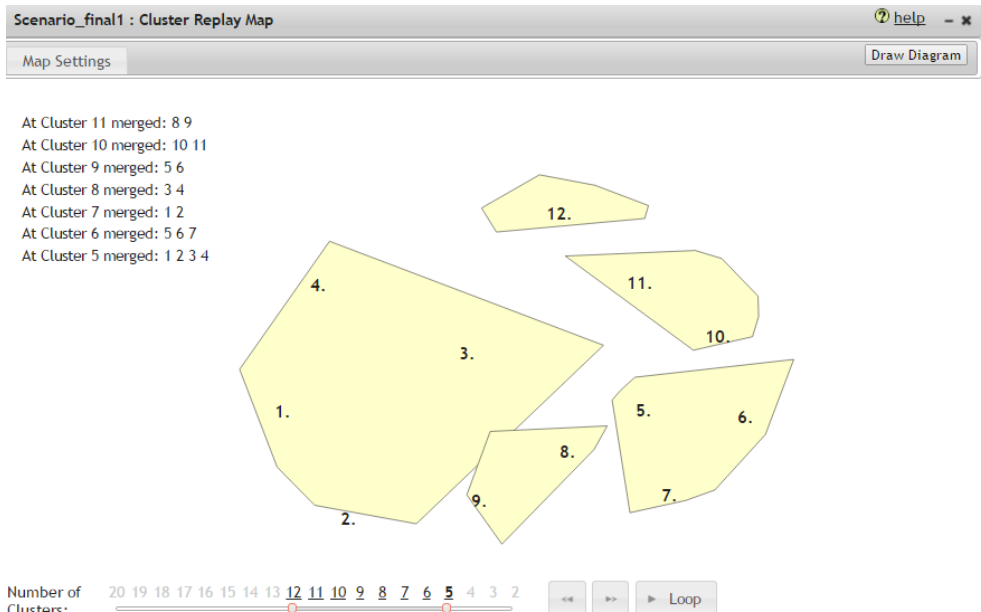


Figure 3: Replay map 5-cluster solution

We then checked whether any suggestion for merging clusters made sense exploring in detail the content of these clusters. Two researchers went independently through all suggestions using a check list with options Agree, Disagree and Undecided. We then look at the cutting point of Agree and Disagree in both check lists to decide upon the final number of clusters (for more details see Kane & Trochim, 2007). We came to the conclusion that 9-cluster solution reflects in a best possible way the data and the purpose of the study (See Figure 4).

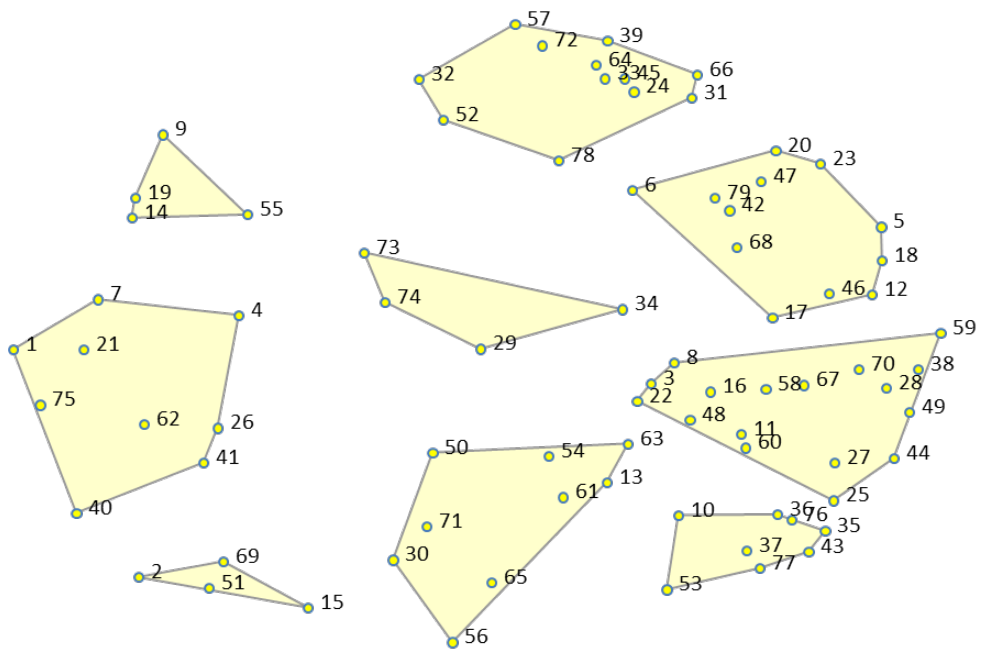


Figure 4: 9-cluster solution

The next step in giving sense of the data was to attach names to the clusters. In general, there are three ways for that:

- a) by simply going through the content of a particular cluster and deciding upon what meaning the majority of the ideas in the cluster depicts;
- b) by looking at the bridging values of the ideas in a cluster - the ideas with lowest bridging values express the meaning of a cluster best; and
- c) by checking suggestions given by the Concept System software, which compares the distance between centroids of the aggregated clusters and the individual groups of statements compiled by the participants during the raw sorting.

The following themes were identified: Learning design, Curriculum design, Methodologies, Learning network, Self-regulated learning, Assessment, Technology & Scaling, Participation, and Organisation (See Figure 5).

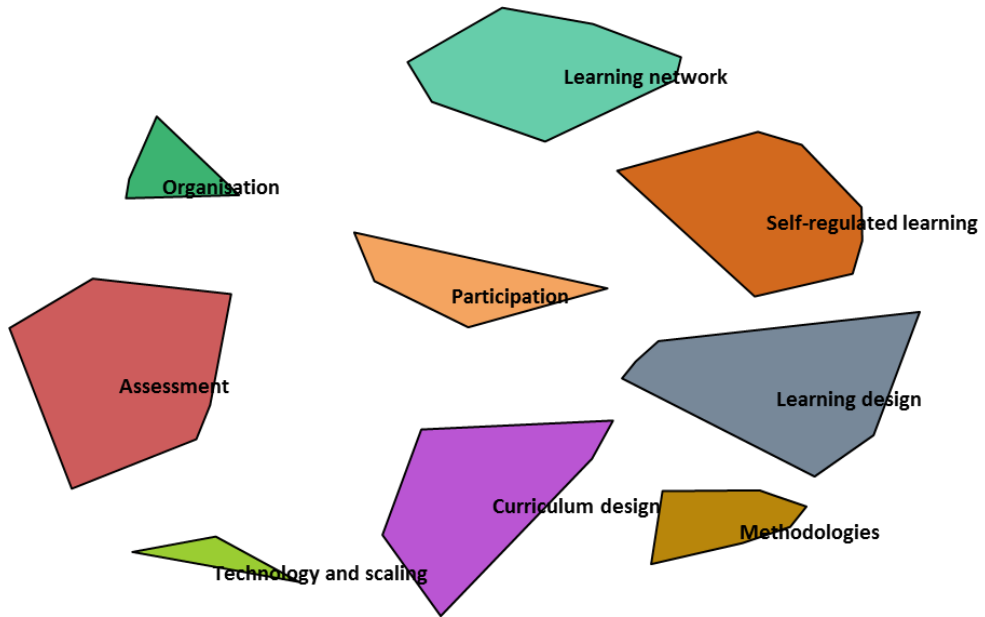


Figure 5: Clusters named

Table 2. presents some representative statements for each clusters.

Table 2: Clusters with representative statements

Cluster	Statement
<i>Curriculum design</i>	There is no 'right way' through the course If MOOC must be suitable for inclusion in regular university programs, the design should be flexible to enable the adaptation

	<p>of the MOOC to the guidelines of the university</p> <p>Accommodate needs of new target groups of 'non-students'.</p>
<i>Methodologies</i>	<p>Align pedagogies with learning paradigms: you may safely combine different learning paradigms in a single MOOC, but use matching pedagogies for each one of them.</p> <p>Before discussing MOOC reflect on what characterizes good learning.</p> <p>A more nuanced approach (not only xMOOC vs cMOOC) is needed that takes into account an analysis of MOOC pedagogy at a micro level of individual course design.</p>
<i>Learning design</i>	<p>Always start from your learning goals / what you want students to achieve through the MOOC.</p> <p>Look at the classical online learning and teaching for inspiration for MOOC pedagogies.</p> <p>Adapt the rhythm of the MOOCs to learner needs.</p>
<i>Self-regulated learning</i>	<p>Participants are expected to work individually and take control of their learning.</p> <p>Each participant forges her/his own learning path through the materials</p> <p>Participants are asked to reflect continually during the course, their personal blogs are particularly important in this respect.</p>
<i>Learning Networks</i>	<p>Try to generate a community of interest among learners that go beyond the MOOC itself.</p> <p>Create a Virtual Community of Practice (that persists after the course's life cycle).</p> <p>Experience gained by the participants needs to be reflected upon, shared and discussed with the others.</p>
<i>Assessment</i>	<p>The key dilemmas in MOOCs centre on what participation actu-</p>

	<p>ally means, how it should be measured, and consequently, what metrics of success and quality are appropriate for these courses.</p> <p>Include case-studies, interaction and group work in the assessment.</p> <p>If MOOC must be suitable for inclusion in regular university programs, suggestions must be available for the university about how to perform the examination.</p>
<i>Technology & scaling</i>	<p>Explore affordances of emerging technologies.</p> <p>Systematically check the scaling ability of the solutions you use. Can each one of them scale up from, say 100 to 1000-2000 students?</p> <p>Build a framework that is based on Google Apps supporting most of the technical and pedagogical resources that are common in MOOCs.</p>
<i>Organisation</i>	<p>Clear contact point/person for questions. Contact points for specific topics (technical, administrative, content issues).</p> <p>Share the learning materials and resources openly, using for instance, Creative Commons CC0, CC BY or CC BY-SA licensing.</p> <p>Define the technical tools students are assumed to be able to use for the specific MOOC.</p>
<i>Participation</i>	<p>Accommodate different levels of participation (from 'completing' to 'lurking').</p> <p>Reach new and small/specific target groups.</p> <p>Profiles and characteristics of MOOC learners that include motivational factors, ethnicity, and socioeconomic status rather</p>

than simple demographics of age and gender alone.

The most coherent cluster is Learning design, which means that the participants agreed most consistently on grouping the statements in this cluster (cluster bridging value (BV) is 0.08). The cluster next on the list on this criterion is Methodologies (bridging value of 0.15), followed by Self-regulated learning (BV= 0.19), Learning network (BV= 0.22), Curriculum design (BV= 0,25), Participation (BV= 0.26), Technology & Scaling (BV= 0.47), Assessment (BV= 0.48) and Organisation (BV= 0.81).

Rating data brings some additional information. Almost all of the clusters score high on importance with 5 layers (mean ranging between 3.86 and 3.99). Some exceptions are Self-regulated learning, Assessment (both with 3 layers) and especially Technology & Scaling (1 layer). It should be noted that all clusters score on average above 3. The margin between the lowest and the highest scores is relatively narrow. See Figure 6.

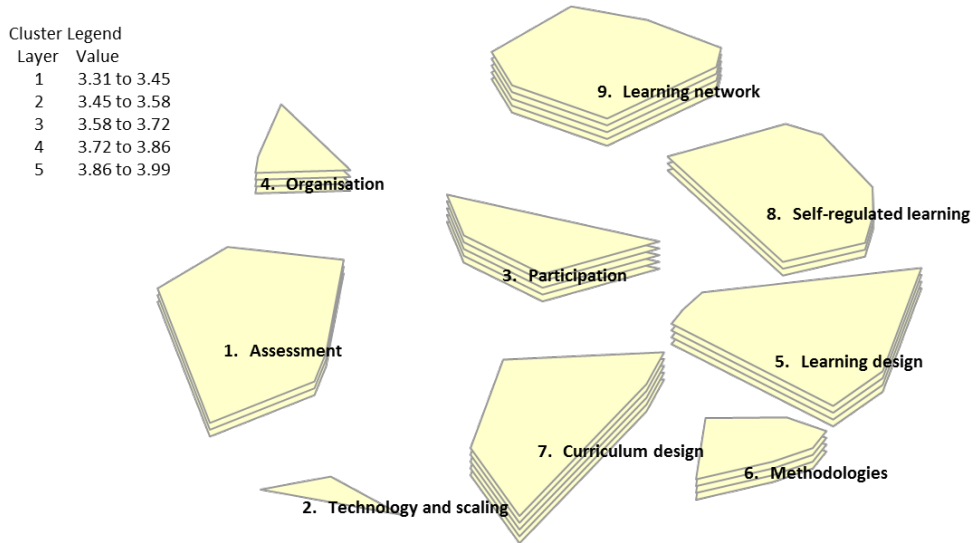


Figure 6: Rating map on Importance

The analysis of rating data on difficulty/easy to apply provides a rather different picture (see Figure 7). Organization scores again the highest (very easy to apply with 5 layers), followed by Self-regulated learning (again with three layers like its rating on Importance), Learning design with 3 layers but two less compared to its rating on Importance, and Technology & Scaling (3 layers but two more in contrast to its rating on Importance). The margin between the lowest and the highest score is large. On that criterion Curriculum design, Methodologies, Learning network, Participation, and Assessment got each a low average score.

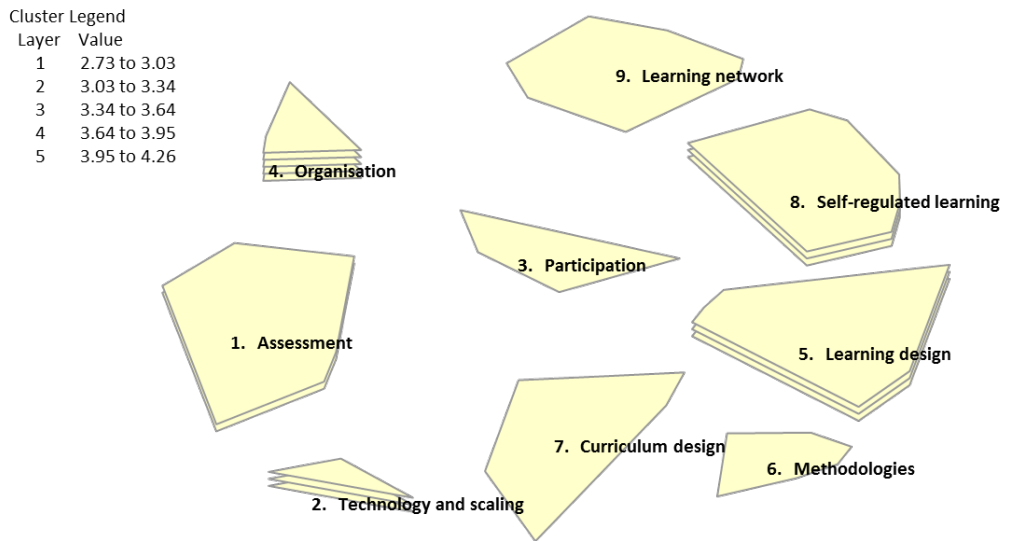


Figure 7: Rating map on Difficulty/Easy to apply

Another visualization that helps to compare the clusters on the two values and see the relative position of clusters to each other is pattern match. See Figure 8, where for importance: 1 = relatively unimportant, 5 = extremely important; for difficulty: 1 = very difficult; 5 = very easy.

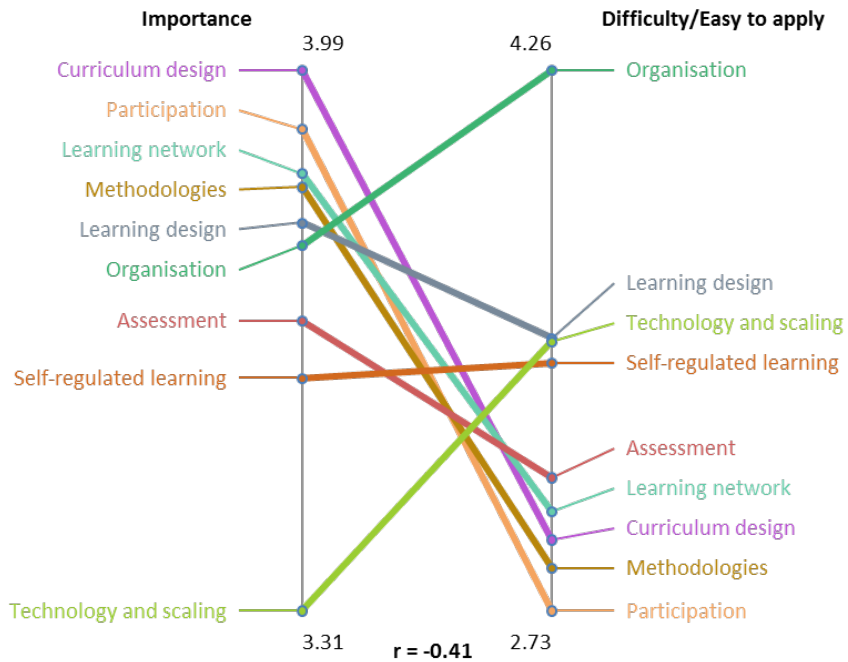


Figure 8: Patter match Importance vs Difficulty/Easy to apply

The graphic provides a clear indication that Curriculum design, Participation, Learning network, Methodologies and Learning design score very high on Importance and very low on Difficulty/Easy to apply. An opposite view is presented by the scores of Organisation and Technology & Scaling. The scores on Self-regulated learning are connected by a straight line. The correlation (Pearson product-moment) between the two ratings data is moderate downhill.

Pattern matching can be used also to compare the ratings of different groups participants. For example, the participants involved more in teaching and those involved more in research do not differ in their ratings on importance and difficulty/easy to apply ($r_{imp} = 0.78$; $r_{diff} = 0.83$, respectively) See Figure 9 and Figure 10.

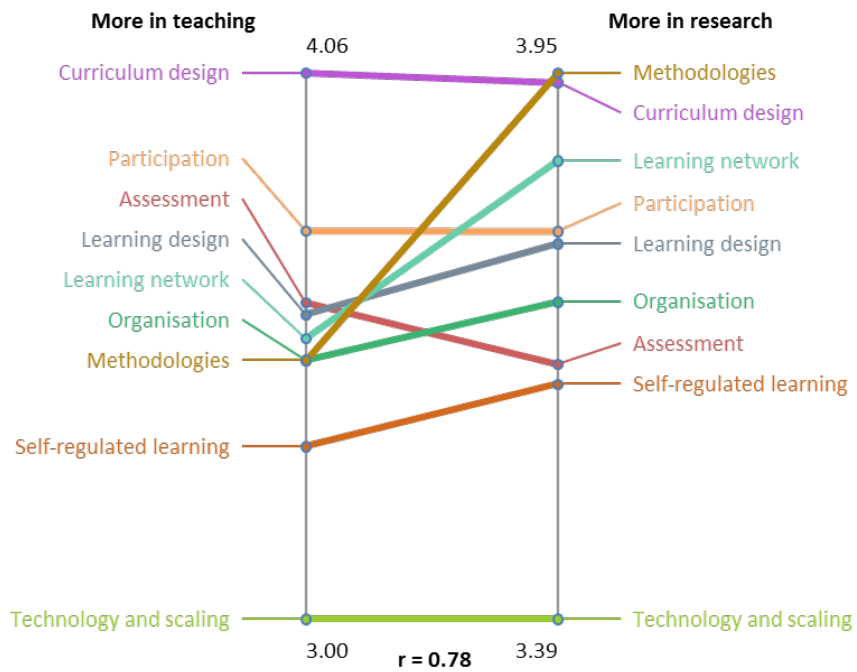


Figure 9: Pattern match Involvement rating on Importance

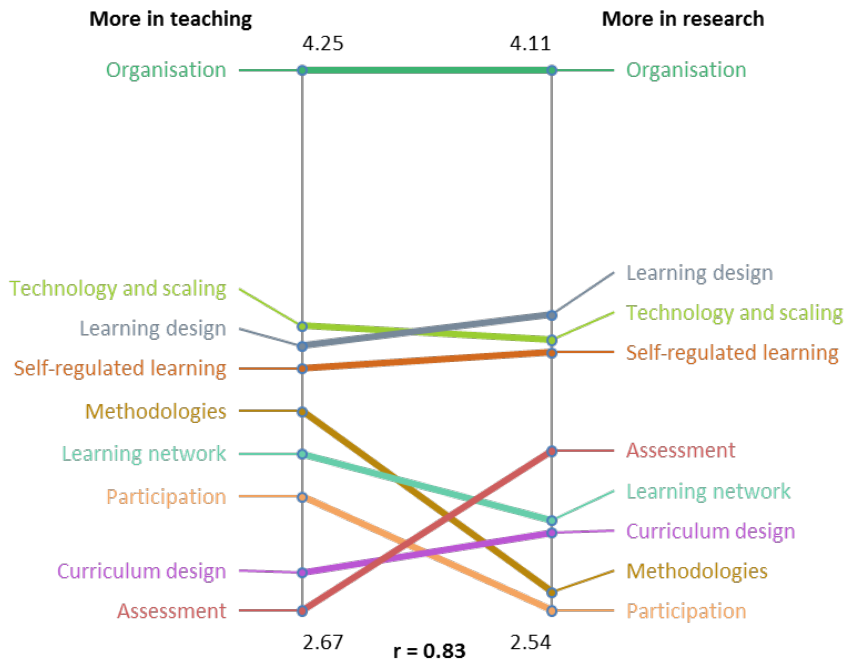


Figure 10: Pattern match Involvement rating on Difficulty/Easy to apply

While the participants with different level of expertise diverge significantly on how they rate the statements on Importance ($r = -0.51$), there is practically no difference in ratings on Difficulty/Easy to apply ($r = 0.93$). See Figure 11 and Figure 12.

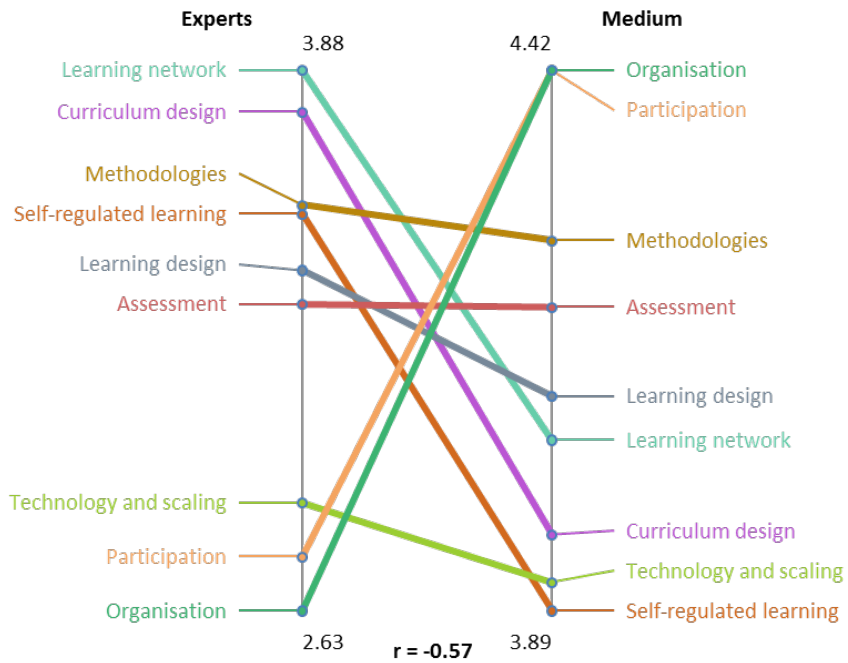


Figure 11: Pattern match Expertise rating on Importance

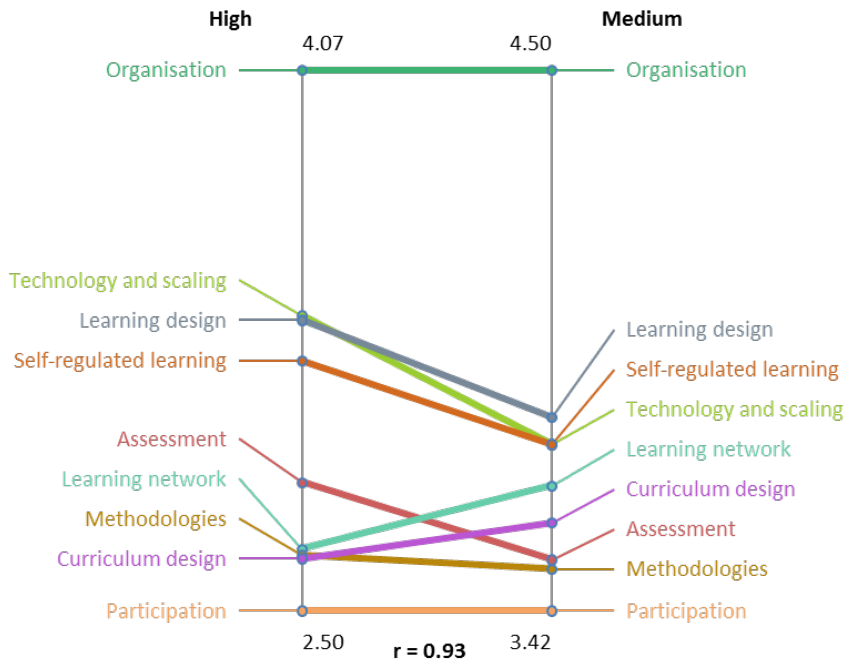


Figure 12: Pattern match Expertise rating on Difficulty/Easy to apply

5 Discussion

Six out of nine themes as identified in the HOME project concept map (Figure 5) reflect issues and trends that are directly related to MOOCs pedagogical approaches. These themes are: Curriculum design, Methodologies, Learning design, Self-regulated learning, Learning network and Assessment. The other three, namely Participation, Technology & Scaling and Organisation, could be considered as supportive. In GCM, the relationships between clusters are defined by distances (like the relationship between individual items). Methodologies, Curriculum design and Learning design are closely related to each other, which also can be

verified by the ideas included in these clusters. The clusters represent three levels of analysis. At a macro level, the cluster Methodologies includes relevant theoretical frameworks. Suggestions are made to combine different learning paradigms, reflect on what characterize good learning, attempt a more nuanced approach (e.g. not only xMOOC vs cMOOC) taking into account the analysis of MOOC pedagogy applied at an individual course design, considering neuroscience and heuristics, and that technological affordances do not automatically transform themselves into pedagogical affordances.

At a meso level, the Curriculum design cluster contains guidelines supporting course design, such as the need for flexibility of the design, i.e. enabling adaptation of the MOOC course to the university's guidelines; accommodating the needs of new target groups of 'non-students', using open educational resources (OER) and considering learners as co-constructors of the course.

At a micro level, the Learning design cluster contains ideas that can contribute to a good design blueprint: define learning objectives, confront learners with a problem, issue, or challenge, preferably, real-life one, provide for each task explicit support in terms of background information, examples, procedures, methods, techniques, and tools, provide feedback to continuously reflect on the learning progress, accommodate learning preferences, and focus not only on personalisation but also on collective intelligence.

The Learning network cluster emerges from the data to emphasize the need for interaction, dialogue and collaboration. Some of the statements in the cluster are more common for xMOOCs, i.e. experience gained by the participants needs to be reflected upon, shared and discussed with the others, enhance social collaboration and interaction to provide a richer learning experience, as a way to reduce drop-out rates, and the need for a visible presence of teachers/facilitators in the course space. Most of the statements, however, define features of cMOOCs, i.e. create a community of interest among learners that go beyond the MOOC itself, promote social collaboration among students internally as well as among external

networks, MOOCs rely on the benefits of scale through significant interaction with a distributed network of peers, and MOOCs alter the relationship between learner and instructor and between academia and the wider community by potentially providing a very large and diverse forum and meeting place for ideas.

The cluster Self-regulated learning contains statements representative for either internal or external learning locus of control (Stoyanov, 2001). Examples of statements that reflect the need for supporting internal learning locus of control are: 'Participants are expected to work individually and take control of their learning', 'Participants are asked to reflect continually during the course, their personal blogs are particularly important in this respect', and 'Each participant forges her/his own learning path through the materials'. There are statements in this cluster that imply also a support for external learning of control: work with study guides for transparent and clear communication and information, and organize convergence sessions. In addition, the cluster includes statements that suggest combining internal and external locus of control, namely: offering additional materials and resources to enable interested participants to expand the topic (including links to other related MOOCs to facilitate for the continuation of the learning process on a topic) and invite eminent researchers to interact with students within the MOOC discussion space as one of the ways of providing learners with alternative points of view. This cluster plays a bridging role between a more instructivist area on the map (Curriculum design, Learning design, Methodologies) and a more connectivist area (Learning network).

The results of this study clearly suggest combining instructional principles and guidelines of xMOOCs and cMOOCs. First, there are clusters that specifically support either xMOOCs or cMOOCs. Second, this is the bridging role of self-regulated learning containing statements supporting both external and internal learning locus of control. Third, there are individual statements in xMOOC clusters that support cMOOCs (e.g. 'Focus not only on personalisation but also on collective intelligence', 'Use connectivist instructional principles and strategies to move be-

yond prescriptive learning') and statements in the cMOOCs cluster that support xMOOCs (e.g. 'Visible presence of teachers/facilitators in the course space'). The most important is that the proposition of combining xMOOC and cMOOC has been operationalized through concrete ideas that make the clusters.

Assessment is unexpectedly far away from the pedagogical clusters, meaning no relationship between the two zones as seen by this group of participants. While the cluster contains some ideas that are valid for any online learning assessment ('Include case-studies, interaction and group work in the assessment'; 'Include student peer review in the evaluation'), the focus seems to be on some specific MOOC issues regarding assessment such as low completion rate, badges and certification, and inclusion in regular universities programmes. Some ideas about assessment can be found in other clusters but they are formulated in a close relation to other pedagogical issues (i.e., the need to relate learning objectives with assessment strategies and personalization based on dynamic assessment and data gathering).

The same trend can be detected with technology. There is a cluster about technology (with a few items), but it is mainly related to technological platforms and scaling from one side, and general purpose technology like Google apps, from the other. Specific idea about technology can be found in other clusters (e.g. 'MOOC pedagogy is not embedded in MOOC platforms', 'Take into account the possibilities of the platform you will use from the start of the design process', 'Use tools that support MOOCs' instructional design (e.g. Learning Designer, CompendiumID, Cloudworks, Design Decision Framework)' and 'Harness the power of social and participatory media to enable participants to communicate and collaborate through a variety of channels'. Technology should always be considered in context.

The cluster 'Participation' is located in the centre of the map containing ideas about level of participation and type of participants. It connects pedagogical clusters ('east coast') with assessment, organization and scaling areas ('west coast').

'Organisation' includes ideas that refer to different organizational aspects such technology, contact points/persons, and Creative Commons licensing. This is the least coherent clusters (high bridging values for all ideas in it). It seems the participants had difficulty grouping these items.

While we believe that the results of the GCM study on MOOC's pedagogical approaches contribute to the efforts in this specific research field, they should be considered with caution. The sample is small. For results based on the sorting, it is perhaps not an issue (Trochim, 1993; Rosas & Kane, 2012), but for the rating it is. It should be noted, however, that in GCM sorting is the primary activity, rating is the secondary one. This GCM study should be considered as an exploratory study that invites for formulating more precise hypotheses that need to be further explored.

6 Conclusions

The conclusions that could be drawn from the utilisation of the GCM in this study on MOOC's pedagogical approaches are as follows:

1. The study identified the following thematic clusters: Learning design, Curriculum design, Methodologies, Learning Network, Self-regulated learning, Assessment, Technology & Scaling, Participation, and Organisation.
2. Curriculum design, Methodologies, Learning design, Self-regulated learning, Learning network and Assessment are directly related to MOOC's pedagogical approaches. Participation, Technology & Scaling and Organisation could be considered supportive in this respect.
3. The participants most consistently agreed on grouping the statements in the cluster Learning design, followed by Methodologies, Self-regulated learning, Learning network, Curriculum design and Participation. It seems they had most difficulties grouping the statements that make the cluster Organisation.

4. The results of this study are in line with other scholar works that propose combining instructional principles of xMOOCs and cMOOCs but the current research provides empirical basis and concrete guidelines how this instructional design integration could be implemented. The statements in the clusters that directly reflect MOOC's pedagogical approaches can be considered building blocks for designing concrete MOOCs.
5. Curriculum design, Participation, Learning network, Methodologies and Learning design score very high on importance but very low on difficulty/easy to apply. This is in contrast to the rating pattern of Organisation and Technology & Scaling.
6. There is not a difference in ratings on importance and difficulty/easy to apply between the participants who are involved more in research and those who are involved more in teaching. A difference is observed between expert and non-expert participants on importance but not on difficulty/easy to apply MOOC instructional guidelines in practice.

References

- Anderson, T. & Dron, J. (2011). Three generation of distance education pedagogies. *International Review of Research in Open and Distance Learning*, 12(3), 80-97.
- Bali, M. (2014). MOOC Pedagogy: Gleaning good practice from existing MOOCs. *MERLOT Journal of Online Learning and Teaching*, 1, 44-55.
- Bayne, S., & Ross, J. (2014). *The pedagogy of the Massive Open Online Course: the UK view*. The University of Edinburgh, The Higher Education Academy.
- Conole, G., de Laat, M., Dillon, T., & Darby, J. (2008). Disruptive technologies, pedagogical innovation: What's new? Findings from an in-depth study of students' use and perception of technology. *Computers & Education*, 50, 511– 524.

Cross, S. (2013). *Evaluation of the OLDS MOOC curriculum design course: participant perspectives, expectations and experiences*. OLDS MOOC Project, Milton Keynes.

Kane, M., & Trochim, W. M. K. (2007). *Concept mapping for planning and evaluation*. Thousand Oaks, CA: Sage.

Kop, R., Fournier, H., & Sui Fai Mak, J. (2011). A Pedagogy of abundance or a pedagogy to support human beings? Participant support on Massive Open Online Courses. *The International Review of Research in Open and Distance Learning*, 12(7), 74-93.

Margaryan, A., Bianco, M., & Littlejohn, A. (2015). Instructional quality of massive open online courses (MOOCs). *Computers & Education*, 80, 77-80.

Rosas, S.R. & Kane, M. (2012). Quality and rigor of the concept mapping methodology: A pooled study analysis. *Evaluation and Program Planning* 35, 2, 236–245.

Stoyanov, S. (2001). *Mapping in the Educational and Training Design*, Doctoral dissertation, University of Twente, the Netherlands. Print Partners Ipskamp: Enschede).

Stoyanov, S., Sloep, P., de Bie, M., & Hermans, V. (2014 July). Teacher-training, ICT, creativity, MOOC, Moodle - what pedagogy? In L. Gómez Chova, A. López Martínez, I. Candel Torres (Eds), *Proceedings of Edulearn 14. Paper presented at the Sixth International Conference on Education and New Learning Technologies (EDULEARN 14)*, Barcelona, 7-9 July, 2014 (pp. 5678-5686). IATED Academy: IATED Digital Library.

Trochim, W. (1989). An introduction to concept mapping for planning and evaluation. *Evaluation and Program Planning* 12, 1–16.

Trochim, W. (1993 November). Reliability of concept mapping. *Paper presented at the Annual Conference of the American Evaluation Association*, Dallas, Texas.



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